

BYTE

SEPTEMBER 1990

A MCGRAW-HILL PUBLICATION

63 of the World's Most Influential People in Personal Computing Predict the Future, Analyze the Present

- PAUL ALLEN, Microsoft/Asymetrix □ STEWART ALSOP, P. C. Letter □ ANDY BECHTOLSHEIM, designer/Sun Microsystems □ GORDON BELL, VAX designer/Stardent Computer □ JIM BLINN, graphics/Cal Tech □ GORDON CAMPBELL, early chips/Chips & Technologies □ ROD CANON, Compaq □ PAUL CARROLL, Wall Street Journal □ JOHN CAULFIELD, optics/University of Alabama □ JOHN COCKE, first RISC computer/IBM Fellow □ ESTHER DYSON, Release 1.0 □ DOUG ENGELBART, groupware/Stanford University □ DAVID EVANS, graphics/Evans & Sutherland □ FEDERICO FAGGIN, early microprocessors/Synaptics □ LEE FELSENSTEIN, Osborne-1/Golemic □ BOB FRANKSTON, spreadsheet/Lotus □ BILL GATES, Microsoft □ DANNY HILLIS, programming theory/Oxford University □ GRACE HOPPER, White House Correspondent □ BILL JOY, SPARC/ □ MITCH KAPOR, Lotus and 1-2-3/ Dynabook and Smalltalk/Apple True BASIC □ BRIAN KERNIGHAN, □ JACK KILBY, integrated circuit/CP/M/Digital Research Stanford University □ STEVE LEININGER, □ RICH MALLOY, BYTE MANZI, Lotus □ JOHN Times □ CARMA object orientation/MCWILLIAMS, Amdahl □ JAY Ventritex □ RYOICHI University of Tsukuba, NEGROPONTE, MIT hypertext/Xanadu integrated circuit/DEC □ SEYMOUR Intelligence Laboratory microprocessors/THStyme System/Pick Systems □ JERRY □ WAYNE RATLIFF, dBASE II Production □ DENNIS RITCHIE, □ JONATHAN SACHS, Lotus 1-2-3/TRON Project/University of Tokyo, □ CHARLES SIMONYI, software developer/Report □ ALVY RAY SMITH, graphics/Pixar consultant □ BJARNE STROUSTRUP, TITUS, Mark-8 designer/EDN Magazine
- PAUL ALLEN, Microsoft/Asymetrix □ STEWART ALSOP, P. C. Letter □ ANDY BECHTOLSHEIM, designer/Sun Microsystems □ GORDON BELL, VAX designer/Stardent Computer □ JIM BLINN, graphics/Cal Tech □ GORDON CAMPBELL, early chips/Chips & Technologies □ ROD CANON, Compaq □ PAUL CARROLL, Wall Street Journal □ JOHN CAULFIELD, optics/University of Alabama □ JOHN COCKE, first RISC computer/IBM Fellow □ ESTHER DYSON, Release 1.0 □ DOUG ENGELBART, groupware/Stanford University □ DAVID EVANS, graphics/Evans & Sutherland □ FEDERICO FAGGIN, early microprocessors/Synaptics □ LEE FELSENSTEIN, Osborne-1/Golemic □ BOB FRANKSTON, spreadsheet/Lotus □ BILL GATES, Microsoft □ DANNY HILLIS, programming theory/Oxford University □ GRACE HOPPER, White House Correspondent □ BILL JOY, SPARC/ □ MITCH KAPOR, Lotus and 1-2-3/ Dynabook and Smalltalk/Apple True BASIC □ BRIAN KERNIGHAN, □ JACK KILBY, integrated circuit/CP/M/Digital Research Stanford University □ STEVE LEININGER, □ RICH MALLOY, BYTE MANZI, Lotus □ JOHN Times □ CARMA object orientation/MCWILLIAMS, Amdahl □ JAY Ventritex □ RYOICHI University of Tsukuba, NEGROPONTE, MIT hypertext/Xanadu integrated circuit/DEC □ SEYMOUR Intelligence Laboratory microprocessors/THStyme System/Pick Systems □ JERRY □ WAYNE RATLIFF, dBASE II Production □ DENNIS RITCHIE, □ JONATHAN SACHS, Lotus 1-2-3/TRON Project/University of Tokyo, □ CHARLES SIMONYI, software developer/Report □ ALVY RAY SMITH, graphics/Pixar consultant □ BJARNE STROUSTRUP, TITUS, Mark-8 designer/EDN Magazine
- Connection Machine/Thinking Machines □ TONY HOARE, COBOL/DEC □ BRIT HUME, ABC News Chief Sun Microsystems □ PHILIPPE KAHN, Borland On Technology □ ALAN KAY, Fellow □ JOHN KEMENY, BASIC/programming/AT&T Bell Labs consultant □ GARY KILDALL, □ DONALD KNUTH, TeX/ TOM KURTZ, BASIC/True BASIC TRS-80 designer/Adaptive Plus and BYTEWEEK □ JIM MARKOFF, BYTE/New York MCCLURE, CASE and consultant □ TOM computer-aided engineering/MINER, Amiga designer/MORI, superdistribution/Japan □ NICHOLAS Media Lab □ TED NELSON, (Autodesk) □ BOB NOYCE, Sematech □ KEN OLSEN, PAPER, Logo/MIT Artificial □ CHUCK PEDDLE, early □ DICK PICK, Pick Operating PERNELLE, BYTE columnist and dBASE III/Ratliff Software C and Unix/AT&T Bell Labs independent developer □ KEN SAKAMURA, Japan □ DICK SHAFFER, Computer Letter □ MICHAEL SLATER, Microprocessor □ BILL STALLINGS, networking/C++/AT&T Bell Labs □ JONATHAN and EDN News □ JOHN WARNOCK, PostScript/Adobe Systems □ TERRY WINOGRAD, natural language/Stanford University □ NIKLAUS WIRTH, Pascal and Modula-2/Swiss Federal Institute of Technology (ETH) □ STEPHEN WOLFRAM, Mathematica/Wolfram Research □ ED YOURDON, CASE and object orientation/consultant



anniversary SUMMIT



\$3.50 U.S.A./\$4.50 IN CANADA
0360-5280

IT.

volume buyers

call us now.
like you. Satisfied.



THE DELL SYSTEM 325
25MHz i386 and DELL SYSTEM
310 20 MHz i386.

The best combination of performance and value available in their class.



STANDARD FEATURES:
• Intel® 80386 microprocessor running at 25 MHz (Dell 325) and 20 MHz (Dell 310).
• Minimum 1 MB of RAM, optional 2 MB or 4 MB of RAM* expandable to 16 MB

- (using a dedicated high-speed 32-bit memory slot).
- Advanced Intel 82385 Cache Memory Controller with 32 KB of high-speed static RAM cache.
- Page mode interleaved memory architecture.
- Socket for WEITEK 3167 math coprocessor.
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
- 1 parallel and 2 serial ports.
- 8 industry standard expansion slots (6 available).
- 12-month On-Site Service Contract provided by Xerox.†

†**Commercial Lease Plan. Lease for as low as \$131/month (325) and \$112/month (310).**

‡**Xerox Extended Service Plan pricing starts at \$370 (325) and \$251 (310).**

	325	310
40 MB VGA Monochrome System	\$3,599	\$2,999
80 MB VGA Color Plus System	\$4,099	\$3,499
80 MB Super VGA Color System (800 x 600)	\$4,199	\$3,599
190 MB Super VGA Color System (800 x 600)	\$4,699	\$4,099

Prices listed include 1MB of RAM, 100, 330 and 650 MB hard drive configurations also available.



THE NEW DELL SYSTEM 320LX
20 MHz i386SX.

One of the fastest SX's around.

STANDARD FEATURES:

- Intel 80386SX microprocessor running at 20 MHz.
- Minimum 1 MB of RAM,* optional 2 MB or 4 MB expandable to 16 MB (8 MB on the system board).
- VGA systems include a high-performance 16-bit video adapter.
- LIM 4.0 support for memory over 1 MB.
- Socket for 20 MHz: 80387SX math coprocessor.
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
- Integrated high-performance hard disk interface and diskette controller on system board (ESDI-based systems include a hard disk controller).

- 1 parallel and 2 serial ports.
- Enhanced 101-key keyboard.
- 200-watt power supply.
- 8 industry standard expansion slots (7 available).
- 12-month On-Site Service Contract provided by Xerox.†

†**Commercial Lease Plan. Lease for as low as \$98/month.**
‡**Xerox Extended Service Plan pricing starts at \$261.**

	316SX	210
20 MB VGA Monochrome System	\$1,949	\$1,649
40 MB VGA Color Plus System	\$2,449	\$2,149
40 MB Super VGA Color System (800 x 600)	\$2,549	\$2,249
80 MB Super VGA Color System (800 x 600)	\$2,749	\$2,449

Prices listed include 1 MB of RAM, 190, 330 and 650 MB hard drive configurations also available.



THE DELL SYSTEM 316SX
16 MHz i386SX and DELL SYSTEM 210 12.5 MHz i286.

The perfect low profile mainstream computers.

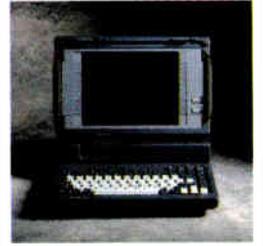
STANDARD FEATURES:

- Intel 80386SX microprocessor running at 16 MHz (Dell 316SX) and 80256 microprocessor running at 12.5 MHz (Dell 210).
- Minimum 512 KB of RAM, optional 640 KB, 1 MB or 2 MB of RAM* expandable to 16 MB (8 MB [316SX] and 6 MB [210] on system board).
- LIM 4.0 support for memory over 640 KB.
- Socket for Intel 80387SX (316SX) and 80287 (210) math coprocessor.
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
- 1 parallel and 2 serial ports.
- 3 full-sized 16-bit AT expansion slots available.
- 12-month On-Site Service Contract provided by Xerox.†

†**Commercial Lease Plan. Lease for as low as \$73/month (316SX) and \$62/month (210).**
‡**Xerox Extended Service Plan pricing starts at \$196 (316SX) and \$158 (210).**

	316SX	210
20 MB VGA Monochrome System	\$1,949	\$1,649
40 MB VGA Color Plus System	\$2,449	\$2,149
40 MB Super VGA Color System (800 x 600)	\$2,549	\$2,249
80 MB Super VGA Color System (800 x 600)	\$2,749	\$2,449

Prices listed include 1 MB of RAM. 2 MB versions of the above systems are available for an additional \$200. 100 and 190 MB hard drive configurations available.



THE DELL SYSTEM 316LT
16 MHz i386SX.

This full-featured, battery-powered 386SX laptop costs less than most 286 laptops.

STANDARD FEATURES:

- Intel 80386SX microprocessor running at 16 MHz.
- Minimum 1 MB of RAM, optional 2 MB of RAM* expandable to 8 MB (on the system board using 1 MB SIMMs).
- LIM 4.0 support for memory over 1 MB.
- Adjustable and detachable 640 x 480 VGA Liquid Crystal Display.
- One industry standard half-size 8-bit expansion slot.
- Socket for 16 MHz Intel 80387SX math coprocessor.
- 3.5" 1.44 MB diskette drive.
- 83-key keyboard with embedded numeric keypad and separate cursor control keys.
- 1 parallel, 1 serial, and external VGA monitor port.
- Connector for 101-key keyboard or numeric keypad.
- Two removable and rechargeable NiCad battery packs utilizing Dell's "Continuous Power Battery System" (patent pending).
- AC Adapter.
- 12-month On-Site Service Contract provided by Xerox.†

†**Commercial Lease Plan. Lease for as low as \$120/month.**
‡**Xerox Extended Service Plan pricing starts at \$303.**

20 MB, 1 MB RAM	\$3,199
20 MB, 2 MB RAM	\$3,399
40 MB, 1 MB RAM	\$3,499
40 MB, 2 MB RAM	\$3,699

THE NEW DELL i486 33 MHz and 25 MHz EISA SYSTEMS.

The best value in high performance PCs, combining i486 performance, 32-bit EISA I/O bus, and the industry's top rated service and support.

STANDARD FEATURES:

- i486 microprocessor running at 25 MHz or 33 MHz.
- EISA architecture (downward compatible with ISA).
- Standard 4 MB of RAM,* expandable to 16 MB on system board, using optional 1 MB and 2 MB SIMMs.
- VGA systems include a high performance 16-bit video adapter.
- Socket for WEITEK 4167 math coprocessor.
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
- 5 half-height drive bays.

- Dual diskette and hard drive controller.
- Six 32-bit EISA (ISA compatible), plus two 16-bit ISA expansion slots.
- High performance, IDE (80 MB, 100 MB, 190 MB), and ESDI (330 MB, 650 MB) hard disk drives.
- Enhanced 101-key keyboard.
- 1 parallel and 2 serial ports.
- 231-watt power supply.
- 12-month On-Site Service Contract provided by Xerox.†

†**Commercial Lease Plan. Lease for as low as \$232/month (425E) and \$286/month (433E).**

‡**Xerox Extended Service Plan available. Call for pricing.**

	425E	433E
80 MB VGA Monochrome System	\$6,399	\$7,899
190 MB VGA Color Plus System	\$7,199	\$8,699
330 MB Super VGA Color System (900 x 600)	\$8,099	\$9,599
650 MB Super VGA Color System (900 x 600)	\$9,299	\$10,799

Prices listed include 4 MB of RAM. 100 MB hard drive configurations also available.

The Dell Systems 433E and 425E are Class A devices sold for use in commercial environments only. *Performance Enhancements: Within the first megabyte of memory, 128 KB (316SX, 316LT and 210) or 384 KB (320LX, 325, 425E and 433E) of memory is reserved for use by the system to enhance performance. Can be optionally disabled on 316SX and 210. All systems are photographed with optional extras. All prices and specifications are subject to change without notice. Dell cannot be responsible for errors in typographical or photographic. †Pricing based on 36-month, open end lease. Leasing arranged by Leasing Group, Inc. In Canada, configurations and prices may vary. DELL SYSTEM is a registered trademark and Dell, 4167E and 433E are trademarks of Dell Computer Corporation. Intel is a registered trademark and 486, 486SX and 800 are trademarks of Intel Corporation. ‡Based on Compaq published price list dated March 5, 1990 for Compaq DeskPro 386-11 model 84, with 387 coprocessor, 54 MB hard drive and video graphics adapter. UNIX is a registered trademark of AT&T in the United States and other countries. Other trademarks and trade names are used to identify the parts and names of their products. Dell Computer Corporation disclaims any proprietary interest in trademarks and trade names other than its own. *No service call fee for available in certain locations. Shipping and applicable sales tax are not included. For information on and a copy of Dell's 30 Day Total Satisfaction Guarantee, limited warranty, and Xerox Service Contract, please write to: Dell Computer Corporation, 9505 Arboretum Boulevard, Austin, Texas 78759-7299. ATTN: Warranty. © 1990 Dell Computer Corporation. All rights reserved.

AD CODE: 11E23

**A WORD
TO THE
POWER
HUNGRY.**

COME AND GET

The new EISA-based Dell Systems® 433E™ and 425E.™ According to your letters and phone calls, they're just what you've been waiting for. Fast, affordable EISA-based i486™ computers.

And here they are. A 25 MHz and 33 MHz 486™ PC. Both with six EISA slots that are completely ISA compatible, plus two more ISA slots so you can meet both present and future expansion needs. And up to 33 MB per second bus transfer rate in EISA burst mode, so they're ideal for network server and UNIX® applications.

They even have something computer users have always been hungry for: toll-free technical support directly from the company that built the computers. Support that helps you get more from your Dell™ 486 than you would from other 486 computers.

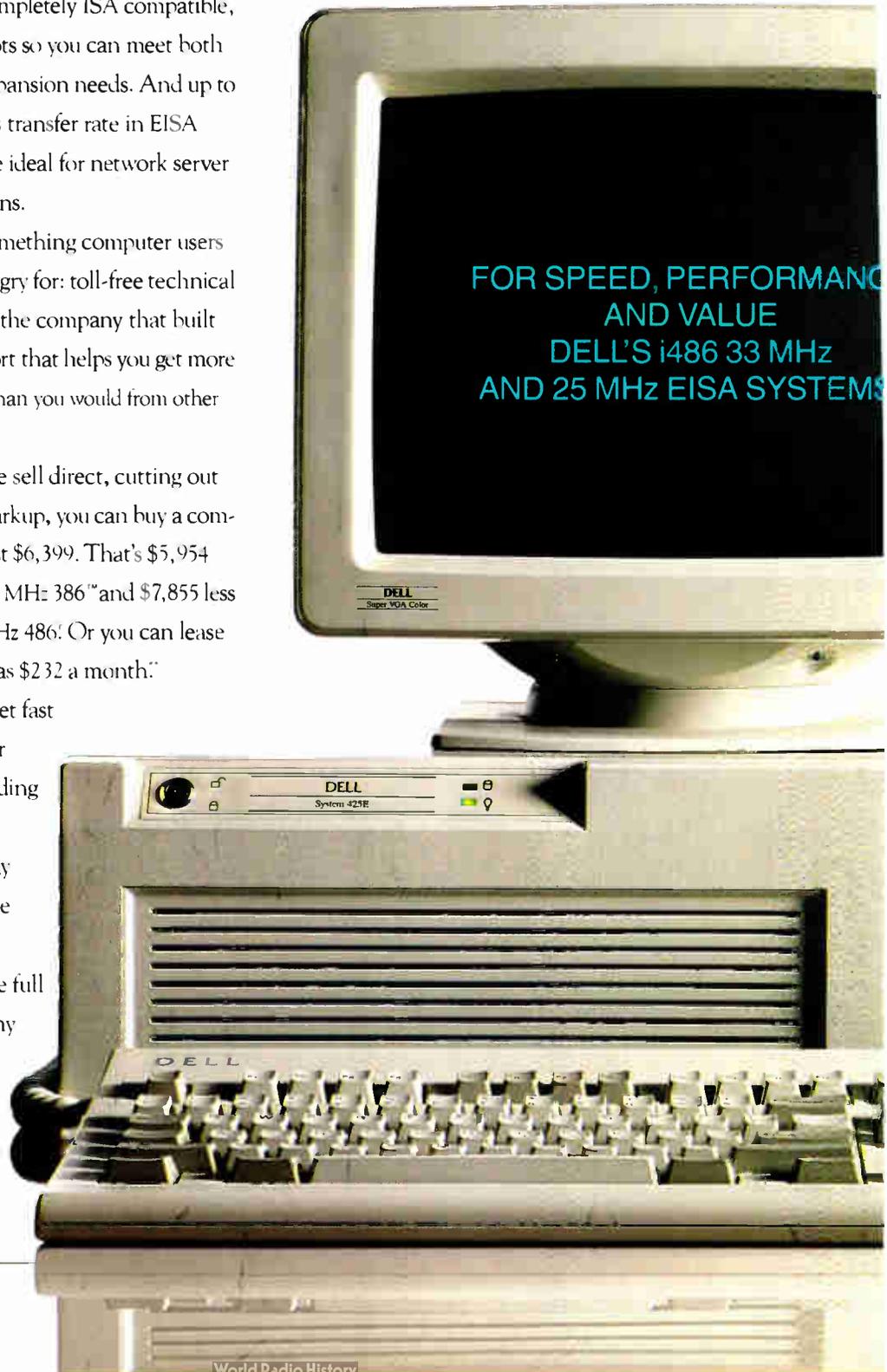
Best of all, since we sell direct, cutting out the retailer and his markup, you can buy a complete Dell 425E for just \$6,399. That's \$5,954 less than Compaq's 33 MHz 386™ and \$7,855 less than Compaq's 25 MHz 486. Or you can lease our system for as low as \$232 a month.*

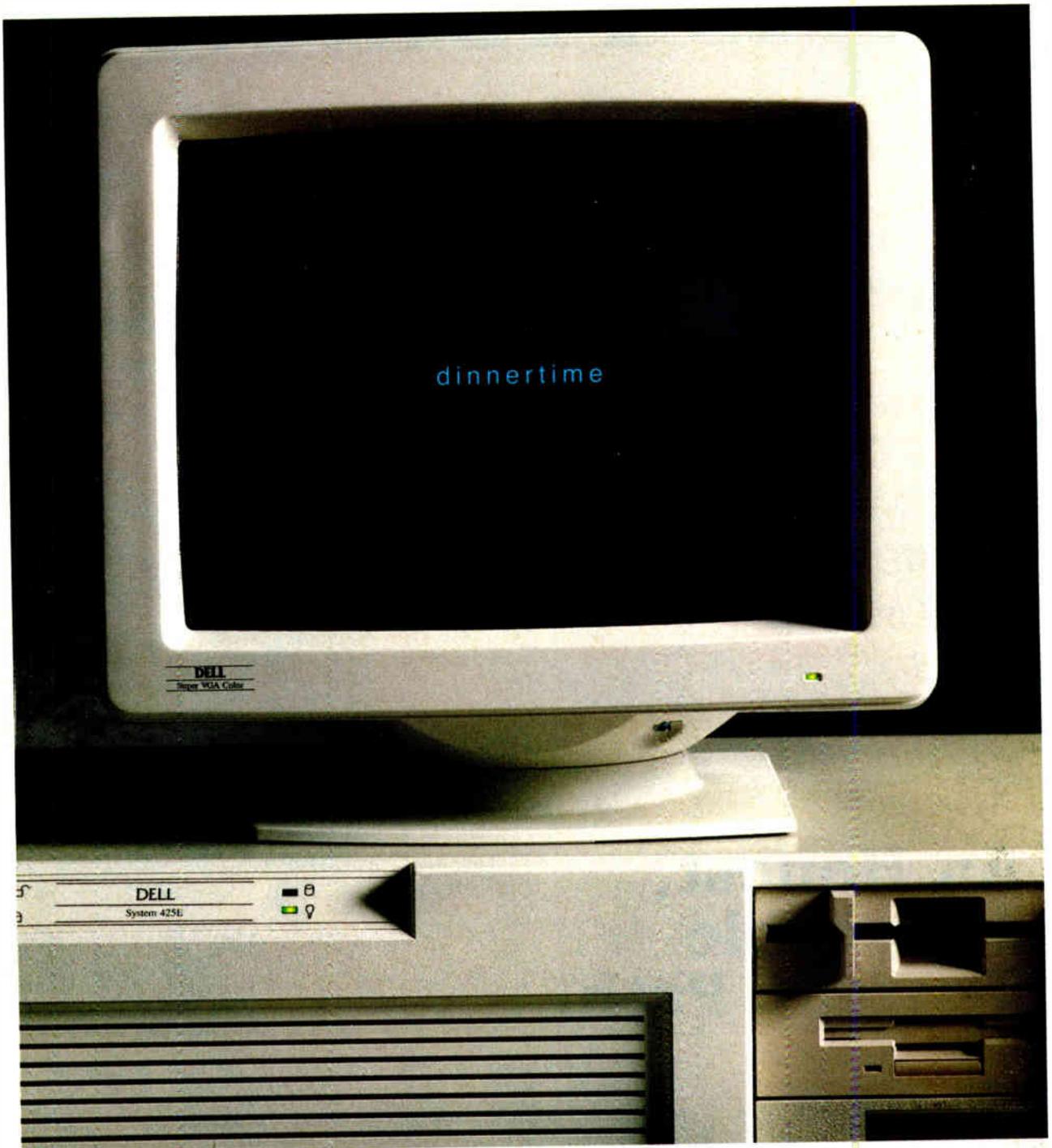
Just call us. You'll get fast delivery of a computer with the works. Including a one-year limited warranty and next-day desk-side service by the Xerox Corporation.△

Not to mention the full attention of a company that's been voted number one for overall customer

satisfaction in all six PC Week polls of corporate personal computers.

To order one of the most powerful PCs around. And soon we'll have another word for people

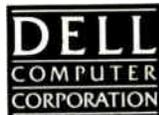




If you've been craving more power, we've got just the system for you. See inside for details.

TO ORDER, OR FOR OUR CATALOG, CALL NOW.

800-365-1460



FOR NETWORKING OR UNIX® INFORMATION.

800-678-UNIX

In Canada 800-387-5752 In the U.K. 0800 414535 In France (1) 05.00.33.55 In Germany 06103/701-3 In Sweden 0760-713 50

Circle 85 on Reader Service Card

World Radio History

Years From Now,

**Standard Features
at \$5995...**

EISA

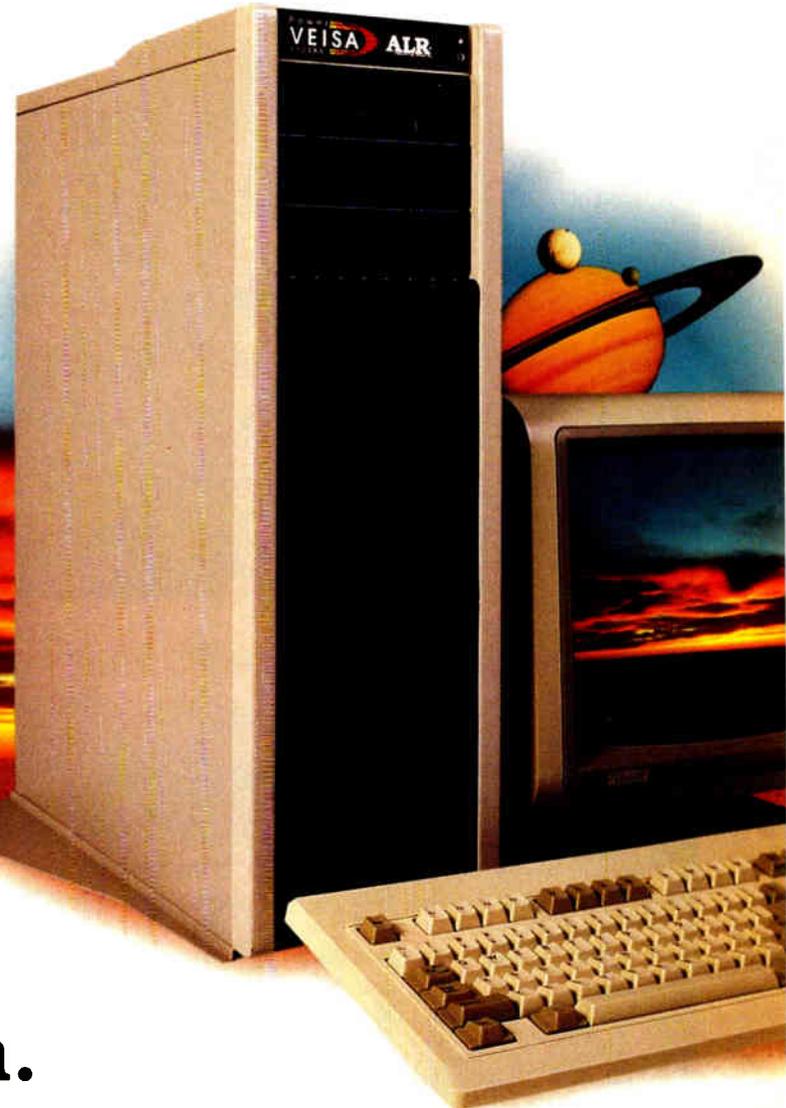
33-MHz 386

64-KB Cache

5-MB RAM

106-MB Hard Disk

**What more
could you want?**



An Honest, Affordable Upgrade Path.

You know what you want from a 386™ PC. ALR's **PowerVEISA 33/386** delivers. Cached 33-MHz performance, plenty of RAM to run even the bulkiest of today's applications, a choice of high performance hard disks, and **EISA** compatibility — all at a price that puts many similarly equipped ISA systems to shame. So what more could you want?

How about the future?

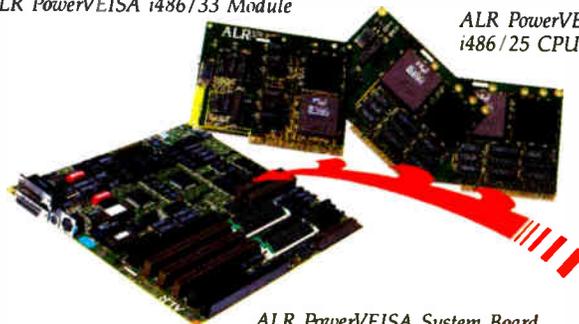
ALR's PowerVEISA 33/386 offers you an honest, affordable upgrade path to

25-MHz, 33-MHz (available second quarter) and future i486™ processors.

ALR PowerVEISA i486/33 Module

ALR PowerVEISA i486/25 CPU Module

ALR PowerVEISA 386/33 CPU Module



ALR PowerVEISA System Board

Prices and configurations subject to change without notice. Shown with optional monitor. Prices based on U.S. dollars.

It's Still What You Want...

Introducing the ALR® PowerVEISA 386/33™



ALR	AST
PowerVEISA 386/33	Premium®386/33
Model 110	Model 115V
i386 33-MHz CPU	i386 33-MHz CPU
✓ 5-MB RAM	2-MB RAM
✓ 64-KB Cache	32-KB Cache
106-MB Hard Drive	110-MB Hard Drive
✓ EISA	ISA
Optional VGA	VGA
	add \$295
	\$6,290
i486 25-MHz Upgrade	i486 25-MHz Upgrade
	add \$1995
✓ EISA Standard	Optional EISA Upgrade
	add \$1250
	\$8,285
	\$8,495
	add \$2995
	\$12,740
PowerVEISA costs \$2200 less today; over the years, it can save you more than \$4400 !	

The modular design of this system lets you change processors in about five minutes. More importantly, you can change the CPU module without having to replace cache or system memory, saving you hundreds of dollars when compared to some competitive upgrade schemes.

Engineered for the future, the floor-standing chassis of the PowerVEISA 386/33 can accommodate a total of 49-MB of memory and up to 1.2-GB (gigabytes) of fixed disk storage. Its EISA capabilities let you take advantage of the

latest in 32-bit I/O and bus mastering technology, while remaining compatible with 8 and 16-bit "AT" boards.

Even the PowerVEISA's innovative **FlexCache+** memory architecture was built for the future. Based on ALR's award-winning FlexCache architecture, this 64-bit dual-bus design incorporates an advanced "read and write back" 64-KB cache. FlexCache+ has been fine-tuned for optimum efficiency, especially when combined with an i486 processor upgrade.

Add ALR's one year factory warranty, on-line technical support, and optional on-site service from Intel™ to round out one of the best PC investments around.

The PowerVEISA 33/386 -- ready to meet today's needs and tomorrow's challenges.

For more information on the PowerVEISA 33/386 and ALR's complete line of systems, please call: **1-800-444-4ALR**

ALR®

Advanced Logic Research, Inc.
9401 Jeronimo Irvine, California 92718
(714) 581-6770 FAX: (714) 581-9240

ALR is a registered trademark and PowerVEISA is a trademark of Advanced Logic Research, Inc. AST and AST Premium are registered trademarks of AST Research Inc. Intel, 386, i386, and i486 are trademarks of Intel Corporation. AT is a registered trademark of International Business Machines Corporation.

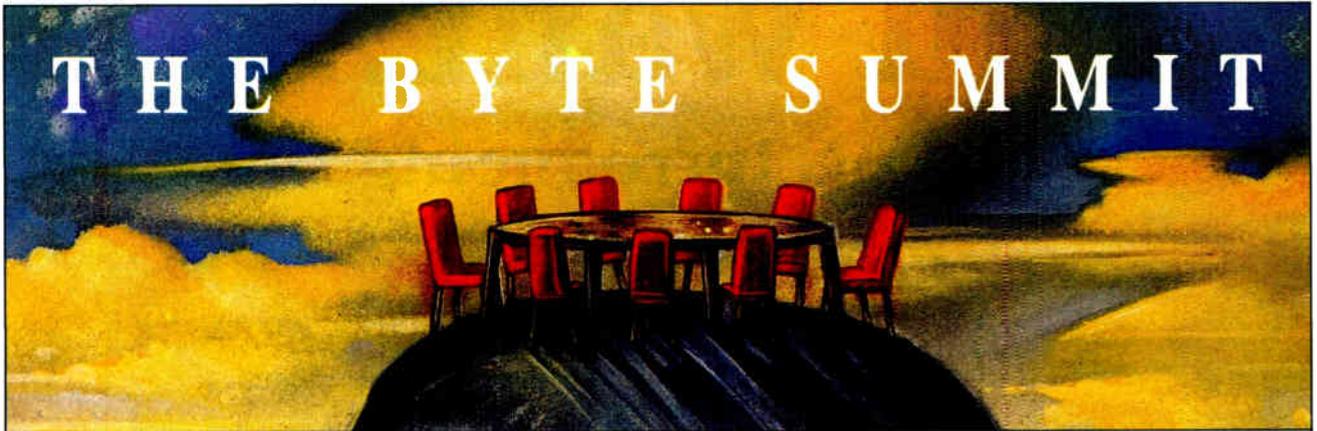
Circle 16 on Reader Service Card (RESELLERS: 17)

World Radio History

BYTE

CONTENTS

September 1990
Volume 15, Number 9



Editorial:
BYTE's 15th Anniversary Summit
What it is,
why we're doing it.

218

Welcome to the BYTE Summit
Sixty-three of the most creative
and influential people in the industry
discuss their perspectives on the
microcomputer industry of the future.

222

**15 Years of Bits, Bytes,
and Other Great Moments**
A look at key events in BYTE, the
computer industry, and world history
during the last 15 years.

369

NEWS

- 19 **MICROBYTES**
Late-breaking technology
and industry reports
from the BYTE news staff.
- 42 **WHAT'S NEW**
Product snapshots of
recent hardware and software
announcements.

FIRST IMPRESSIONS

- 120 **SHORT TAKES**
RasterOps Accelerator,
speeds up Macintosh graphics
- Backpack, MicroSolutions**
lets you add a drive easily
- Legacy, a word processor**
for Windows 3.0 from NBI
- Norton Utilities 5.0, a new**
version with mixed blessings
- HardFacts, information on**
6000 hardware products

- 128 **The NEC ProSpeed SX/20:**
Take It and Leave It
This 13-pound laptop can double
as a powerful desktop system.

REVIEWS

- 132 **Word Processors That**
Build Character
The BYTE Lab evaluates 15
WYSIWYG word processors
for the Mac and the PC.
- 154 **DEC's Latest RISC**
Digital Equipment makes a play
for the serious workstation
user with its revved-up
DECstation.
- 159 **Windows 3.0 Software Tool**
for End Users
Asymetrix's ToolBook lets you
create Windows 3.0 applications
without learning C.
- 162 **The Mac at 40 MHz**
The Mac IIfx is a powerful
number cruncher in the Mac
or Unix environment.
- 169 **Two Different Approaches**
to Mac Portability
The Outbound and Dynamac take
opposing approaches.
- 176 **Open Desktop: Relief**
for the Unix-Wary
SCO's Open Desktop may be the
shrink-wrapped Unix that DOS
users have been waiting for.
- 182 **G Is for Graphics**
Lotus finally gets graphical
with 1-2-3/G.
- 185 **9600-bps Modem Brings Apple**
Networks Closer Together
Thanks to its AppleTalk connector,
Shiva's NetModem V.32 can serve
as a shared network modem and
an internetwork router.
- 188 **New Floppy Drive Puts**
20-MB Disk in Your Pocket
Q/Cor's new floppy disk drive
leads the 20-megabyte vanguard.
- 196 **Strictly for Personal Information**
A roundup of seven personal
information managers shows that
there is a way to get organized.

EXPERT ADVICE

65
COMPUTING
AT CHAOS MANOR
Fifteen Years and Counting
by Jerry Pournelle
Jerry looks back at 15 years of BYTE.

81
THE UNIX /bin
Future History
by David Fiedler
Looking at business software from the last 15 years and the next 15.

87
MACINATIONS
The Place to Be for DTP
by Don Crabb
Talking to professional desktop publishers reveals surprising facts about desktop publishing on the Macintosh.

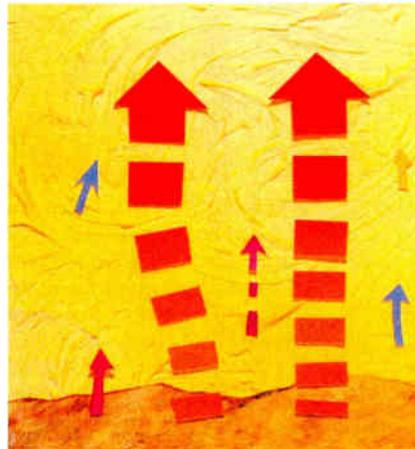
93
DOWN TO BUSINESS
Moving Down to Micros
by Wayne Rash Jr.
Powerful decision-support systems, once used only on mainframes, are now migrating to micros.

101
OS/2 NOTEBOOK
Mastering OS/2 Threads
by Douglas A. Hamilton
Mastery of OS/2 threads taxes developers but rewards users.

113
NETWORKS
Unite or Die
by Mark L. Van Name and Bill Catchings
Three developing application areas must unite before LANs can become a part of everyday life in the 1990s.

BYTE (ISSN 0360-5280/90) is published monthly with an additional issue in October by McGraw-Hill, Inc. U.S. subscriber rate \$29.95 per year. In Canada and Mexico, \$34.95 per year. Single copies \$3.50 in the U.S., \$4.50 in Canada. Executive, Editorial, Circulation, and Advertising Offices: One Phoenix Mill Lane, Peterborough, NH 03458. Second-class postage paid at Peterborough, NH, and additional mailing offices. Postage paid at Winnipeg, Manitoba. Registration number 9321. Printed in the United States of America. Postmaster: Send address changes, USPS Form 3579, and fulfillment questions to BYTE Subscriptions, P.O. Box 551, Hightstown, NJ 08520.

The Creation of the IBM PC/414



- 206 **Speaking OS/2's Native Language**
Object-1 speaks to OS/2's Presentation Manager in object-oriented terms.
- 212 **Dual-Page Duel: Two High-Resolution Monitors Square Off**
New high-resolution monitors from Cornerstone and Radius aren't just for desktop publishing.
- 214 **Flashdisk: Not Your Father's RAM Disk**
Digipro's Flashdisk plugs up to 8 megabytes of nonvolatile memory into any available 16-bit slot.

FEATURES

- 401 **Personal Computing in Eastern Europe**
Behind the crumbled Iron Curtain lie lands of high-technology disarray—and opportunity.
- 414 **The Creation of the IBM PC**
Design choices that culminated in the machine that conquered the microcomputer world.

- 423 **Alternative Operating Systems, Part 2: From a Tiny Kernel . . .**
When you're building a real-time operating system, it helps to start small.

- 429 **Sounds of Success**
Professional sound capabilities, once the exclusive domain of high-end recording studios, are now available to PC users.

HANDS ON

- 445 **UNDER THE HOOD Of Monitors and Emissions**
What's being done about magnetic fields from monitors?
- 455 **SOME ASSEMBLY REQUIRED Virtually Virtual Memory**
A memory management system for MS-DOS that lets you break the 640K-byte barrier.

DEPARTMENTS

- 6 **Spotlight**
A look at the future and a stroll down memory lane.
- 10 **Editorial: Happy Anniversary!**
We've thrown *you* a party.
- 34 **Letters, Ask BYTE, and Fixes**
BYTE readers predict the future.

PERSPECTIVES

- 516 **CHAOS MANOR MAIL**
- 518 **PRINT QUEUE Images Beget Images**
Visualization is a volume that challenges our notions of visual reality.
- 520 **STOP BIT**
Litigation vs. Innovation
Mitch Kapor argues against litigation as a business tactic.

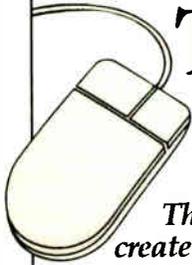
READER SERVICE

- 506 Editorial Index by Company
- 508 Alphabetical Index to Advertisers
- 510 Index to Advertisers by Product Category
- Inquiry Reply Cards: after 512

PROGRAM LISTINGS

- From BIX: See 466
- From BYTEnet: Call (617) 861-9764
- On disk: See card after 184

UNLEASH TURBO SPEED



The fastest way to create powerful programs with Turbo Pascal 5.5, Turbo C 2.0 and Turbo C++!

POWER TOOLS PLUS™/5.1 – \$149

– lightning-fast routines to help you:

- ◆ Add easy-to-use integrated mouse support for windows and menus
- ◆ Generate context sensitive help screens
- ◆ Resize and move windows and use drop shadows for that professional look
- ◆ Let users choose from window-oriented pick lists
- ◆ Create and access "huge" data structures
- ◆ Use multiple-line edit fields with fully configurable edit keys
- ◆ Add EMS support
- ◆ Write TSRs and ISRs easily
- ◆ Create powerful programs in Turbo Pascal 4.0, 5.0 & 5.1!

Turbo C TOOLS™/2.0 – \$149

– fast, high quality functions to help you:

- ◆ Add easy-to-use integrated mouse support for windows and menus
- ◆ Quickly include virtual windows and menus
- ◆ Integrate your windows and menus with Turbo C's text windows
- ◆ Create context-sensitive help screens
- ◆ Provide multiple-line edit fields with fully configurable edit keys
- ◆ Write TSRs and ISRs easily
- ◆ Create powerful programs in Turbo C 1.0, 1.5, 2.0 and Turbo C++!

FREE with these products!

All source code, complete sample programs, and a comprehensive manual are included. We offer free technical support and a bulletin board dedicated to technical issues.

Unleash your potential!

We offer programming tools that are fast, flexible and affordable. Call now to order, or to ask for a free brochure on our full line of products for C and Pascal.

Put Blaise tools to the test!

If during the first 30 days you are not satisfied, we'll refund your money.

Call (800) 333-8087 today!

BLAISE COMPUTING INC.
2560 Ninth Street, Suite 316 Berkeley, CA 94710
(415) 540-5441 FAX (415) 540-1938

Trademarks are property of their respective holders.



S P O T L I G H T



The **BYTE 15th Anniversary team:** (from left to right) Jeff Edmonds, copy editor; Amanda Waterfield, editorial assistant; Jane Morrill Tazelaar (seated), senior editor; Jan Muller, art assistant/photo researcher; Bob Ryan, technical editor; and Nancy Rice, art director. Not shown are Joe Gallagher, assistant art director; Lisa Nardecchia, Summit designer; Gene Smarte, special projects editor; and Andy Reinhardt, associate news editor.

THE ONCE AND FUTURE GURUS

See what 63 gurus think about the future, then stroll down memory lane

If you could talk to any of the computer industry gurus, whom would you pick? What questions would you ask? This was the delightful dilemma faced by the BYTE crew responsible for our 15th Anniversary BYTE Summit. Led by Jane Morrill Tazelaar, senior editor, staff members from every editorial department conducted and compiled interviews with 63 of the most important movers and shakers in the business. The cumulative result is a unique and comprehensive view of the future of computing.

Enthusiasm for the project ran high. For those doing the interviews, hearing what these luminaries had to say about the industry was a thrill. As Tazelaar put it, "It really blows your mind to answer your phone and find Jack Kilby on the other end."

After completing the interviews, some staff members volunteered to transcribe them from cassette to an ASCII file. The transcribed files totaled over half a megabyte—enough to fill 500 pages in

BYTE. Many extra hours were spent editing and collating questions to boil that down to the 70-plus pages in this issue. We hope you find the BYTE Summit entertaining, thought-provoking, and revealing.

But How Did We Get Here?

To get a true perspective on the future, it pays to review the past. The second part of our Anniversary section, "15 Years of Bits, Bytes, and Other Great Moments," is a time line compiled by Gene Smarte, special projects editor, and Andy Reinhardt, associate news editor. It follows industry milestones from 1975, the first year BYTE was published, to 1990.

And we have one last historical treat for you. In researching the article "The Creation of the IBM PC," Janet Barron, technical editor, "discovered" the original prototype IBM PC. While she was speaking with one of the PC's designers, David J. Bradley, Barron asked if IBM had a photo of the original PC. Bradley replied that a colleague had the prototype in his office closet and volunteered to send it to her.

The photo of the first IBM PC motherboard (on page 416) is the only one ever to have appeared in any computer magazine. That it is published in BYTE's 15th Anniversary issue seems only fitting. ■

—Michael Nadeau

New FoxPro

Shifting the Balance of Power in Database Management

There's a new leader in the relational database management world. Its name is FoxPro.

FoxPro is the first and *only* microcomputer database management system that combines astonishing performance with a sleek interface of amazing power and beauty.

- FoxPro offers all the elegance and accessibility of a graphic-style interface, yet operates at the stunning speeds possible only with character interfaces.
- FoxPro is so easy to learn and use, even beginners can become productive immediately; yet it's powerful and sophisticated enough to satisfy the needs of the most demanding developers and power-users.
- FoxPro gives you choices instead of limits: use a mouse or a keyboard; type commands or use the object-oriented interface; run in one window, or hundreds.
- FoxPro is so efficient, it runs in a 512K PC-XT, yet it's able to take advantage of the speed, expanded memory and extended video modes of the most advanced machines available. You don't even need a graphics card or special windowing software.



Nothing is Faster

Fox Software products are famous for their unmatched execution speed. FoxPro extends that tradition.

FoxPro is up to eight times faster than dBASE IV—more than 15 times faster than dBASE III PLUS!

And that blazing speed translates into unprecedented power. Now you can efficiently process gigantic databases with hundreds of thousands—even millions—of records.

Protecting Your Investment

With FoxPro, your existing FoxBASE+ or dBASE III PLUS programs will run perfectly—first time, every time, no excuses. And FoxPro is language-compatible with dBASE IV. But FoxPro doesn't stop there. It has over 140 language enhancements not found in any version of dBASE. We've outdone ourselves by adding more than 200 language extensions you won't find in FoxBASE+.

Best of all, FoxPro opens up whole new worlds for your applications by letting you move them onto a variety of different platforms.

The Tradition Continues

Fox Software is committed to excellence—our products prove it.

We've been producing superb database management software since 1983. And our products for both the PC and the Macintosh continue to win awards worldwide.

We've taken everything we know about software engineering, databases and interface design, and focused it into one remarkable product—FoxPro.

FREE Demo Disk

Shift the balance of power in your favor by trying FoxPro for yourself.

Call (419) 874-0162 now to get your free demo disk. Or ask for the FoxPro dealer nearest you. See for yourself: **Nothing Runs Like The Fox.**

FoxBASE+ Users: Call About Our Liberal Upgrade Offer!

System Requirements: FoxPro operates in 512K RAM (640K recommended) with MS/PC-DOS 2.0 or greater and an 8086/8088, 80286 or 80386 microprocessor. For optimum performance, FoxPro takes complete advantage of any available EMS (expanded memory) or a math coprocessor.

Trademark/Owner: FoxPro, FoxBASE+/Fox Software; dBASE III PLUS, dBASE IV/ Ashton-Tate.

Fox Software

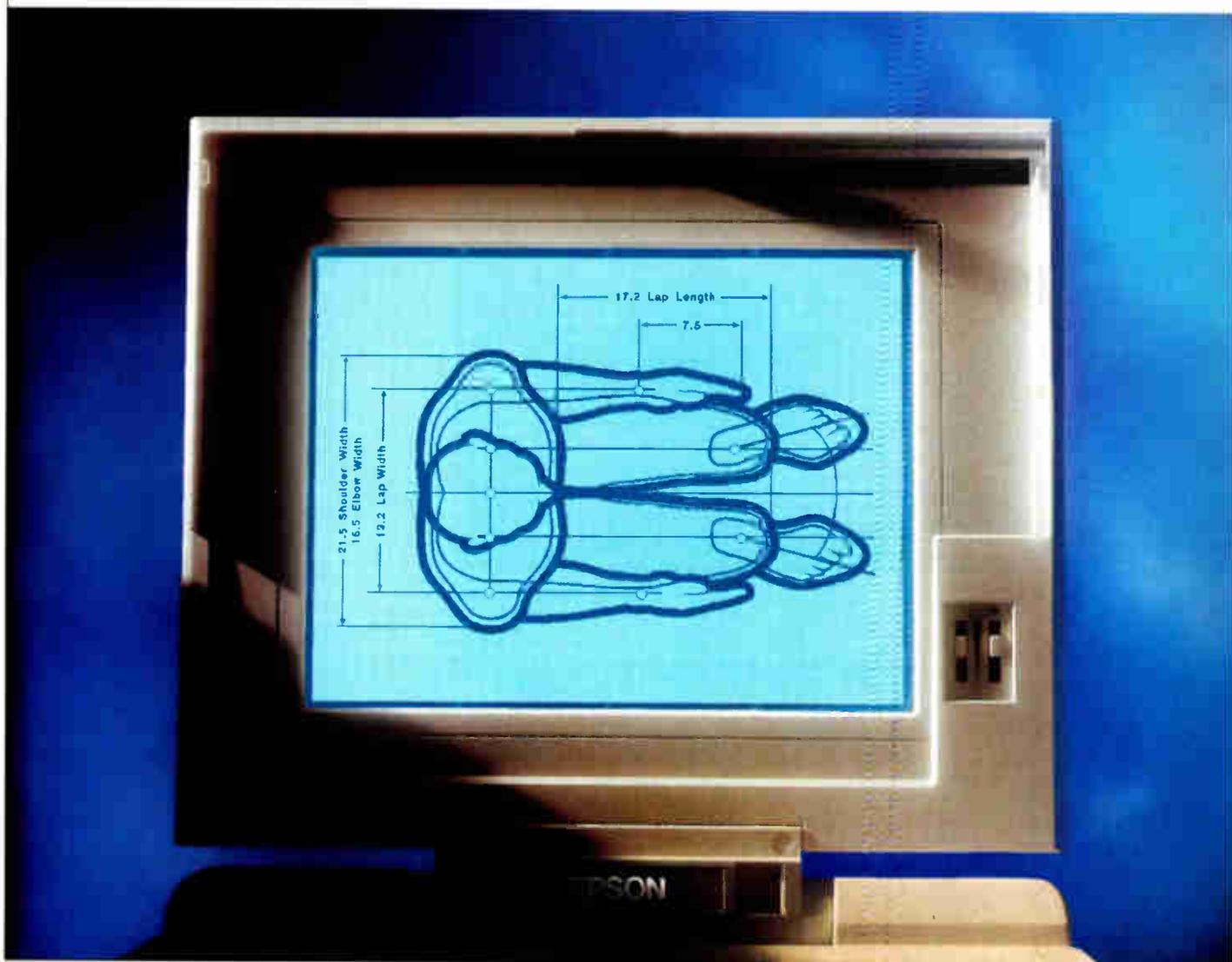
Nothing Runs Like The Fox.

Fox Software, Inc. (419) 874-0162
134 W. South Boundary FAX: (419) 874-8678
Perrysburg, Ohio 43551 Telex: 6503040827 FOX

Circle 121 on Reader Service Card



A laptop designed
that while your
your lap will stay p



*Third party drive port available from Manzana Microsystems, Inc. Epson is a registered trademark of Seiko Epson Corporation.

with the knowledge
needs may expand,
pretty much the same.

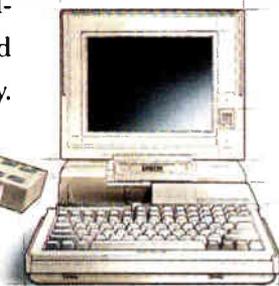
Introducing the Equity LT 386SX Laptop

Adding power, speed and peripherals to a personal computer is a constant test of design innovation.

Configuring a *laptop* to meet expanding needs becomes an even more demanding challenge because size, weight, and battery life come dramatically into play.

Epson® engineers have met that challenge with their new Equity LT 386SX, featuring one of the most powerful microprocessors available in a battery-powered laptop. It is a design of both distinctiveness and common sense.

Epson's Datasafe hard drive can be removed, making it easy to transport, or store separately for added security. With an optional* drive port, the hard drive can plug directly into a desktop computer. It offers a choice of 20 MB or 40 MB



Epson's unique, removable hard drive: key component of the most flexible laptop ever made.

capacity, and a shock indicator that alerts the user to the occasional hard knock.

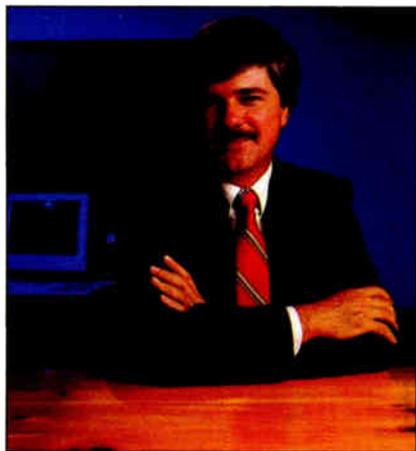
The modular design of Epson's entire laptop series suggests a new standard for customized performance. The user can easily install or remove options such as a modem, extended RAM, external keyboard, or 2/3 length industry standard card. The VGA screen can also be removed or left in place when using an external monitor.

The Epson laptop indicates its own vital signs—battery life, speed, and disk drive in use—on a unique LCD status bar, and even has the good sense to turn off its own screen and hard drive when not in use.

The LT 386SX offers a degree of speed, power and flexibility once limited to desktop computers. In fact, there is one feature of this remarkably engineered bit of technology that a desktop can only envy. Its size.

Engineered For The Way You Work.





HAPPY ANNIVERSARY!

To celebrate 15 years of publication, we've thrown you a party

Senior Editor Ken Sheldon was standing in my door, a box in his hands. "Would you like to see the original, hand-assembled prototype of the first IBM PC motherboard?" he asked. "I have it here."

I knew that Ken was working on an article on the first PC as one of many special articles for this anniversary issue—but the actual original prototype IBM PC motherboard? Holy smokes!

Naturally, I said yes, and Ken then carefully unwrapped his prize. There it was: sire of all the PC progeny. Undoubtedly, this mass of hand-wiring and temporary sockets was among the most significant technological artifacts of our time. I felt as if I should be wearing gloves to handle it.

This was IBM's own original PC prototype—one of only two built. The other had been shipped to Microsoft in 1980 for development of the original PC software. What a treasure!

You can see and read more about "The Creation of the IBM PC" on page 414 in this issue. But don't stop there, because that's just a sample of the gems that you'll find in this Special 15th Anniversary Issue.

For example, in addition to a full, normal complement of features, reviews, First Impressions, news, and columns, we also have the "BYTE Summit," beginning on page 226. In it, 63 world leaders of the microcomputing industry—drawn from both the business and technological communities—address the 13 most important questions that will shape the industry for years to come. The "BYTE Summit" amounts to a sneak preview of the future, provided by those

who will build that future.

Why are we doing all this? Why pack so much into one issue?

In a phrase, to say "Thank you."

With this issue, BYTE completes its 15th year of publication—the only general-circulation computer magazine ever to reach this milestone. You and a half million other readers around the globe have made it possible, and we wanted to pull out all the stops to give you a truly memorable issue.

And what a 15 years it's been. BYTE was born along with the microcomputer industry, back when the idea of a computer of your own was still a novel concept. In fact, small computers weren't even called "personal computers" until BYTE coined the term, in our May 1976 issue.

That's not the only common computer term that was born in BYTE. The *Oxford English Dictionary*, called the "final arbiter of the origins and use" of the En-

glish language, cites BYTE as the source for such computer terms as backslash, boot, bulletin (as in bulletin board), CD-ROM, clone, hacker, lap (as in laptop), transportable, user, WYSIWYG (what you see is what you get), and half a dozen other terms.

BYTE not only was there at the start, but it helped define the whole genre as it grew and matured from a hobbyist pastime to a cornerstone of modern business.

As the computer industry changed, our readers' needs changed, and so did BYTE. For example, as off-the-shelf products proliferated, BYTE published the industry's first microcomputer reviews and the first comparative reviews. BYTE also created the first magazine-sponsored computer lab and provided the first widely used microcomputer benchmarks.

Today, thanks to you, BYTE has reached record-high circulation levels and—because of your growing needs—is turning out more information than ever before, as you can see from the size of the issue you're holding.

That information falls into two broad categories: buying and using today's hardware and software, and understanding the emerging technologies that will become the tools of tomorrow. As always, BYTE is platform-independent, covering all major architectures and all significant operating systems.

About a year ago, as BYTE entered its 15th year, I added up the text file of what we had published to that point and found that it topped some 150 megabytes—well over a billion bits. Now, as we're well on the way toward the second billion bits, we're deeply honored that you've chosen to read BYTE, and we pledge to continue to do our best to meet your high standards.

Happy anniversary!

—Fred Langa
Editor in Chief
(BIX name "flanga")





See through your code

Our new Turbo Debugger® & Tools 2.0 gives you the vision to take a closer look at your code.

You can see a bug and kill it. See an execution bottleneck and get rid of it. See opportunities to fine-tune for maximum speed and go for it.

Turbo Debugger & Tools is a professional programmer's three-step secret for faster, more reliable applications.

Step 1: Turbo Debugger 2.0 shows you where the bugs are

Turbo Debugger® 2.0 has again advanced the art of debugging. It lets you go forward and also backward

through your code with a brand-new technique called *reverse execution*. With it, you step backward—undoing program execution—to locate bugs previously passed over. And with our Turbo Drive™ technology, you can debug the largest

programs using 286 protected mode or 386 virtual mode. Turbo Debugger also supports object-oriented debugging in Turbo C++ and Turbo Pascal.*



Step 2: Turbo Profiler !!NEW!! shows you where the bottlenecks are

Turbo Profiler™ is the world's first interactive profiler for DOS. With it you can see exactly where improvements to your programs will cut through execution bottlenecks and deliver maximum speed.

Turbo Profiler gives you a histogram of time-critical statistics, like how often each routine is called, how much time is spent in each routine, and how system resources are being used.

Step 3: Turbo Assembler lets you put on the speed

You can really put the pedal to the metal with Turbo Assembler®, the world's fastest MASM-compatible assembler. Replacing time-critical segments using Turbo Assembler is the fast-track to Turbo-charged programming.

Works with any compiler

Turbo Debugger & Tools is available separately, or bundled together with Turbo C++ Professional or Turbo Pascal® Professional 2nd Edition. It also supports any Microsoft® compiler supporting CodeView, any compiler generating .MAP files, and programs compiled by any DOS compiler at the machine-code level.

New Turbo Debugger & Tools

Turbo Debugger 2.0

- New user interface with mouse support
- Debug programs of any size with Turbo Drive on 286, 386 and remote debugging
- Object-oriented debugging—browse class hierarchies, inspect objects
- Walk through linked lists
- Keystroke record/playback gives "instant replay"
- 13 different program views, including breakpoints, watch and CPU

Turbo Profiler

- Tells how many times a line or routine is executed
- Shows which files are accessed and for how long
- Tells how efficient your overlays are
- Displays interrupt usage and call history
- 9 different program views

Turbo Assembler 2.0

- Optimizing multipass assembler with NOP squishing
- More compatible than and twice as fast as MASM

Order now!

Special limited time offer: Get Turbo Debugger & Tools for only \$99⁹⁵ (suggested retail price \$149⁹⁵)*

Registered owners of Turbo Assembler & Debugger, Turbo C® Professional or Turbo Pascal Professional can upgrade to Turbo Debugger & Tools for \$59⁹⁵.

Call 1-800-331-0877

Circle 44 on Reader Service Card
(RESELLERS: 45)

B O R L A N D

Code: MD23

*Offer expires August 30, 1990. Offer good in United States and Canada only. Turbo Assembler, Turbo Debugger, Turbo C, Turbo C++, Turbo Drive, Turbo Pascal, Turbo Profiler and Turbo Debugger & Tools are trademarks or registered trademarks of Borland International, Inc. Copyright ©1990 Borland International, Inc. All rights reserved. B1-1-41

World Radio History

NEW *OmniKey*TM/ULTRA

Finally... Everything You Want

12 SF-keys on the top—use them as duplicates or to access CTRL, ALT, SHIFT combination commands with just one stroke!

Period/Comma Lock key locks out < >

Repeat Rate select key lets you set rate from 3-120 CPS inside DOS or a program

12 F-keys on the left—where your fingers naturally find them for fast CTRL, ALT, SHIFT key commands

Quality lifetime double injected keycaps

Weighs almost 5 lbs. Stays put on your desk—no matter how fast you type!

Dvorak and AMIGA keytops available

Interchangeable CTRL, ALT and CAPS LOCK—put them where you want them

More features than any keyboard ever made!

The touch that made Northgate *OmniKey* famous! *OmniKey*/ULTRA has the same crisp feel that rocketed Northgate to the top spot in keyboard design. The secret? ALPS tactile mechanical key switches that let you know each keystroke has registered with a precise "click".

Double the function keys! You get 12 F-keys on the left—where you naturally reach for them. PLUS 12 programmable SF-keys on top perform SHIFT, CTRL or ALT functions. What a time saver in Word Perfect, Lotus and macro intensive programs!



Switchable keys—ULTRA flexibility! Switch CTRL, ALT and CAPS LOCK at the left.

Keep them as shown above or put them in the standard IBM enhanced layout; CAPS LOCK NEXT TO "A", ALT next to space bar, CONTROL under SHIFT. Right ALT and CTRL flop to

But that's just the beginning. With *OmniKey*/ULTRA, you can even swap Backslash and Asterisk ... it's up to you!



In A Keyboard!



SF-Select key lets you program SF keys to perform CTRL, ALT and SHIFT functions

Interchangeable BACKSLASH and ASTERISK

Separate cursor pad with extra down arrow—you get BOTH diamond and inverted T cursor arrangements!

Separate numeric keypad with extra equals key—Excel users love it!



Famous Northgate Functions! Never type U>S>A> when you want to type U.S.A.! Our Period/Comma Lock key locks out <> even when shifted!



Instantly change Repeat/Delay rate from 3-120 CPS—just press Rate Select key! Zip through spreadsheets!

Double down arrow cursor pad! Both diamond and inverted T cursor control options. An extra down arrow key adds so much flexibility!

Separate numeric keypad, too! Cursor control is free at all times. Added equals key, too!

And that's not all! Dip switches give you unmatched compatibility with IBM type systems: PC, AT, XT, Tandy, AT&T, Amstrand and AMIGA. FCC Class B Certified, too.

Use the Keyboard Of the 90's RISK FREE FOR 60 DAYS!

Users all over the world told us what they wanted in their ultimate keyboard! We Heard You ... Now Here's *OmniKey/ULTRA*!

The keyboard for everybody—combines the best of all popular layouts! No matter what layout you prefer—function keys on left or top, diamond-shaped or inverted T cursor controls ... you get it with *OmniKey/ULTRA*!

Use *OmniKey/ULTRA* for 60 days! If it doesn't live up to everything we promise, return it. We'll refund every penny—including ground shipping charges!

Keep your keyboard and it's backed by THE INDUSTRY'S STRONGEST WARRANTY—FIVE FULL YEARS! Any problems due to materials or workmanship we'll repair or replace *OmniKey/ULTRA* at no charge!

OmniKey/ULTRA

Another Northgate
"Smart Tool For
Business"TM

ONLY

\$149⁰⁰

FOB Minneapolis

Use *OmniKey/ULTRA* Risk Free for 60 days! Phone for the Dealer Nearest You or Place Your Order Direct!

800-526-2446

CHARGE IT! We accept your VISA, MasterCard or Northgate Big 'N' Credit Card.

HOURS: Mon. - Fri. 7 a.m. to 8 p.m.; Sat. 8 a.m. to 4 p.m. Central. Dealer and Distributor prices available. FAX Your Order! 612-476-6443. Notice to the Hearing Impaired: Northgate now has TDD capability: Dial 800-535-0602.



1 Northgate Parkway, Eden Prairie, MN 55344

©Northgate Computer Systems, Inc. 1990. All rights reserved. Northgate, OmniKey and the Big 'N' logo are trademarks of Northgate Computer Systems. Other brand names are trademarks or registered trademarks of their respective owners. Specifications subject to change without notice. Subject to occasional inventory shortages.

Circle 205 on Reader Service Card

World Radio History

BYTE

EDITOR IN CHIEF
Frederic S. Langa

MANAGING EDITOR
Anne Fischer Lant

NEWS
New York: Managing Editor: Rich Malloy
Associate News Editor: Andrew Reinhardt
Peterborough: Senior Editor, Microbytes:
D. Barker
Associate News Editors, What's New: David
Andrews, Martha Hicks
Editorial Assistant: Amanda Waterfield
San Francisco: News Editor: Owen
Linderholm
Associate News Editor: Jeffrey Bertolucci
London: Senior Editor: Colin Barker

BYTE LAB
Managing Editor: Michael Nadeau
Technical Director: Rick Grehan
Senior Editor: Dennis Allen
Technical Editors: Alan Joch, Robert
Mitchell, Tom Yager
Testing Editors/Engineers: Stephen Apiki,
Stanford Diehl, Howard Eglowstein,
Stanley Wszola

STATE OF THE ART
Senior Editor: Jane Morrill Tazelaar
Technical Editor: Robert M. Ryan

FEATURES
Senior Editor: Kenneth M. Sheldon
Technical Editors: Janet J. Barron,
Ben Smith

SENIOR EDITORS, AT LARGE
Tom Thompson, Jon Udell

SPECIAL PROJECTS
Senior Editor: Gene Smarte

SENIOR CONTRIBUTING EDITOR
Jerry Pournelle

CONTRIBUTING EDITORS
Bill Catchings, Don Crabb, David Fiedler,
Hugh Kenner, Mark J. Minasi, Wayne
Rash Jr., Mark L. Van Name

CONSULTING EDITORS
Jonathan Amsterdam, Nick Baran,
Laurence H. Loeb, Trevor Marshall, Stan
Miaszkowski, Dick Pountain, Phillip
Robinson, Peter Wayner

COPYEDITING
Chief Copy Editor: Lauren A. Stickler
Copy Administrator: Cathy Kingery
Copy Editors: Susan Colwell, Jeff
Edmonds, Judy Graham, Nancy Hayes,
Margaret A. Richard, Warren Williamson

EDITORIAL ASSISTANTS
Office Manager: Peggy Dunham
Assistants: Linda C. Ryan, June Sheldon

ART
Director: Nancy Rice
Assistant Director: Joseph A. Gallagher
Art Assistants: Jan Muller, Lisa Nardecchia
Technical Artist: Alan Easton

BIX BYTE INFORMATION EXCHANGE

DIRECTOR
Stephen M. Laliberte

MANAGING EDITOR
Tony Lockwood

MICROBYTES DAILY
Coordinator: D. Barker Peterborough,
Rich Malloy New York, Nicholas Baran
San Francisco, Jeffrey Bertolucci
San Francisco, Laurence H. Loeb
Wallingford, CT, Stan Miaszkowski
Peterborough, Wayne Rash Jr. Washington,
DC, David Reed Lexington, KY,
Andrew Reinhardt New York, Jan Ziff
Washington, DC

PRODUCTION
Director: David R. Anderson
Senior Editorial Production Coordinator:
Virginia Reardon
Editorial Production Coordinators:
Barbara Busenbark, Denise Chartrand

TYPOGRAPHY
Systems Manager: Sherry Fiske
Applications Manager: Donna Sweeney
Typesetter: Christi Patterson

ADVERTISING SERVICES (603) 924-6448
Director of Advertising: Lisa Wozmak
Assistant: Christine W. Tourgee
Customer Service Supervisor: Linda Fluhr
Senior Account Coordinator: Lyda Clark
Account Coordinator: Dale J. Christensen
Materials Coordinator: Karen Cilley
Advertising Assistant: Roxanne Hollenbeck
Creative Services Manager:
Susan Kingsbury
Production Artist: Lillian J. Wise
Quality Control Manager: Wai Chiu Li
Production Coordinator: Rod Holden

ADMINISTRATION
Publisher's Assistant: Donna Nordlund

MARKETING AND PLANNING
Director: L. Bradley Browne
Marketing Communications Manager:
Pamela Petrakos-Wilson
Public Relations Manager: Dawn Matthews
Assistant Promotion Manager: Lisa
Jo Steiner
Marketing Art Director: Stephanie
Warnesky
Associate Art Director: Sharon Price
Senior Market Research Analyst: Julie
Perron
Copyrights Coordinator: Faith Kluntz
Reader Service Coordinator: Cynthia
Damato Sands
Marketing Assistant: Carol Pitman

FINANCIAL SERVICES
Director of Finance and Services:
Philip L. Penny
Business Manager: Kenneth A. King
Assistants: Marilyn Parker, Diane Henry,
JoAnn Walter, Jaime Huber, Agnes Perry

CIRCULATION
Director: Glyn Standen
Subscriptions Manager: Paul Ruess
Assistant Manager, Subscriptions:
Margaret Liszka
Subscriptions Assistant: Holly Zilling
Newsstand Manager: Vicki Weston
Distribution Coordinator: Karen Desroches
Back Issues: Louise Menegus
Direct Accounts Coordinator: Ellen Dunbar
Direct Accounts Telephone Sales
Representative: Karen Carpenter

BUILDING SERVICES
Manager: Tony Bennett
Assistants: Cliff Monkton, Gary Graham,
Ed Codman

PERSONNEL
Human Resources Administrator: Patricia
Burke, Human Resources Assistant: Fran
Wozniak, Receptionist: Beverly Goss

EXCHANGE EDITORS
Macintosh Exchange: Laurence H. Loeb,
IBM Exchange: Barry Nance, User Group
Exchange: David Reed, Interactive Game
Exchange: Richard Taylor, Amiga
Exchange: Joanne Dow, Writers Exchange:
Wayne Rash Jr., Tojery Exchange: Jerry
Pournelle, Telecommunications Exchange:
Stephen Satchell

PUBLISHER
Ronald W. Evans

ADVERTISING SALES
Associate Publisher, Vice President
of Marketing: Steven M. Vito
Administrative Assistant: Carol Cochran
Eastern Advertising Director:
Arthur H. Kossack (312) 616-3341
Sales Assistant: Julie Barker
Western Advertising Director:
Jennifer L. Bartel (214) 701-8496
Sales Assistant: Susan Vernon

NEW ENGLAND
ME, NH, VT, MA, RI, CT, ONTARIO,
CANADA, & EASTERN CANADA
Daniel D. Savage (617) 860-6395

EAST COAST
NY, NJ, DE, PA
Kim Norris (212) 612-2645
Ariane Casey (212) 612-2368

SOUTHEAST
NC, SC, GA, FL, AL, TN, VA, MS, AR, LA,
DC, MD, WV, KY
John Schilin (404) 843-4782

MIDWEST
IL, MO, KS, IA, ND, SD, MN, WI, NE,
IN, MI, OH
Kurt Kelley (312) 616-3328

SOUTHWEST, ROCKY MOUNTAIN
CO, OK, TX
Alison Keenan (214) 701-8496

SOUTH PACIFIC
SOUTHERN CA, AZ, NM,
LAS VEGAS, UT
Ron Cordek (714) 557-6292
Alan El Faye (714) 557-6292

NORTH PACIFIC
HI, WA, OR, ID, MT, NORTHERN CA, WY,
NORTHERN NV, WESTERN CANADA
Bill McAfee (408) 679-0371
Roy J. Kops (415) 362-4800
Leslie Hupp (408) 679-0371

CATALOG SHOWCASE/OUTBERTS
Scott Gagnon (603) 924-2661

INSIDE SALES
Director: Liz Coyman
Administrative Assistant: Susan Boyd

NATIONAL SALES
Mary Ann Goulding (603) 924-2664
Patricia Payne (603) 924-2654
Jon Sawyer (603) 924-2666

BYTE BITS (2x3)
Mark Stone (603) 924-6830

THE BUYER'S MART (1x2)
Brian Higgins (603) 924-3754

REGIONAL ADVERTISING SECTIONS
James Bail (603) 924-2533
Barry Echavarría (603) 924-2574
Larry Levine (603) 924-2637

BYTE POSTCARD DECK MAILINGS
BYTE DECK
Ed Ware (603) 924-6106
COMPUTING FOR ENGINEERS DECK
Ellen Perham (603) 924-2596

INTERNATIONAL ADVERTISING SALES STAFF
See listing on page 509.

BUSINESS AND MARKETING
Secretary: Patricia Bausum, Marketing
Services Coordinator: Denise A. Greene,
Billing Services Coordinators: Tammy
Burgess, Donna Healy, Editorial Assistant:
Brian Warnock

TECHNOLOGY
Programmer/Analyst: John Spadafora,
Programmer: Peter Mancini, Systems
Consultant: Gary Kandail

EDITORIAL AND BUSINESS OFFICE:
One Phoenix Mill Lane, Peterborough, NH
03458, (603) 924-9281.

West Coast Branch Office: 425 Battery St.,
San Francisco, CA 94111, (415) 954-9718;
3001 Red Hill Ave., Building #1, Suite 222,
Costa Mesa, CA 92626, (714) 557-6292.

New York Branch Editorial Office: 1221 Avenue
of the Americas, New York, NY 10020, (212)
512-3175.

BYTEnet: (617) 861-9764 (set modem at 8-1-
N or 7-1-E; 300 or 1200 baud).
Editorial Fax: (603) 924-2550. Advertising Fax:
(603) 924-7507.

SUBSCRIPTION CUSTOMER SERVICE: Outside
U.S. (609) 426-7678; inside U.S. (800) 232-
BYTE. For a new subscription—(800) 237-
9402 U.S. only, or write to BYTE Subscrip-
tion Dept., P.O. Box 555, Hightstown, NJ
08520. Subscriptions are \$29.95 for one
year, \$54.95 for two years, and \$74.95 for
three years in the U.S. and its possessions.
In Canada and Mexico, \$34.95 for one year,
\$64.95 for two years, \$87.95 for three years.
£41 for one-year air delivery to Europe.
¥28,800 for one-year air delivery to Japan,
¥14,400 for one-year surface delivery to
Japan, \$50 surface delivery elsewhere. Air
delivery to selected areas at additional rates
upon request. Single copy price is \$3.50 in
the U.S. and its possessions, \$4.50 in
Canada. Foreign subscriptions and sales
should be remitted in U.S. funds drawn on a
U.S. bank. Please allow six to eight weeks
for delivery of first issue.

EDITORIAL CORRESPONDENCE:
Address editorial correspondence to:
Editor, BYTE, One Phoenix Mill Lane,
Peterborough, NH 03458. Unacceptable
manuscripts will be returned if accom-
panied by sufficient postage. Not respon-
sible for lost manuscripts or photos.
Opinions expressed by the authors are not
necessarily those of BYTE.

PHOTOCOPY PERMISSION:
Where necessary, permission is granted by
the copyright owner for those registered
with the Copyright Clearance Center (CCC),
27 Congress St., Salem, MA 01970, to
photocopy any article herein for personal or
internal reference use only for the flat fee of
\$1.50 per copy of the article or any part
thereof. Correspondence and payment
should be sent directly to the CCC, 27
Congress St., Salem, MA 01970. Specify
ISSN 0360-5280/90, \$1.50. Copying done
for other than personal or internal refer-
ence use without the permission of McGraw-Hill,
Inc., is prohibited. Requests for special
permission or bulk orders should be
addressed to the publisher. BYTE is avail-
able in microform from University Microfilms
International, 300 North Zeeb Rd., Dept.
PR, Ann Arbor, MI 48108 or 18 Bedford
Row, Dept. PR, London WC1R 4EJ,
England.

OFFICERS OF MCGRAW-HILL, INC.:
Joseph L. Dionne, Chairman, President and
Chief Executive Officer; Robert N. Landes,
Executive Vice President, General Counsel
and Secretary; Walter D. Serwatka,
Executive Vice President; Frank D.
Penglase, Senior Vice President, Treasury
Operations; Robert J. Bahash, Executive
Vice President and Chief Financial Officer;
Thomas J. Sullivan, Executive Vice
President, Administration; Mary A. Cooper,
Senior Vice President, Corporate Affairs,
and Executive Assistant to the Chairman;
Ralph R. Schulz, Senior Vice President,
Editorial.

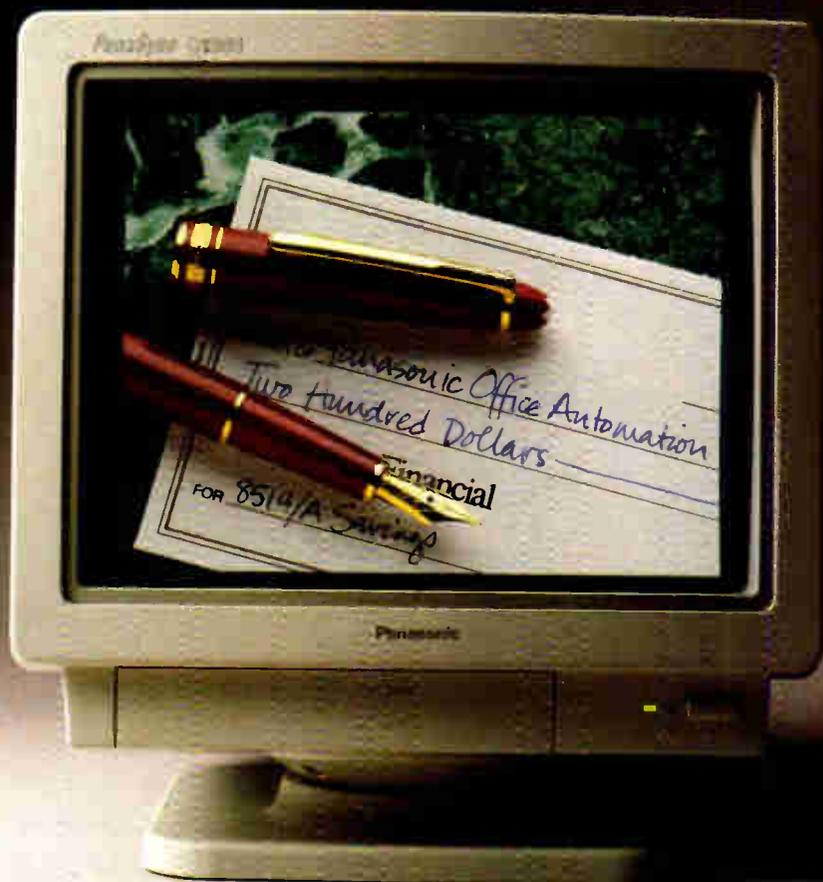
Founder: James H. McGraw (1860-1948).

Copyright © 1990 by McGraw-Hill,
Inc. All rights reserved. BYTE and
BYTE are registered trademarks of
McGraw-Hill, Inc. Trademark registered in
the United States Patent and Trademark
Office.

 Member
Audit Bureau of Circulation

Introducing the PanaSync™ C1381 Monitor:

8514/A resolution. VGA® price.



If you want the ultimate VGA graphics standard, and you've resigned yourself to paying a premium of hundreds of dollars to get it, you'll find our newest monitor pleasant viewing indeed.

The PanaSync C1381 gives you a sharp 1024 x 768 pixels, with 0.28 dot pitch. And virtually infinite color resolution. It's compatible with the most popular VGA boards, as well as analog RGB, MCGA, SuperVGA, and — of course — 8514/A standards.*

It's comfortable in virtually any IBM-compatible or Mac II environment.**

And it's a masterpiece of ergonomics. With front-mounted controls, tilt/swivel stand, plus a non-glare tinted black-matrix screen.

All this at a suggested retail price comparable to many of the ordinary VGA monitors on the market right now. For more information, simply call toll-free 1-800-742-8086.

*Peripherals, Computers, Printers,
Copiers, Typewriters and Facsimiles*

Panasonic
Office Automation 

PanaPro™ Monochrome Desktop Publishing Monitors with Video Adapters.



M1900
ME

(Mac SE)



M1900
M2

(Mac II)



M1900
AT

(IBM XT/AT & PS/2 Model 30)



M1500
AT



C1391

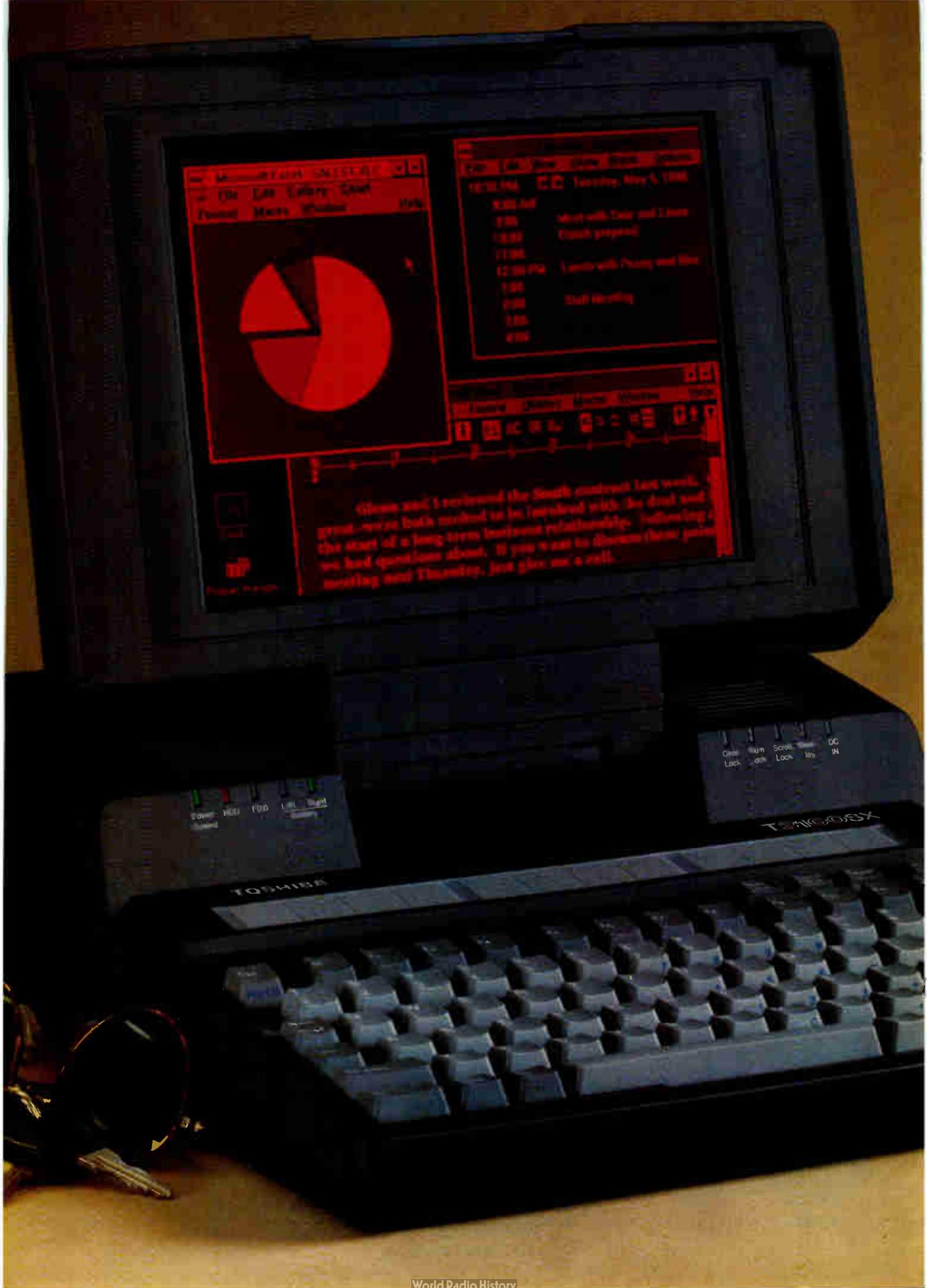
C1381

PanaSync™ Multiscanning Color Monitors.

* VGA, MCGA and 8514/A are trademarks of International Business Machines Corp.
** IBM XT, AT and PS/2 are registered trademarks of International Business Machines Corp. Macintosh is a registered trademark of Apple Computer Inc. An optional cable is required for Macintosh.

M3-B

Circle 217 on Reader Service Card



The ultimate portable for the ultimate program.



Since the T3100SX is battery operated, you can use powerful 386 applications wherever you choose.

Toshiba has combined the ultimate battery-operated portable, the T3100SX, with the ultimate program, Microsoft® Windows™ 3.0, to create the ultimate work environment.

The T3100SX gives you everything you need to get down to business. Including the brute strength of the 386SX™ microprocessor. And there's no better screen in a portable. It has a brilliant 640 x 480 VGA gas plasma display and a 100:1 contrast ratio.

All the other capabilities to unleash the power of Windows are there, too. Like 1MB of RAM that's expandable to 13MB. A choice of a 40MB or 80MB hard drive model. And 3 hours of battery life so you can work wherever you need to.

Plus from now through the end of the year we'll give you Windows 3.0 free with every T3100SX.

Put the latest in 386SX computing power to work for you. Turn on the T3100SX. And open a few windows.

The Toshiba T3100SX.

Take it. See how far you can go.

SX

The 386SX microprocessor gives you all the power you need to run the 386-based programs of today and tomorrow.



Microsoft Windows makes today's sophisticated programs easy to use. And it's free with your T3100SX.

T3100SX: 12.2 pounds (without batteries, 14.9 pounds with batteries); 16MHz 386SX with 80387SX math coprocessor socket, 40 or 80 MB hard disk with 25msec access, two removable, rechargeable batteries; three dedicated Toshiba memory slots, one dedicated Toshiba modem slot, one Toshiba general purpose slot, simultaneous display, 1MB RAM expandable to 13MB, gas plasma VGA display with 16 gray scales and 100:1 contrast ratio; L44 MB 3½" diskette drive. Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation. 386 and SX are trademarks of Intel Corporation.

For more information call (800) 457-7777, Dept. W.

In Touch with Tomorrow
TOSHIBA

Toshiba America Information Systems Inc., Computer Systems Division
Circle 302 on Reader Service Card (RESELLERS: 303)

Ventura Publisher introduces the Gold Series. It simply does more, any way you look at it.

And now there are several new ways to look at it. Because the desktop publisher that does more for you now does it all in the three leading PC environments.

The Gold Series introduces new Ventura Publisher® editions for DOS/GEM, Windows 3.0, and OS/2 Presentation Manager. That means new ease of use and learning as well as compatibility with hundreds more software applications. All three new editions can use documents from Ventura Publisher 1.1 and 2.0.

It does even more than before.

The Gold Series gives you much more than a choice of environments. At no extra cost, each edition includes our Professional

Extension and Network Server. So you also get such advanced DTP features as interactive table creation and scientific equation editing, cross referencing, and vertical justification.

And you get networking. So several users can edit and proofread simultaneously as well as share stylesheets and network resources. On Novell, IBM, 3COM, and other Windows- and OS/2 Presentation Manager-compatible networks.

Whether you're designing a newsletter or publishing a directory, you'll do it faster and more effectively with Ventura Publisher. Unique features give you more flexible and precise type control, and automate many

steps other programs make you repeat over and over. Ventura Publisher is the one DTP program that can handle all your publishing and design projects.

If you want to do more in desktop publishing, doesn't it make sense to use the program that does the most? Call today for more information about the new Ventura Publisher Gold Series. (800) 822-8221 in USA; (800) 228-8579 in Canada. For training information, call (800) 445-5554. Ventura Software Inc., a Xerox company.

Ventura Publisher Gold Series *It simply does more.*



Ventura Publisher® is a trademark of Ventura Software Inc., a Xerox company. XEROX® is a trademark of XEROX CORPORATION. All other product names or trademarks are property of their respective owners. © 1990, Ventura Software Inc.

Circle 312 on Reader Service Card

MICROBYTES

Research news and industry developments shaping the world of desktop computing
Edited by D. Barker

The Lotus Case: Judge Rules User Interface Is Protected by Copyright

When U.S. District Court Judge Robert Keeton issued his final declaration in the look-and-feel lawsuit filed by Lotus Development against Paperback Software, he wrapped up at least the first phase of one of the most closely watched legal cases ever to hit the computer industry. Judge Keeton's decision was firm and unambiguous, and if it sticks, it could deal a deathblow to software cloning, even in the form of a "compatibility" option such as that offered in Borland's Quattro Pro.

Although Keeton's ruling would not provide precedence for similar court cases being heard elsewhere in the country (e.g., Apple's suit against Microsoft over Windows), it's a significant decision in the legal wrangling over the protection of noncode aspects of software. Keeton tossed aside the nebulous concept of look and feel in favor of the more prosaic principle of "structure, sequence, and organization" to find that 1-2-3's user interface is a creative "expression" worthy of copyright protection. If the logic holds firm through subsequent court challenges—some observers predict it won't—it could become more difficult for software engineers to create products that don't infringe.

Among the giant look-and-feel cases twisting their way through the courts, the suit filed in 1987 by Lotus against two companies that make 1-2-3 work-alikes, Paperback Software (VP-Planner) and Mosaic Software (Twin), might have been the cleanest. The battle between Apple and Microsoft/Hewlett-Packard over Windows is complicated by messy contractual and licensing issues, while the suit filed by Ashton-Tate against dBASE cloner Fox Software involves tricky questions about the copyrightability of computer languages and of products derived from publicly funded research. At its most basic, the Lotus case promised to answer the question of how much copying is too much.

As in any copyright case, the judge had to first determine whether 1-2-3 was indeed copyrightable and then whether the defendants' products

"I conclude that a menu command structure is capable of being expressed in many if not an unlimited number of ways, and that the command structure of 1-2-3 is an original and nonobvious way of expressing a command structure.

"The user interface of 1-2-3 is its most unique element, and is the aspect that has made 1-2-3 so popular. That defendants went to such trouble to copy that element is a testament to its substantiality.

"I must disregard defendants' experts' predictions of doom for the computer programming industry if copyright is extended to the user interface and other nonliteral elements of computer programs. . . . Rather, this legal issue must be resolved in such a way as to extend copyright protection, clearly and unequivocally, to those nonliteral elements of computer programs that embody original expression."

—Judge Robert Keeton

violated that copyright. There is virtually no legal dispute over the right to protect underlying source and object code, and in any event there was no evidence here that Paperback Software had copied 1-2-3 code. The problem was whether by imitating 1-2-3's menus and commands the defendants had acted unlawfully.

In making his determination, the judge said that he had not found the concept of look and feel, as expressed in earlier lawsuits outside the software industry, to be helpful; rather, he relied on Lotus's definition of a user interface, as determined by the structure and organization of menus, the macro language, the use of function keys, and so on.

Keeton quickly pointed out that Lotus doesn't own the concept of an electronic spreadsheet. He also found certain elements of 1-2-3's user interface to be nonprotectable; for example, he said that the use of a rows-and-columns screen arrangement with horizontal and vertical cell addresses was not copyrightable because Lotus didn't invent it and it was essentially the only way to organize a spreadsheet.

If the realization of an electronic spreadsheet involved no creativity beyond what was dictated by the concept itself, 1-2-3's user interface

would not be copyrightable. But Keeton found the organization and wording of the program's descending menu tree to constitute the essence of its commercial and intellectual value. According to Esther Schachter, editor of *Computer Law and Tax Report*, Keeton looked at the "gestalt" of 1-2-3, rather than at specific words or screens, to determine that it is indeed an original work. The judge also said that even though commands such as Print or File Retrieve are functional in nature, that doesn't preclude awarding protection to the overall menu scheme.

The most important point in support of 1-2-3's nonunique originality came from alternative products on the market. Paperback Software argued that 1-2-3 was a market standard and that achieving success required making a program "compatible" with the standard's keystrokes, macros, and file format. But Keeton saw the success of programs such as Microsoft Excel and Computer Associates' SuperCalc4 as evidence that other, incompatible spreadsheet designs were technically feasible and commercially viable.

After finding that 1-2-3's structure was original, the judge had to determine whether that structure represented a "substantial" part of its expressiveness.

continued

NANOBYTES

One plaintiff happy with U.S. District Court Judge Robert Keeton's ruling in the Lotus/Paperback Software case is **Ashton-Tate** (Irvine, CA), which sued Fox Software and The Santa Cruz Operation way back in 1988 for allegedly violating the look and feel of its dBASE products, a suit that Fox said has "absolutely no merit." "We think the judge should be given a Nobel prize," Stan Witkow, vice president and general counsel for Ashton-Tate, told BYTEWEEK.

Weighing in with a different opinion was the **League for Programming Freedom**, which planned to protest the Lotus lawsuits with its second march to the company's headquarters in Cambridge, MA. "The Lotus victory sets a precedent that threatens to bollux the entire software industry. . . . Imagine if there were a copyright on the layout of keys on the typewriter," the league said in its official statement. "We are marching to call public attention to the new monopoly that is being rammed through the courts." Besides cofounder **Richard Stallman** (MacArthur Fellowship winner and father of the Free Software Foundation), the league's membership includes AI pioneer Marvin Minsky and Lisp inventor John McCarthy.

The **National Science Foundation** is working with industry and academia to develop an **advanced computer network** expected to transmit 1 billion bits of data per second. More than \$100 million for the project has come from corporations, including IBM, AT&T, MCI, and the regional Bell telephone companies. Among the universities involved are MIT, the California Institute of Technology, the University of Pennsylvania, and the University of California at Berkeley. Government laboratories in the project include Lawrence Livermore (California), Los Alamos (New Mexico), and the five super-computing centers. NSF official Stephen Wolff said he is confident that "new sorts of wonderment will ensue" from the project. Weather forecasting, three-dimensional medical imaging, and multimedia teleconferencing are some of the applications planned for the network.

"That the answer to this question is 'yes' is incontrovertible," he wrote. "The user interface of 1-2-3 is its most unique element."

Chilling?

The value of Keeton's decision as legal precedent will remain unknown until future cases have passed through the courts. Paperback Software has vowed to appeal. The resolution of this knotty problem might end up in the U.S. Supreme Court if Congress doesn't act first to provide legislative clarification.

Some analysts said that the Keeton decision greatly expands the definition of copyright protection for software. The judge apparently found the copyright violation so obvious and egregious that he was able to pronounce in fairly sweeping terms that the structure and organization of 1-2-3 represent its primary value. A more subtle case of copying might have required a finer definition of structure.

But Keeton also complained in his decision about the lack of solid precedents and said that he opted for a strict reading of congressional statutes. In that sense, the decision is quite narrow: He refused to consider the defendants' wish that he forge new copyright law by drawing a "bright line" to limit software copyrighting to the underlying code. To do so would exceed his jurisdiction, Keeton said.

Keeton also declined to consider—although he did take testimony on the subject over Lotus's objections—philosophical questions about the "chilling effect" of a finding for Lotus. He wrote that numerous experts, including VisiCalc coauthor Dan Bricklin, testified against extending copyright protection beyond underlying code. But he concluded that the views of these experts contradict the evident intentions of Congress in its 1976 and 1980 copyright statutes.

Tom Lemberg, chief counsel for

Lotus, not surprisingly argues that protecting the user interface actually helps software innovation. "We see it as a great victory for innovation because it provides a framework that allows people to invest in engineering and be protected enough to recover their investments," Lemberg said. "If the law protected the right of a programmer to copy the de facto standard, then there would be no need to innovate."

"99% Different" Doesn't Count

A few key elements of Keeton's decision could spell trouble for Borland, subject of Lotus's latest legal action, and other companies that incorporate what can be construed as 1-2-3-like menus. The judge quoted from earlier decisions that "the piracy of even a quantitatively small fragment . . . may be qualitatively substantial," and "a laundry list of specific differences . . . will not preclude a finding of infringement where the works are substantially similar in other respects."

"If one publishes a 1000-page book of which only a 10-page segment is an unauthorized reproduction of copyrighted material, and if the 10-page segment is a qualitatively substantial part of the copyrighted work, it is not a defense to a claim of infringement that the book is 99% different from the copyrighted material."

Other cases, particularly the suit between Apple and Microsoft, might have more to say about the problem of defining originality and copyright in a standards-based software environment. A finding as broad as Keeton's could cause nothing but confusion when independently developed applications use similar screens, menus, and file formats. And if we ever achieve the world of small, interchangeable program "objects" envisioned by Bill Gates and other software developers, we'll be in a real legal mess.

— *Andy Reinhardt*

Macintosh Veterans Conjuring New Magic

Two of the prime forces behind the Macintosh are heading up a new Apple spin-off to develop "personal intelligent communicator" products. Bill Atkinson, principal designer of MacPaint and HyperCard, and Andy Hertzfeld, author of most core Macintosh software, along with Marc Porat, ex-manager of business development at Apple's Advanced Technologies Group, will be the "executive team" heading

General Magic, Inc.

Just what's going on with GMI has been a topic of quiet but rampant speculation, since the new company was green-lighted by Apple 90 days before it was publicly announced. Apple would say only that the "concern will address market segments outside of Apple's mainstream business."

But deducing from their past work and

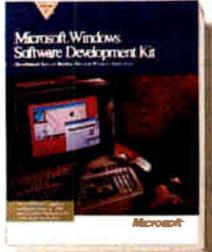
continued



Captain Midnight's
SECRET SQUADRON
 NEW OFFICIAL CODE
 AND MANUAL
 for 1948

Still writing code with the same old tools?

You're only as good as the tools you use. An excellent reason to acquire the new Microsoft® Windows™ Software Development Kit. Tools tailor-made to build applications for the huge new Windows market.



Including a specially made CodeView® debugger for Windows that easily debugs even the largest applications.

And all the "how to" help you'll ever need—from the extensive hard copy and online documentation to the sample source code to the comprehensive IBM® CUA style guide.

Plus some sophisticated analysis tools and improved resource editors.

All of which suggests that if you're not

using our SDK, then you're trying to write tomorrow's programs with yesterday's tools.

But that's a situation you can easily fix with the following official code numbers: (800) 323-3577, Dept. M24.

Call now to update your old kit with the Windows version 3.0 SDK at \$150 per kit. Or call us just to answer your questions.

The sooner you dial, the sooner you can really go to work on Windows apps.

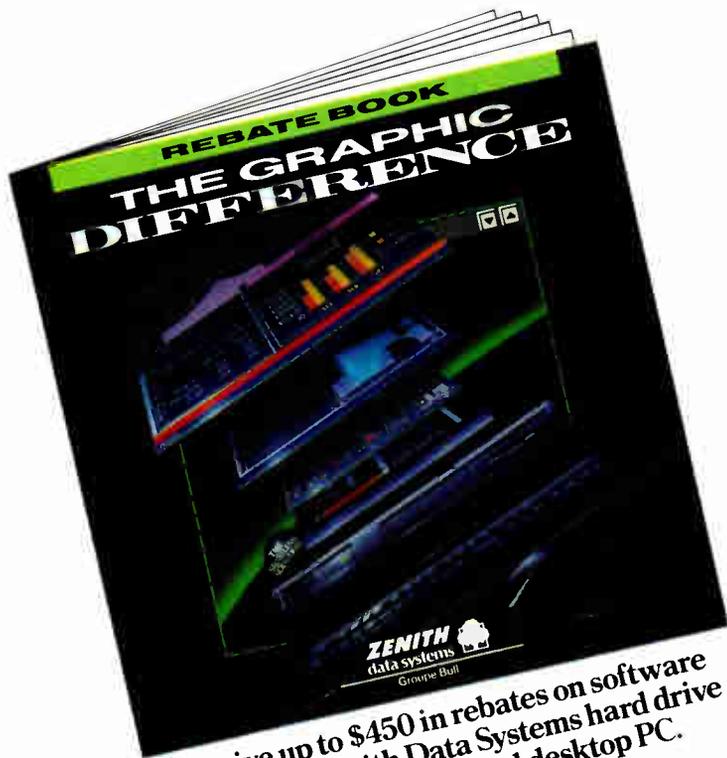
Instead of just toying around with them.

(800) 323-3577

Microsoft®
 Making it all make sense®

Offer good only in the 50 United States. Payment in U.S. funds (plus a \$750 shipping and handling fee and applicable sales tax). Please allow two to four weeks for delivery. © 1990 Microsoft Corporation. All rights reserved. Microsoft, CodeView and the Microsoft logo are registered trademarks and Making it all make sense and Windows are trademarks of Microsoft Corporation. IBM is a registered trademark of International Business Machines Corporation. CAPTAIN MIDNIGHT is the registered trademark of Sandoz Nutrition Corporation which does not endorse the Windows SDK and is not affiliated with Microsoft.

We Wrote The Book Appreciate Microsoft



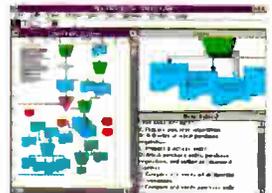
Receive up to \$450 in rebates on software with every Zenith Data Systems hard drive 286- or Intel386™-based desktop PC.

ZENITH DATA SYSTEMS INNOVATES AGAIN™

Now when you buy any Zenith Data Systems hard drive 286 or 386 desktop PC, you get Microsoft® Windows™ v.3.0 preinstalled plus a free Microsoft Mouse. Giving your Windows applications a common look, so you can pick up new applications easily. Almost seamlessly.

And, you get something more.

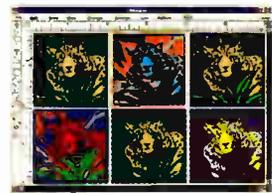
Manufacturers' rebates of up to \$450 on today's most advanced software



ABC Flowcharter™ for easier flowcharting than ever before.



ConvertIt!™ for simple conversion of applications from HyperCard® to ToolBook®.



Micrografx® Designer™ for easy artwork creation from imported images.



Superbase® 4. Relational applications database. Powerful, yet easy to learn and use.

designed for Windows v.3.0. Everything from Aldus® PageMaker™ to Microsoft Word™ for Windows.

Purchase a qualifying Zenith Data Systems hard drive desktop PC today. And receive up to \$450 in rebates. But hurry, this offer is good for purchases made through **September 28, 1990**. For more information and the name of your nearest Medallion Reseller, call **1-800-523-9393**.

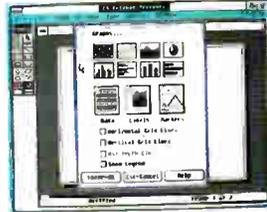
On How To Fully Windows Version 3.0.



Aldus® PageMaker® for design and production of professional-quality documents.



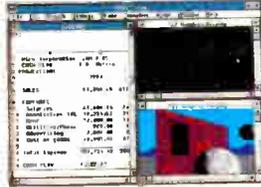
Ami® Professional for total "word publishing" with text and page layout tools.



CA-Cricket Presents™ for creating sensational presentation graphics.



Corel® DRAW! The ideal illustration program for novices or professionals.



DynaComm®. An ideal communications solution—in synchronous or asynchronous versions.



Legacy™ for advanced word processing and "WYSIWYG" page layout.



Microsoft® Excel™ for powerful spreadsheets, with spectacular charting.



Microsoft Word for Windows™ for quickly combining text, graphics and data.



Windows Workstation™. Networking with Windows made simple.

The Microsoft Mouse. The industry standard for fingertip control.



The Zenith Data Systems Sphere
The universal symbol of simplicity, the sphere perfectly represents The Seamless Solution™ from Zenith Data Systems.



Groupe Bull

Limit one rebate per coupon. Void where prohibited. Other restrictions apply. See rebate book for full details available at participating locations. Offer not available through Zenith Data Systems Education Resellers, or on software sold at education pricing. Not available in conjunction with any other offer. Where indicated, product and company names are trademarks of their respective holders. Graphics simulate Microsoft® Windows Version 3.0, a product of Microsoft Corporation. © 1990 Zenith Data Systems Corporation

NANOBYTES

PostScript laser printers are taking a dive in price. **QMS** (Mobile, AL), which has tended to set price trends in this field, zapped \$1000 off its eight-page-per-minute models. The 68000-controlled PS 810 and 820 now sell for \$3995 and \$4995. QMS also knocked \$500 off its 68020-based Turbo models, which now sell for \$5995 and \$6995. Meanwhile, **Océ Graphics** (Mountain View, CA) reduced the price of its color printer by \$2000; the thermal printer now sells for \$8990.

While lawn-conscious Americans were mowing their yards this summer, several top computer makers were **mowing their prices**. **Tandy** (Fort Worth, TX) did its usual hot-weather trimming, lowering the price of the 2800 HD laptop from \$3499 to \$2999 (and, until the end of this month, throwing in a free cellular phone) and cutting the 1000 TL/2 from \$1299 to \$999. As a "competitive pressure move," **Zenith Data Systems** (Mt. Prospect, IL) pruned \$300 off its Z-386 SX desktop computer. The company shaved a similar amount off the price of the SupersPort 286e portable. And with new versions in the works, **NEC Technologies** (Wood Dale, IL) took the price-whacker to its UltraLite laptop, buzzing off as much as \$1000. The 2-MB model is now \$1999; the 1-MB model, \$1599.

Novell (Provo, UT) plans to start shipping this fall a family of products for enabling NetWare 386 LANs to communicate with IBM mainframes. The software and associated architecture, collectively called NetWare 386 Communication Services, supports mainframe links over Token Ring networks and Synchronous Data Link Connection links. The family of connectivity packages will consist of NetWare 386 Services for SAA 1.0, which runs on the server, and NetWare 3270 LAN Workstation packages for Windows 3.0, DOS, and Macintosh systems plugged into the network. Software that will allow OS/2 or Unix workstations on a NetWare LAN to communicate with a mainframe will be released in 1991, said Gerry Machi, director of marketing for Novell communications products.

information from sources familiar with the project, GMI is working on a hand-held device for writing and sending electronic messages. Some Apple watchers say that the machine will use a pen and tablet and be capable of reading handwritten input.

HyperCard evolved from a minimalist Rolodex program that Bill Atkinson wrote in 1985; it used a card as an information container. A machine smaller than the Mac might require a smaller information container in a smaller working environment—say, a "postcard" instead of a "desktop." Those postcards need addresses if you want to send them anywhere, and Atkinson has already shown that he can make a hypertext-linked database out of cards, with a proprietary data-compression scheme that minimizes storage requirements of those cards. This compression scheme would be essential in such a system.

Andy Hertzfeld codes mostly in assembly, which allows him to write fast and tight programs. Such programs would be perfect for a hand-held machine.

Marc Porat's background includes setting up large-scale networks. It's likely that these postcards will be delivered by way of a special network; according to some sources, the GMI machine will operate with both radio waves (using Motorola's Ardis network, one source said) and telephone lines. Porat's latest stint at the Advanced Technologies Group has kept

him up on the latest R&D, such as work going on in handwriting recognition.

The fact that Apple has a nonexclusive license to manufacture what GMI conjures up implies that there's another manufacturing concern involved in this, but quietly. Insiders say that Sony is involved; that company has had a long relationship with Apple, providing it with power supplies and disk drives. Sony recently introduced a product called the CPT-1 that has been, interestingly enough, impossible to find in stores around San Francisco. The CPT-1 has a pen attached to it that lets you use handwritten characters as input. If Sony were to provide pen hardware and screens for GMI, it could also supply the same hardware to other computer companies. GMI's communicator might very well use a pen instead of a keyboard. You can select an icon with a pen instead of a mouse.

If this machine is to be more useful than an automated FiloFax, it will have to print things out. If it has a thermal printer, why not use it as a fax machine as well? Observers also speculate that this device will have an internal modem that's fax-compatible.

In any case, the device that GMI will produce won't be immediately forthcoming. One Apple insider put it this way: "Think of what the Macintosh was envisioned as in 1981. That had changed drastically by 1982, and it didn't ship until 1984. They have a vision; now they need time to develop it."

—*Laurence H. Loeb*

Experimental Holographic System Promises Massive Data Storage, Rapid Access

After several years of research, Microelectronics and Computer Technology Corp. (Austin, TX) says that it has developed a working model of holographic data storage. The federally funded MCC says that within two years, it could have prototype storage systems with a capacity of up to a gigabyte, read access times of between 1 and 10 μ s, and write times of approximately 100 μ s. This would mean an average data transfer rate of between 100 and 800 MBps.

MCC says that a future commercial product derived from this technology could store 1.125 terabytes and be capable of read times as low as 100 ns and write times of 10 μ s; the data transfer rate could be as fast as a phenomenal 50 gigabytes per second, MCC officials say. The eventual cost of

such a data storage device would be about the same per bit as magnetic drives and optical disks, says MCC.

Previous attempts at manufacturing holographic data storage systems failed because it proved impossible to retain the data for more than a few reads. One of MCC's patents concerns a new technique involving static electric fields and polarized laser beams, which allows for a much higher rate of data retention. The other patent concerns the use of an array of crystallites to store data, rather than the previous technique of using a single large crystal.

Holographic data storage works by embedding holographic patterns inside a crystal. Holograms are formed when a reference beam and an image beam of laser light intersect. Multiple holograms

continued

Other laser
printers
play with
one standard
dot size.

HP makes it a

ASTRONOMY IS
LOOKING UP
THE HIRSCH REPORT OF THE SKIES VOL. 8, NO. 4, FALL 1990

STAR SHORTS

Reported by The Star

Every day billions of dust particles enter into Earth's atmosphere. Now scientists are working to make meteor-burst communication a practical and economical alternative to the use of tele-

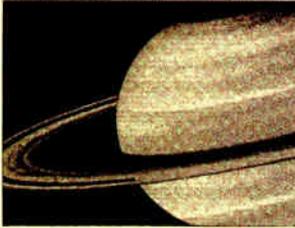
(continued on page 2)

You Can't See the Great Wall from the Moon!

Everyone has heard that you can see the Great Wall of China from the Moon. Or from Earth orbit. Or even from Mars. Certainly you cannot see the Great Wall from the Moon. According to an astronaut, it's difficult even seeing continents. You may be able to see the Great Wall from orbit, but, in general, it's difficult even to see familiar objects; the planet's swift motion-

(continued on page 3)

Voyager's Last Picture Show: When Voyager 2 was launched 12 years ago, who could have imagined these photos at this point in time.



NO BLACK HOLES?

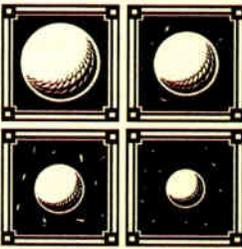
Scientists are still unable to confirm the existence of even a single black hole, despite widespread belief that such things should exist. Tracking down these invisible objects isn't easy, because they can only be studied indirectly by the effects they have on their surroundings. There are several types of places that

(continued on page 3)

MIRROR, MIRROR

It's a chore, but all reflecting telescopes require cleaning their reflective mirrors. Eventually, the aluminum coating on their mirrors deteriorates and needs replacing. For large instruments, the process requires removing the tele-

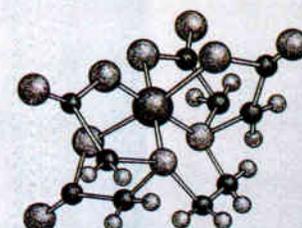
(continued on page 5)



More on planetary explosions inside.

CHAIN REACTION
RABOT'S CHEMICAL LETTER

JUNE 9, 1990
VOLUME FOUR
ISSUE THREE



New Leaps in Metal-Organic Chemistry

Metal-organic chemistry bridges the gap between organic and inorganic chemistry. It can lead to important new products (for example, poison antidotes). A chelate, such as EDTA above (containing carbon, hydrogen, oxygen and nitrogen atoms) can surround ions of metals and remove them from unwanted places. *(continued next page)*

What's New in Superconductivity?

It was almost exactly three years ago that a ceramic material that superconducts above liquid nitrogen temperature was discovered. Within days of the discovery, electronics, power transmission, and transportation were being redefined in everyone's imagination. Yet superconductivity was not a new phenomenon. The effect was first observed in mercury in 1911, and, since then, more than 6000 elements, alloys, and compounds have been found to superconduct. *(continued next page)*

Antimatter Bottled

A device tested may give investigators a glimpse of what an antimatter world might look like. The device cools antimatter to a temperature a few degrees above absolute zero and stores it for several days at a time. *(continued next page)*

Fifty Years Ago

Rumor has it that before WWII, our chemists were experimenting with a distilling process to lower the calories of ordinary beer. Abandoning the research at the onset of world war, researchers then pursued the development of a shelf-stable C ration. Don't believe all rumors.

Introducing the new HP LaserJet III printer with Resolution Enhancement technology.

The rules have changed. Now the name of the game is Resolution Enhancement technology. You'll call it the best thing to happen to laser printing since the very first HP LaserJet printer. It gives you clearer resolution. Curves that really curve. And edges that are never jagged.

Instead of a "one-size-fits-all" dot, HP's built-in intelligence varies dot sizes. So they can fill areas where

they could never go before. For clearer, more professional-looking documents.

Resolution Enhancement technology shrinks dots to fit in curves and diagonals where they've never gone before.

NANOBYTES

Intel (Santa Clara, CA) has a new single-chip **cache memory controller for 386-based systems** that's designed around the advanced cache built into the i486. Intel claims that the new 386 SmartCache chip (more formally called the 82395 DX), which integrates 16K bytes of static RAM with the cache controller, is the equal of 128K-byte memory caches. The new million-transistor chip incorporates 1000 cache tags as well as the control logic and static RAM. The chip uses a caching technique called write-buffer, essentially a write-through cache with a 128-bit buffer. This eliminates much of the typical delay associated with write-through caches, which need to write directly to memory and use CPU cycles and bus bandwidth to do it. The CPU can return to processing while the cache controller handles the buffering to memory.

Hoping to help establish **standards in object-oriented computing**, the **Object Management Group** (Framingham, MA) has issued a "request for information" on technologies that will help it define its Object Request Broker, the means by which objects handle requests and responses. The ORB is the "primary message delivery vehicle" in an object-oriented system, a spokesperson explained. A common ORB could result in a transparent mechanism for swapping information between different types of computers in a distributed environment, the OMG says. If you're interested in working with the OMG, phone (508) 820-4300 or fax (508) 820-4303.

The new **wristwatch pager** from **AT&E** (San Francisco) and **Seiko** could change the definition of remote communications. The Seiko Receptor MessageWatch Receiver's most remarkable achievements are in miniaturization: The device contains a digital watch, an LCD, an FM receiver, and microelectronics (intelligence and memory) in a package slightly larger than a wristwatch. The chip set used in the Receptor **might find its way into laptop computers**, AT&E says. The paging system relays messages using phone networks and subcarrier FM channels.

are stored in a single crystal by altering the angle at which the beams enter the crystal. At the intersection point of the two beams, a standing wave is formed, similar to light interference patterns. The pattern is stored by a charge field that captures photo electrons from the beam. If the reference beam is retransmitted to the crystal, the holographic image is regenerated and can be read. However, during this readout, the electronic charge pattern is weakened, and after a few reads, it disappears.

MCC's technique to get around this involves using a strong electric field 90 degrees out of phase and converting the electron charge pattern to an ionic charge pattern. This ionic pattern is not destroyed by reads in the same manner as the electron pattern. "We have not yet assessed if you can let this pattern sit for years and years," warned MCC's Jerry Willenbring.

Another technique that MCC has developed and patented involves using an array of crystals rather than a single large crystal. Although in theory there should be no difference in the storage

capabilities, using an array has a number of practical advantages, including eliminating "cross talk." Cross talk is an interference problem caused by the laser beam activating an adjacent hologram that interferes with the data readout. Using an array of crystals eliminates cross talk between adjacent holograms. MCC plans to use stacks of pages to store data and is limiting each crystal to a single stack. Using multiple small crystals in an array also has cost benefits. It's far more difficult to artificially grow large crystals than small ones, so it's cheaper to use a cluster of bonded crystals rather than a single large crystal. Also, an array can be scaled and enlarged as required, whereas a single large crystal cannot.

MCC plans to have a working storage device by early 1992 and to have commercial products by 1995. The holographic storage modules will be ideal for computer storage applications, as well as for use in digital high-definition TV, video, and audio.

—Owen Linderholm

EFF: Bringing Bill of Rights into Computer Age

Lotus founder Mitch Kapor and several industry colleagues have formed an organization they say will fight to ensure that the Bill of Rights covers computer-based communication and electronic information. The purpose of the Electronic Frontier Foundation (Cambridge, MA) is to combat violations of civil liberties, Kapor says, as well as to educate government policymakers, law enforcement agencies, and the public about computers.

The EFF has taken heat from some members of the industry because they see it as simply a "hacker defense fund," and some law enforcement officials are not necessarily in favor of it. "It's as if NOW started a foundation to come to the assistance of [people charged in] rape cases," says Don Ingraham, chief of the high-tech crime team and an assistant district attorney for Alameda County in northern California. "We don't know what to think of it." He says he doesn't understand why the computer industry would defend people trying to break into their systems.

But Kapor says that is not the organization's purpose. "Unauthorized entry into computer systems is an improper act," he stresses. "It ought to be illegal. It's not the mission of the

foundation to provide legal defense for people who break into computer systems. If people are ripping off credit card numbers and posting them on bulletin boards, there are laws about that, and I hope they're appropriately enforced," Kapor says.

It is important that freedoms provided in the Bill of Rights be associated with electronic information as well as information on paper, says Russell Brand, senior computer scientist for Reasoning Systems and a government consultant on computer security. "Paper is archaic," he says. "If your civil rights become attached to paper, they become archaic, and you lose. The Bill of Rights has to be attached to all forms of technology." Even in the case of suspected criminals, due process needs to be followed. "Privacy issues start with the people you hate," he says.

Ingraham points out that authorities have to be able to search computers for incriminating evidence; otherwise, it's like freeing people from being searched as long as they can afford a computer. And the computer itself, as well as the hard disks containing data, must be seized to guarantee that the evidence came from a defendant's computer rather than that of the DA's office, he

continued

NOW YOUR SOFTWARE CAN TEST ITSELF.

NOW AVAILABLE IN
VGA

AND
PS2!!

Your customers expect software that works. All the time. The key to software quality is exhaustive testing. It's also an engineer's worst nightmare. But it doesn't have to be. Because now you can automate your software testing.

Introducing the Atron Evaluator. The first and only non-intrusive automated PC-based software testing tool.

The Atron Evaluator automatically runs your software regression testing programs. All of them. All day. All night. Giving you thoroughly tested, higher quality software.

The Atron Evaluator is hardware-based. And since it's non-intrusive, software behavior is tested without the risk of alteration. Once your tests have run, you can refer to automatically generated test reports to double-check test results.

The Atron Evaluator saves time. And time makes you money. Development cycles are shortened, so your software gets to market sooner. And while your test programs are running, you can be more productive. Start a new project. Or go home.

For more information about the Atron Evaluator, call us at **1-800-283-5933**. And put an end to your worst nightmares. Automatically.

Atron

A Division of CADRE Technologies

Saratoga Office Center
12950 Saratoga Avenue
Saratoga, California 95070

Circle 30 on Reader Service Card

In Europe, contact:

Elverex Limited, Enterprise House
Plassey Technology Park, Limerick, Ireland
Phone: 061-338177

QA Training Limited, Cecily Hill Castle
Cirencester, Gloucestershire, GL7 2EF, England
Phone: (0285) 5888

NANOBYTES

Apple Computer reversed its 1987 decision to spin software development off into a separate company and will keep **Claris** as a fully owned subsidiary. Claris, which had planned excursions into Windows and maybe even the exotic lands of OS/2 and Unix, will now focus its development and marketing efforts on its flagship applications, such as ClarisCAD; extensions to Apple's system software; and products that link the Macintosh with other computing environments. "There will be a greater emphasis on software as a point of differentiation in coming years in the industry," said Apple spokesperson Chris Escher. "We want to maximize our software differentiation and get optimized applications out there."

Dayna Communications plans to soon ship a new series of Ethernet cards for Mac IIs and SE/30s. The new DaynaPort for Ethernet cards are based on technology licensed from Novell's Kinetics division and will cost \$495.

Mr. Jobs' Journal: Former BYTE West Coast bureau chief Nick Baran plans to launch this month a newsletter covering the NeXT Computer and related subjects. *Baran's Tech Letter* will aim to provide users and developers with news and analysis of products and technology issues. A subscription to the monthly, advertising-free publication is \$125. For more information: P.O. Box 876, Sandpoint, ID 83864, (208) 265-5286.

Sorry you bought those Billy Joel compact disks? Want to swap that Paula Abdul for The Ramones? Call the **Compact Disc Exchange** (San Francisco), a new electronic BBS for buying and selling music CDs. There's also an area for "gabbing about music," says system operator Wayne Gregori. For every disk you sell (the average price on the board is about \$10), CDE takes "a small percentage of the sale as a fee." As Gregori says, the system is especially useful for music listeners living in small towns or rural areas, where you're more likely to find used 45s than used CDs for sale. To go online, dial (415) 824-7603.

says. Ingraham stresses that law enforcers do follow the laws. "If the argument is with the way the stuff is seized, then they're barking up the wrong tree."

With the EFF, Kapor hopes to educate law enforcement officials on technical fine points. "We haven't spoken yet with law enforcement officials, but we're trying to find occasions to get

across a table from each other and talk." One of the group's first steps was a grant to Computer Professionals for Social Responsibility, which will use the money for its Computing and Civil Liberties Project. CPSR will also conduct "policy roundtables" with computer users, hackers, lawmakers, the FBI, and industry representatives.

— Sharon Fisher

Superconductor Chips Now Rolling Off the Line

Superconductors hold mighty potential, but researchers are still working on real-life applications. Now a small Silicon Valley start-up is doing something that should lead to superconductor-based products. Conductus (Sunnyvale, CA) has started producing superconductor chips that could be the brains of superfast computers and advanced communications systems. Superconductors allow electricity to pass through them with little or none of the resistance that constricts the flow of electricity in conventional conductors.

Conductus doesn't do any superconductor research itself but focuses on combining new superconductor technology with existing semiconductor manufacturing methods to build commercially viable products.

Conductus has developed a process that involves placing a thin layer of superconducting film on top of the semiconductor. The technique deposits yttrium barium copper oxide on a 1-inch

wafer that's then sliced into chips. The devices have found their way into a number of niche products, Smith said, including a bolometer, which is an infrared sensor for use in space satellites and chemical instruments, and the SQUID (or superconducting quantum interference device), a sensor for detecting magnetic fields.

Among Conductus's current customers are a number of "big companies" that Smith declined to identify. Computer behemoth Hewlett-Packard is among the company's investors, according to a spokesperson.

Conductus is focusing on niche markets because those markets aren't profitable enough for large Japanese and American corporations, many of which are currently developing superconductor applications. The company says that it expects to produce about 12,000 chips annually, which will sell for as much as \$1000 each.

— Jeffrey Bertolucci

AMD Selling 80287 Coprocessor for \$99

Advanced Micro Devices (Austin, TX) has developed a fully compatible version of the Intel 80287 coprocessor and is selling it for \$99.

The AMD 80C287 is the first Intel-based coprocessor from AMD, which currently makes versions of the 286 processor and other ICs. The AMD chip is based on the Intel microcode for the Intel 80287 and is thus completely compatible, AMD says.

The significant difference between AMD's coprocessor and Intel's is the price. AMD is charging only \$99 for the 10-MHz version of its 80287 clone, while the Intel chip has a street price of at least \$179 for the 8-MHz version and around \$210 for the 10-MHz version.

AMD has also introduced a low-power version, designed for use with laptops and notebook-size computers.

— Owen Linderholm

WHAT WILL THE NEXT 15 YEARS BRING? *We'd need a dozen Kreskins and an expert system to answer that, but with your help, we can get a handle on the future of computing. If you, your company, or your research group is working on a new technology or developing products that will significantly affect the world of microcomputing, we'd like to hear about it. Phone the BYTE news department at (603) 924-9281. Or send a fax to (603) 924-2550. Or write to us at One Phoenix Mill Lane, Peterborough, NH 03458. Or send E-mail to "microbytes" on BIX or to "BYTE" on MCI Mail. An electronic version of Microbytes, offering a wider variety of computer-related news on a daily basis, is available on BIX.*

Windows Sprouts Wingz.



Introducing Wingz™
for Windows 3.0 and OS/2,
the only spreadsheet to offer both
versions in the same package, each
separately developed and optimized.

It's also the only spreadsheet with
HyperScript®—the easy way to
build custom applications without
programming knowledge.

With Wingz-Datalink you can access
remote Informix SQL databases, such as
INFORMIX®—OnLine.

And Wingz is the only PC spread-
sheet to combine numbers, text and
3-D graphics in one window, on
one page, with one product.

“For sheer spreadsheet power, Wingz
outperformed 1-2-3/G and Excel in PC Week’s
spreadsheet benchmark tests.” (PC Week 7/9/90)

Free Test Flight

For a free demonstration of
Wingz, simply drop by your
local dealer. Or, for only \$9.95,
we'll send you a demonstration
version. Just call 1-800-331-1763
(in Canada, 416-566-7024).

Wingz is also available for the
Apple® Macintosh®, Unix® versions
support Open Look™, OSF/Motif™
and NextStep™.

 **INFORMIX®**



Pretty.



*Mission Critical Workstation 1448:
9 option slots and 2 drive bays.*

A PC that looks good in your office won't look good for long out in the plant.

Heat murders microprocessors. Dust decimates disk drives. Vibration victimizes video cards.

Any or all can wreck your entire operation.

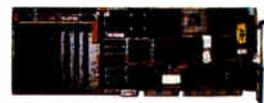
Texas Microsystems line of rugged, reliable ISA Bus products and systems are specifically engineered for those brutal industrial environments that eat pretty PCs for breakfast.

To ensure maximum reliability we design and manufacture from scratch practically everything that goes into our systems, like passive backplanes which we pioneered for microcomputers in 1983. These backplanes accommodate a full compliment of convenient, plug-in components, all compatible with IBM®. They're why our Mean Time To Repair (MTTR) is a phenomenal 10 minutes.

You won't find passive backplanes — or lower MTTR — in any of the leading office PCs.

We also build industrial-strength option cards to handle

myriad functions, in addition to our 286, 386™ and 486™ CPU cards in a full range of processor speeds. Our CPU card designs use Very Large Scale Integrated circuits and programmable array logic devices to reduce component counts by 50-60% which enhances reliability and resistance to physical stress. Ultimately, the design contributes to our remarkably long Mean Time Between Failures (MTBF): 70,000-100,000 hours, calculated against the MIL Standard Handbook 217E.



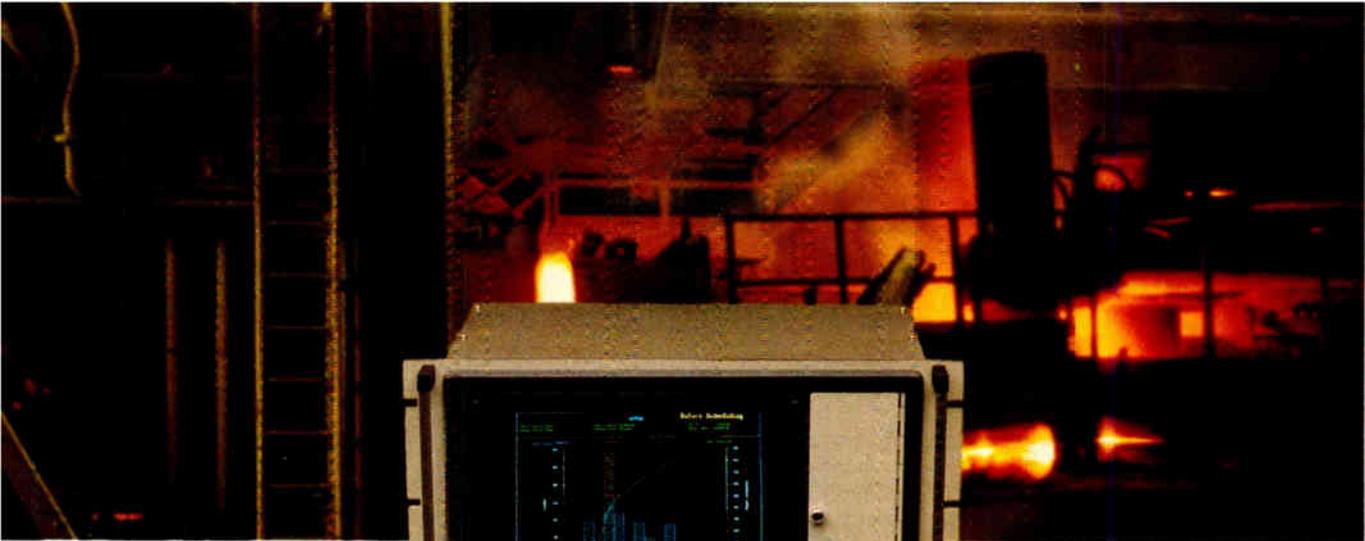
Ultra-fast 32-bit (80386) AT™ equivalent CPU board B386S. Available at 16, 20, 25, 33 MHz.

You won't find that kind of card selection — or MTBF — among the leading PC makers.

You won't find them torturing their systems like we torture ours, either. Not only do we perform extensive "shake, rattle and roll" tests on each new design, we pretest all our systems before they leave our dock. We burn them in at 55°C/131°F for 48 hours straight just to make sure they can take the heat at your plant.



*Mission Critical Benchtop 2003:
10 option slots and 2 drive bays.*



Pretty tough.

What's more, we shock-mount our disk drives to stand up to vibrations surpassing Richter scale proportions and we use only high-reliability power supplies that can go 100,000 hours MTBF.

With all that reliability designed into our products, is it any wonder that we guarantee better support than the other leading PC makers? Every system we offer comes with a full one-year, on-site warranty. Theirs don't. We also offer a toll-free number for technical and sales information, a regional network of sales engineers, engineering support for systems integration and a guarantee to meet shock specs. Of the lead-

ing PC makers, Texas Microsystems has the longest history of design using Intel microprocessors: 15 years in all. You'll find our systems hard at work in harsh operating environments at 70 of the Fortune 100 companies.

Granted, the leading office PCs may be prettier than ours, but our industrial-strength systems are designed to be more reliable. That reliability makes our systems look a lot better where it really counts:

Your production line .



Mission Critical Rack-mount 2001: 10 option slots and 3 drive bays.

It's- No- Comparison			
	Texas Microsystems	COMPAQ	IBM PS/2
Passive Backplane	Yes	No	No
100,000-hour MTBF power supply	Yes	No	No
Shock-mounted disk drives	Yes	No	No
Maximized MTBF	Yes	No	No
Positive pressure, filtration	Yes	No	No
Operation at 55°C/131°F	Yes	No	No
48-hour burn-in at 55°C/131°F	Yes	No	No
Maximum expansion slots available	14	5	5
1-year, on-site warranty	Yes	No	No
Toll-free support number	Yes	No	No
Regional sales support	Yes	No	No
"Shake, rattle and roll" testing	Yes	No	No

For technical or sales information, call

1-800-627-8700



Texas Microsystems, Inc.

10618 Rockley Rd • Houston, TX 77099
713-933-8050 • Fax 713-933-1029

Circle 293 on Reader Service Card

World Radio History

LETTERS

*and Ask BYTE***BYTE Readers Speak on the Future of Computing**

Editor's note: *In his May editorial, BYTE editor in chief Fred Langa asked you, our readers, to submit your opinions of the best and worst microcomputing trends or events, as well as your visions of the future of computing. The following letters are some of your responses.*

The best development is the IBM PC with its open architecture. The PC spawned an explosion in the use of personal computers. The power in the PC allowed many individuals to "do their thing" without having to be accountable for the time and money needed, because they did it on their own.

The worst development is MS-DOS. While it was a pioneering effort and had some good features, much more work should have gone into the user interface.

The future will bring more for less. Displays, memory, mass storage, printers, modems, and so on will provide better quality and performance for the price. Quality and support will mean something. The market will require companies to support what they sell. A total rejection of the look-and-feel lawsuits will produce technical advances.

Standards will be developed by design rather than by default. These standards will ensure that the term *compatible* means something.

By 1995, all software will have "smart" installation programs. PCs will be "aware" of the new software. Users will be able to select options by using menus, keywords, voice commands, and touch. The government will provide on-line database services at little or no charge. Text and video data compression standards, implemented in hardware, will provide immediate viewing with a limited bandwidth for communications. Computers that can talk and understand speech, and cost under \$1000, will benefit deaf and blind people.

By the year 2000, we will see very-low-power optical storage in the hundreds of gigabytes to permit a two-level disk access. Less-used programs and data will be "automagically" moved to the second level; frequently used files will reside in the smaller, faster first level. The system will manage disk storage transparently.

A standard "data access" computer with a phone connection will replace the telephone. Education for any subject will be available electronically. It will be part of a national education system that provides access to any individual. You will be able to subscribe, using one source, to on-line data from all databases according to your area of interest.

Very little or no distinction will exist between portable and home computers by 2005. Unplug your monitor, keyboard, and local "ISDN-Net," and then pick up your computer and go. Low power consumption and rapid-recharge batteries will power personal computers for 24 hours.

By 2010, all the above will be available in one package, with software pre-configured to meet the needs of the average family, for less than \$1000.

Dayne Walker
Oronoco, MN

The best developments over the last 15 years are the emergence of very-large-instruction-word processors, high-level languages such as Prolog, and concepts such as object-oriented programming and the Linda language. The worst was that it took so long.

My wish list for the next five to 15 years includes the following:

- greater portability of software across platforms;
- replacing the keyboard with a microphone;
- a high-resolution (32-bit), full-color, electroluminescent LCD touchscreen, with handwriting recognition abilities, to replace all pointing devices;

- mass storage with gigabyte capacity and no moving parts;
- integrated telephone and computer and a worldwide commitment to broadband ISDN; and
- computerized newspapers, books, dictionaries, encyclopedias, and the like, which would reduce the cost of publishing and make it possible for hypertext-like cross-referencing.

T. Christiansen
Copenhagen, Denmark

What I want is simple: Immortality and infinite power. Lacking that, the more time I can save, the better; the more information I can usefully obtain, the better; and the more fun I can have while doing both, the better.

I will project a pair of reasonable bounds. Naturally, what I project will be wrong, because technological progress is not reasonable. First, the lower bound: a machine that costs no more than a month's pay for a middle-class homeowner—a family car kind of computer. By 2005, this machine will be 15 to 30 times faster than an IBM AT and will have a math coprocessor, 16 megabytes of RAM, as much as 1 gigabyte of optical storage, a high-definition television (HDTV) screen, and full sound-synthesis ability. The main uses of family machines today are text processing and games. In 1995, we'll be able to add household monitoring and security, database and home financial records, and limited communications.

By 2000, most municipalities will have forced cable companies to install two-way amps. Wherever this occurs, there should be an explosion of remote services. By 2005, perhaps we will have the option of voting from home, if verification technology has advanced far enough.

Second, the upper bound: a standard office computer for technical professionals—a machine such as the one I call my "electric secretary." By 2005, this machine will run more than 250 times faster than an IBM AT and have a math coprocessor, 256 MB of RAM, 4 gigabytes of optical storage, an HDTV screen, and full sound-synthesis ability.

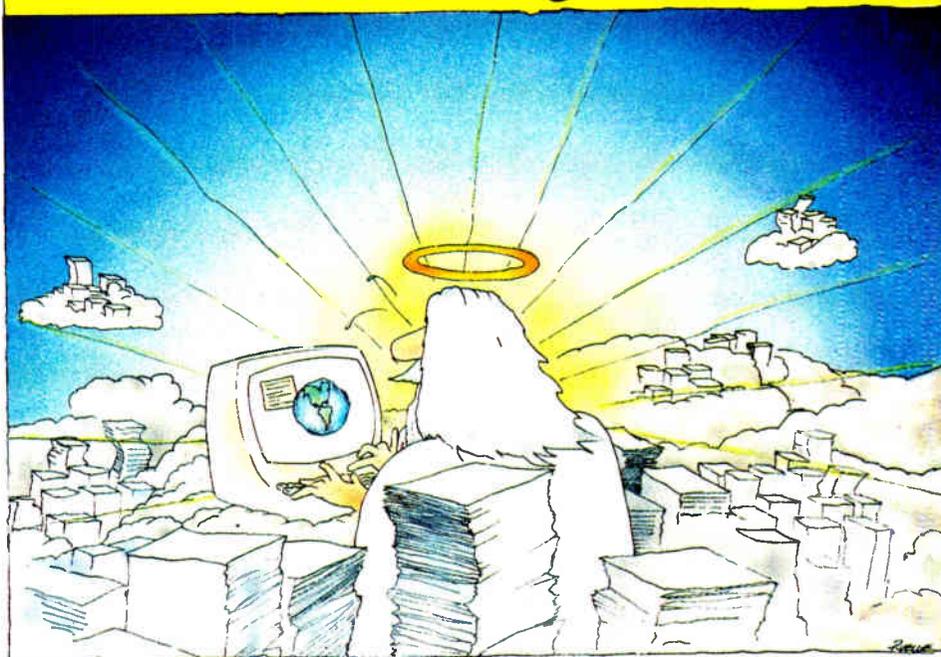
By 1995, wherever two-way cable is

continued

WE WANT TO HEAR FROM YOU. *Please double-space your letter on one side of the page and include your name and address. Letters two pages in length or under have a better chance of being published in their entirety. Address correspondence to Letters Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. You can also send letters via BIXmail c/o "editors."*

Your letter will be read, but because of the large volume of mail we receive, we cannot guarantee publication. We also reserve the right to edit letters. It takes about four months from the time we receive a letter until we publish it.

Great Moments in C-Programmer History



On the third day, He identified the need for an advanced productivity tool.

If you're feeling overwhelmed by impossible deadlines, don't despair. Vermont Views™ 2.0 combines a menu-driven screen designer with a C library of over 550 functions to combat programming stress.

Have Fun Again

With Vermont Views, you'll visually create user interfaces in a fraction of the time required to code them. Include pull-down menus, window-based data-entry forms with tickertape and memo fields, scrollable regions, choice lists, context-sensitive help, and other state-of-the-art features. Quickly create and refine operational prototypes. Use DOS graphics without GUI hassles.



You'll enjoy interactive development without the limitations of 4GL's. When the extensive capabilities of Vermont Views don't meet special needs, attach your own processing functions to menus, forms, fields, and keys. We've designed it so you won't run into dead ends.

A Better CASE

Rapid prototyping is the latest CASE technology. But, with most systems, you must throw the prototype away when coding begins. With Vermont Views, the prototype becomes the application. Menus and data-entry forms are usable in the final application without change. Names of functions for retrieving, processing, and storing data can be specified as the prototype is created. Notes can be attached to forms and fields to help you complete and document the application. Vermont Views objects are checked for validity when created, so integration and testing go more quickly.

Easy Graphics

Vermont Views GraphEx™ makes it easy to enhance your DOS applications with graphics. All Vermont Views windows, menus and forms work in CGA, EGA, VGA, and Hercules graphics modes. Use your favorite graphics package to create charts, graphs, and other images to accompany text displays. Pop-up, overlap, and restore graphics and text windows.

Free Test Drive

Try a working copy of Vermont Views designer for free. Ask for our Test Drive Kit.

Call 800-848-1248

Fax 802-848-3502

Please Mention "049"

A Universal Solution

Create a single interface and port it among PC DOS, OS/2, UNIX, XENIX, and VMS. Use Vermont Views with any database that has



a C-language interface (most do). Create interfaces for any roman-based language. Develop safely on networks with our form-locking version. Truly a universal solution for your interface development needs.

Sweet Music

"Vermont Views... will have the most timid designer riding high in the saddle in no time."

—Edgar Bartholomew, *Unix Review*, April 1990

"At a recent field staff meeting, we were able to get a consensus... using the Designer on a big screen TV. Changes can be posted real-time and a functioning prototype results... The form designer is GREAT."

—Randy Jones, Beta Tester

No-limit Trial

Reduce stress by calling 800-848-1248 and ordering Vermont Views now. There is no risk. You can return it for a full refund — anytime.



Vermont
Creative
Software

Pinnacle Meadows, Richford, VT 05476
Phone: 802-848-7731 Telex: 510-601-4160

available, companies will become heavy users of remote data services. After that, it is all blue sky. Depending on the business climate, the nation—and perhaps many nations together—could become a gigantic wide-area network.

Larry J. Van Stone
Stillwater, OK

Alan Huang's breakthrough in photonics and the computer on a chip are the two best computer developments over the last 15 years. The U.S. losing world and domestic market share for semiconductors, computer manufacturing, and robots, as well as the threat of losing HDTV and supercomputer markets, are the worst developments.

What I want in the near future includes an affordable laptop computer for work, learning, and leisure, and an affordable work/leisure multimedia window. While I cannot always get away to enjoy the mountains here in Montana, I want technology to bring the mountains to me. As I work, I want an active window on my monitor where I can choose the weather, the scenery, the location, and a TV channel. I also want to be able to play a game and to choose the color and music. This window would include interactive multimedia help for all computer programs.

I believe that several technologies will be more fully developed. One is the attached computer—putting on your computer will be as common as putting on your clothes. Should it be attached as a vest? In the shoes? Or directly to the body?

Implanted computers would never forget a name of someone you met. Instantly, the implanted computer would be able to reveal the name of the individual and related information.

Another development will be activating computers and robots with body signals. One look at the computer or robot would turn it on to perform tasks. Physical and emotional body signals, such as temperature, cholesterol count, and stress levels, would activate computerized equipment and robots from a distance. The computer would then prepare the environment to receive the human.

Finally, interactive virtual reality will permit you to choose a role and make choices during a video or movie.

Jeanette J. Bieber-Moses
Billings, MT

I would be delighted to contribute to BYTE's anniversary issue. I've often wondered how BYTE has gotten along without me for so long. I've been a devoted

reader (off and on, to be honest) for nigh onto 10 years. I noticed that you've invited quite a few others—over a million—but I like big parties.

The future of computing lies in computers providing friendly companionship. We will see expert-system shells preloaded with cultural literacy (including, e.g., some law, science, music, history, and business), and with that elusive and sophisticated competence, common sense. Machines will be comfortably skilled at natural-language input and output.

Each of us will have a computer that goes with us everywhere and gets to know us. It will provide instruction when wanted, play games (including simulating and modeling our fantasies and creative inspirations), and counsel us when we are down in the dumps. It will laugh at our jokes and be amazed, impressed, and outwitted as needed. It will also humbly (but with satisfying bouts of jealousy) encourage us to be involved with other friends, relatives, our jobs, and the activities in life that make computers worthwhile—or is it the other way around?

Richard Crews
San Rafael, CA

Beyond the number games of bigger machines with more speed for the buck, there will be a continued migration of functions into the operating system. The next candidates for this migration will probably be graphical user interfaces (GUIs) and databases.

For those who program in compiled languages such as C, the operating system becomes the environment, and, mediated through standard library routines, it is becoming possible to write high-performance software that uses almost any of a system's capabilities in a way that is portable to other machines. The GUI is the last needed piece for this to happen. It is easy to see why it came last; it is the most real-time and idiosyncratic of the interfaces, making it the hardest to standardize.

Just as file systems arrived a short generation after disk drives, databases are going to layer on top of the file systems to provide a more general way to access all the objects in a computer. The resource fork in Macintosh files is one early indication of the need. The basic idea is not that your file system will contain databases, but that it will be a database with the present directory tree structure as one index in it.

This environment spells the end of the TSR approach, and it leads toward a more

consistent look and feel as more of the user interface becomes a system service. But it doesn't tell where the exciting new applications will come from. For that, I'll keep reading BYTE.

Eric Jensen
Bedford, NH

I would like to be able to wear my computer. I would like my computer's output to be a nearly seamless part of my sensory world. My computer should take its input directly from my nervous system. It should monitor and help maintain my bodily functions. Its use should extend my life, as its use enhances the quality of my life now. I don't want to be tied to a desk or a desk-like situation (as with a laptop) to be able to do all this neat stuff.

This technology should lead to the destruction of all forms of authoritarianism. Is that radical enough?

The best developments in computers over the last 15 years have been the availability of public domain and shareware software, without which I could not afford to do much computing, and BBSes—the ideal medium for all us ex-high school nerds.

The worst developments have been the dominance of the segmented Intel architecture and MS-DOS, which is really no friendlier than Unix, and the emergence of men and women with M.B.A.s, boring suits, and not the slightest trace of imagination.

Charles Bridgeland
Urbana, IL

Don't Forget CocoNet

BYTE has done a truly outstanding job in the past in reporting breakthrough trends and new products. It was therefore with great disappointment that we noted our absence from your June article, "DOS and Unix: On Speaking Terms" by Tom Yager. It is especially surprising in light of the favorable review of our product, CocoNet, that you published in your February issue (Reviewer's Notebook).

Our product is unique, and it has several key advantages to solutions noted in the article. It is not enough to provide a TCP/IP DOS LAN on Unix. This simply creates yet another "island of computing" that is divorced from the mainstream of PC LANs, which are NetBIOS or IPX (NetWare) based. Moreover, what is really required is a high degree of integration between Unix and DOS file systems, peripherals, and applications. Unix users must see Unix, and DOS users must see a DOS environment, regardless of file or application location.

continued

DDI 486 ExecuTower...



**Anniversary
Special!***
FREE

**HP Laserjet IIP Printer!
OR Hard Disk Size Upgrade!
OR 20" Color Monitor!
OR Cash Rebate!**
*(with Purchase of Standard
DDI 486 ExecuTower System)*

One of Many...

Full Line of DDI ExecuTower Systems:

- 486™/33 MHz EISA (256K Cache)
- 486™/25 MHz ISA (128K Cache)
- 386™/33 MHz ISA (128K Cache)
- 386SX™/16 & 20 MHz ISA

Standard Systems Include:

ExecuTower System Unit
VGA Video Card 1024x768 512K Video RAM
Super VGA 14" 1024x768 .28mm Color Monitor
1.2 MB 5¼" & 1.44 MB 3½" Floppy Disks
2 Serial, 1 Parallel Ports
101-Key Enhanced Keyboard
Microsoft Compatible Mouse
MS-DOS 4.01

All Systems Run

MS-DOS®, OS/2®, UNIX®, XENIX®

All Systems DELIVERED with MS-DOS
Installed, Configured and READY TO RUN!

Also Available:

SCSI Hard Disks:

(formatted)

85 MB, 28ms
110 MB, 18ms
183 MB, 18ms
338 MB, 15ms
440 MB, 16ms
678 MB, 15ms
1050 MB, 15ms

VGA Monitors:

Size	Type	Resolution	Dot Pitch
14"	Mono	1024x768	N/A
14"	Color	1024x768	.28mm
16"	Color	1024x768	.28mm
20"	Color	1024x768	.31mm
20"	Color	1280x1024	.31mm

We Support You 100%

- 30-day Money-back Guarantee
- One-year Warranty Parts & Labor
- 24-hour Parts Replacement
- Toll-free Technical Support
- Also Available:
 - On-site Service—NATIONWIDE
 - Extended Maintenance Contract
 - Corporate Leasing
 - Custom Configurations
 - OS/2, UNIX, XENIX Technical Support

**Complete VGA Color, 85 MB
System Prices Start At**

\$2,195!

*Anniversary offer available for a limited time only!

**Call Us TOLL-FREE
For Details On Free Offer!**

**Call 1-800-331-1090
FAX 1-401-884-0770**

Digital Distributing, Inc.

20 Cavalier Drive, E. Greenwich, RI 02818 (401) 885-6697

486 and 386 are trademarks of Intel Corporation.
MS-DOS and XENIX are registered trademarks of Microsoft Corporation.
OS/2 is a registered trademark of IBM. UNIX is a registered trademark of AT&T.

CocoNet provides a full NetBIOS LAN from any 386 or 486 Unix personal computer, integrating with existing Novell networks transparently. It runs on Ethernet, StarLAN, and Arcnet, and shortly will be released on Token Ring. It integrates with TCP/IP with NFS. It is smaller, faster, easier to install, and more reliable than TCP/IP solutions alone. It offers a higher degree of integration between DOS and Unix, allowing simultaneous access to shared files, applications, and resources transparently from each user's environment.

Charles M. Robins
President
Atlantix Corp.
Boca Raton, FL

ASK BYTE



Tandy TX Revisited

James Erwin wrote with several very good questions about the Tandy 1000 TX in the May issue. While your responses concerning the 8-bit bus of the Tandy TX were correct, there was a major inaccuracy in your description of the video capability.

Pages 24 and 31 of the Tandy Practical Guide to the Tandy TX (which comes with every new Tandy TX) details the video interrupt switch and three other switches that the user can toggle. You can make the Tandy TX fully configurable for virtually any monitor by changing DIP switch 4. For example, I am using a multisync Super VGA monitor and a Paradise 512K-byte VGA board on one Tandy TX. On another, I use a Hercules-compatible graphics card and a Tandy CM-5 high-resolution monochrome monitor.

Quite a lot of controversy has surrounded the options available for the Tandy TX. The four interrupt switches toggle interrupts 5 through 7 and the video mode. I am using a Tandy TX, networked with Artisoft's LANtastic, which is running quite nicely. All I had to do was toggle interrupt 7 to allow the LAN cards to operate.

William L. Kennon
San Diego, CA

Thank you for the clarification.

—Lab Staff

Computer-Aided Translation

I have two questions. First, are there any programs available for translating text from one language to another? Second,

could you please direct me to any desktop publishing clubs? My main interest is desktop publishing on Apple computers.

Robert I. Feldman
Lompoc, CA

There are a number of language-translation software packages out there. Translation Support Systems from Automated Language Processing (P.O. Box 87819, Salt Lake City, UT 84108, (801) 584-3000) can handle words and phrases. Two packages from International Computer Products—Learn Spanish and Learn German—are for educational use. Contact International Computer Products at 346 North Western Ave., Los Angeles, CA 90004, (213) 462-8318. Also check out MultiTrans from Microlytics (Two Tobey Village Office Park, Pittsford, NY 14534, (716) 248-9150). PC Linguist from Microtrans (348 Turnstone Dr., Livermore, CA 94550, (415) 447-0596) supports only Russian-to-English-and-back as I am writing this. However, the company hopes to have added support for other languages by the time you read this. Give Microtrans a call and see.

Last but certainly not least, if all you are looking for is automated word-at-a-time translation, there's always DAK's pocket Language Barrier Blaster, a hand-held calculator-style translator that "understands" English, French, German, Spanish, and Italian. Contact DAK Industries (8200 Remmet Ave., Canoga Park, CA 91304, (800) 325-0800).

On the topic of desktop publishing clubs, try contacting the PC Publishers of Northern California at (415) 661-9270. Although you state that you are most interested in Apple software and these guys are MS-DOS-minded, perhaps someone there can direct you to an Apple-specific group.—R. G.

Curious About Coprocessors

We read with interest a recent Under the Hood in BYTE concerning the Cyrix CX-83D87 math coprocessor ("Math Coprocessors," January). Could you provide us with more information? We are a small team of programmers, and we are looking for replacements for the Intel coprocessors (which, in Italy, cost an arm and a leg). We are also interested in further information about the IIT-2C87 and 3C87.

Mannori Simone
Florence, Italy

For more information concerning the Cyrix coprocessor, contact Cyrix Corp. (1761 International Pkwy., Richardson,

TX 75081, (214) 234-8388). I'm sure the people there would be happy to send you technical documentation.

BYTE reviewed the IIT-2C87 coprocessor in the September 1989 issue (Reviewer's Notebook). Contact IIT at 2540 Mission College Blvd., Santa Clara, CA 95054, (408) 727-1885, for more information about its coprocessors.—R. G.

Eternal Paper

Do you know of a source for acid-free paper for computer printers and photocopiers? Paper longevity is desirable because you never know what information on hard copy will be important in the far future. A national heritage of data on paper disappears when 15- to 50-year-old paper crumbles. Because of the preservation of the Warsaw telephone directories by the New York Public Library, many of the survivors of the Holocaust were provided with their sole source of documentation for reparations.

My science fiction collection, which I started in the 1960s, is rapidly deteriorating. Although CD-ROM and electronic storage media have their advantages, books have their own peculiar random-access qualities that might never be equalled.

Charles Knickerbocker
East Lansing, MI

There are probably others, but Finch, Pruyn & Co. of Glens Falls, New York, makes a full line of acid-free papers. Contact your local distribution house, and ask for Finch Laser Opaque or Finch Opaque Xerographic paper.

There's another thing to remember about long-term paper storage: The printing itself may be adversely affected by ultraviolet light or heat. After printing your literary gems on acid-free paper, make sure to store them in a dark, cool, dry place. Losing an important 15-year-old printed document can be tragic, but CD-ROM technology may prove to have some problems of its own. I have audio compact disks that date back to 1983 that are no longer playable. I'd like to believe that the bad disks were simply a product of an immature manufacturing process. But until we know more about a CD's life span, I'm not ready to give up on paper, either.—H. E.

Foreign Formats

I often receive data on 5¼-inch floppy disks from other laboratories. The data is either in ASCII files or a form of BASIC. While the disks are ostensibly formatted in an IBM-compatible fashion, I often

continued

Here's what they say about Zortech C++

"Zortech is a truly fine compiler...If you've been waiting for a major player to offer a professional C++ development system for OS/2 and Windows, as well as DOS, wait no longer... Zortech has it!"

Richard Hale Shaw, PC Magazine, p.38, March 13, 1990

"Zortech has done a commendable job with C++ 2.0 and I recommend it highly...The debugger is impressive...Get the Developers version...it's worth the money"

Bruce Eckel, Micro Cornucopia, pp. 8-17, March 1990

"Zortech C++ is one of the best MS-DOS products I've had the luck to use....I can highly recommend the Zortech 2.0 release."

Scott Robert Ladd, Dr. Dobbs Journal, pp. 64-73, January 1990

"We have devoted virtually a full issue to evaluation of C Compilers...it's an easy choice. We pick ZORTECH."

J. D. Hilderbrand, Editor, Computer Language, p. 7, May 1990

AT&T™ C++ V2 Specification

- ✓ Multiple Inheritance
- ✓ Type Safe Linkage
- ✓ Pointers to Members

Compiler Features

- ✓ Native code compiler with separate global optimizer
- ✓ Improved MSC Source Level Compatibility
- ✓ MS Windows™ Compatible
- ✓ CodeView™ Compatible
- ✓ Fast Graphics Library with C++ interface
- ✓ Easy to use TSR functions
- ✓ Standard Library Source Code included with Developer's Edition
- ✓ Seamless LIM/EMS Support via new handle pointers or directly via EMS library functions.
- ✓ Full MS Mouse Library
- ✓ OS/2 Compiler Option
- ✓ 99% ANSI C Compatible
- ✓ Improved code size/speed

C++ Source Level Debugger

- ✓ Also Debugs C
- ✓ Assembler Debugging with access to registers and memory.
- ✓ 16 Debugging Windows
- ✓ Multiple Statement Lines
- ✓ Break/Trace/Watchpoints
- ✓ Dual Monitor Support
- ✓ Full C++ name unmangling for easy use
- ✓ Block memory write protect

C++ Tools Classes

- ✓ 25 C++ Classes with full source code
- ✓ Includes new Text User Interface Classes
- ✓ Event Queue, BCD Maths, Linked Lists, Money, DOS error handling classes, text windows and editing classes, virtual arrays, time and date handling, directories and filenames, interrupt vectors, etc...

PRICES

C++ Compiler \$199.95
 C++ Debugger \$149.95
 C++ Tools \$149.95
 Library Source \$149.95
 Save \$200 - Get the Developer's Edition for only \$450 (includes all the above items).
 OS/2 Option \$149.95
 C++ Video \$499.95

USA: Zortech Inc.
 4-C Gill Street
 WOBURN MA01801
 Voice: 617-937-0696
 Fax: 617-937-0793

EUROPE: Zortech Ltd.
 106-108 Powis Street
 LONDON SE18 6LU
 Voice: 44+ 81-316-7777
 Fax: 44+ 81-316-4138

"ANNOUNCING V2.1" 640K Memory Barrier Smashed!

- **New** VCM™ (Virtual Code Manager) technology
- **New** Rational DOS Extender technology for compiling/debugging massive programs
- **New** Virtual C++ Source Level Debugger requires only 4k RAM!
- **New** Remote Debugging via serial port
- **New** Powerful Environment with Browser
- **New** Completely Revised & Expanded C++ Tools
- **New** Improved Compiler Optimization

Zortech VCM™ for DOS

With Zortech's Virtual Code Manager (VCM) you can compile standard MS-DOS applications containing up to 4Mb of code. VCM is a sophisticated virtual memory system that dramatically improves performance over conventional overlay methods. Naturally, our debugger understands VCM too!

Rational™ DOS Extender Technology...

Version 2.1 incorporates this new technology for compiling and debugging really big programs on 286, 386 or 486 based PC's. You can also use V2.1 together with Rational Systems DOS Extender (purchased separately) to produce your own applications which can access memory beyond the 640k DOS limit.

C++ Debugger in 4k RAM!

Zortech's Virtual C++ Source Level Debugger can now locate itself in extended memory on 386 machines. This requires only 4K of conventional RAM!

STOP PRESS - NEWS FLASH

386 Compiler/Debugger Option (using Phar Lapp DOS Extender), UNIX 386 Compiler and OS/2 Debugger all available soon. Also new C++ Classes and Addison Wesley ZTC++ book.

ORDER/UPGRADE HOTLINE 1-800-848-8408

have difficulties reading them. Is there a program to help me read such disks?

On another topic, what hypertext-like programs are available for IBM PC compatibles?

V. Ackerman
St. Leonards, N.S.W., Australia

In response to your first question, I'm afraid you haven't described your problem clearly enough. I'm not sure what you mean by "difficulties." Can you at least get a directory of the disk? If not, it's likely that somebody's drive is out of alignment—either yours or the drive of whoever is sending you the disks. Try reading the disk on someone else's machine. If you can do it, the sick drive is probably your own.

Also, be certain that you are not trying to read a floppy disk formatted to a higher density than your system can handle—you can't read a 1.2-MB disk in a 360K-byte drive.

You mention that the files may be BASIC files. Are you trying to read an interpreted BASIC program listing as you would read an ASCII file? If so, you'll see lots of strange characters, owing to the fact that BASIC "tokenizes" files when it saves them to disk. You can read the file by running your BASIC interpreter, entering LOAD "<FILENAME>", and typing in LIST. If you want to save the file in human-readable form, type SAVE "MY-FILE.BAS", A, which will copy an ASCII version of the program into the file MY-FILE.BAS.

Finally, assuming none of the above suggestions works, you might try some form of disk utility software, such as the Norton Utilities. You'll have to do some real coal-miner's duty to dig the data off the disk; it depends on how desperate you are to recoup the files. The Norton Utilities are available from Peter Norton Computing, 100 Wilshire Blvd., Ninth Floor, Santa Monica, CA 90401, (213) 319-2000.

And, yes, there are a number of hypertext-like programs for the PC. Here are a few that you could look for:

Guide
Owl International
2800 156th Ave. SE
Bellevue, WA 98007
(206) 747-3203

Coretext
Samna, Inc.
5600 Glenridge Dr.
Glenridge Center
Atlanta, GA 30342
(404) 851-0007

Plus
Spinnaker Software
One Kendall Sq.
Cambridge, MA 02139
(617) 492-1234

Object-Script
Matesys
2001 L St. NW, Suite 801A
Washington, DC 20036
(202) 785-0770

—R. G.

Chickens, Eggs, and Compilers

I am still amazed at compilers; how can a compiler translate a program into machine language? Is the compiler constructed using assembly language? If so, how do you make an assembler, such as Microsoft's Macro Assembler? Furthermore, how do you create an operating system, since that must be built before anything else?

Kabul Suwitaatmadja
Bandung, Indonesia

Your one-sentence questions would require pages to compose an adequate response. I'll handle those that I can here and then suggest some books that should get you the rest of the way.

Currently, commercial compilers are written in high-level languages such as C or Pascal. Of course, since the source code for the compiler has to be compiled by another compiler, you're understandably led into a chicken-and-egg question: Who wrote the first compiler?

Although there was no single primordial compiler, it is true that in the prepubescent days of the digital computer, most work was done in machine language. Programmers sat in front of a panel of switches and toggled bit patterns in one memory location at a time. (In fact, when IBM released FORTRAN, circa 1957, the company had to embark on a large sales campaign to convince its machine-language-entrenched customers of the benefits of a high-level language.) You can get a taste of what it must have been like to put a high-level language together in machine language by scanning through early issues of Dr. Dobbs Journal of Computer Calisthenics and Orthodontia, where you'll find the source code for Tiny BASIC (a later version of Tiny BASIC for the 68000 appeared in a more recent issue). Granted, that limited version of BASIC ran on CP/M machines, but I have seen a Tiny BASIC for MS-DOS available from several of the public domain and shareware software houses.

For further reading in compiler con-

struction, I suggest Programming Language Translation: A Practical Approach by Patrick D. Terry (Reading, MA: Addison-Wesley, 1986) and Compiler Design in C by Allen I. Holub (Englewood Cliffs, NJ: Prentice-Hall, 1990).

For information concerning the design and implementation of operating systems, look for Operating Systems: Design and Implementation by Andrew S. Tanenbaum (Englewood Cliffs, NJ: Prentice-Hall, 1987).—R. G.

They Just Fade Away

I have a problem with the plasma screen on my Ogivar Technologies 286 laptop computer: It's dying. When the problem first appeared a few months ago, it was negligible. Only a few pixels on the edge of the screen were dead (i.e., dark spots appeared on the orange screen). Recently, the situation has deteriorated rapidly. About one-half of the screen is affected with the dying pixels. It looks as though someone left finger scratches all over it. Characters in the affected areas are only partially visible, which makes them difficult to read. Can you help?

Brett Cui
New York, NY

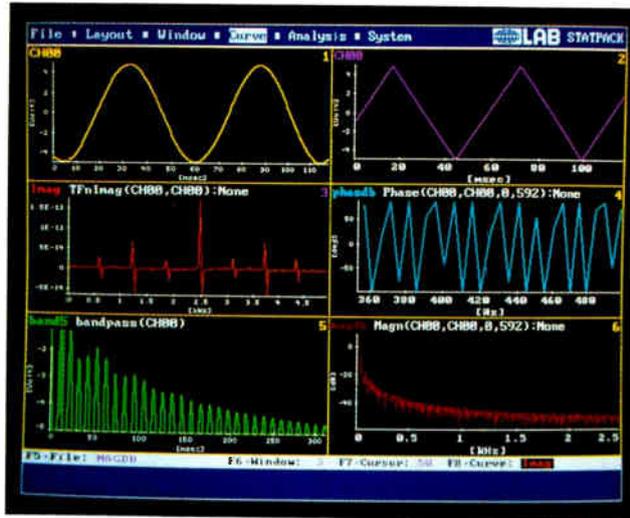
You're not alone with your dying plasma screen. A number of plasma screens are dying a similar death; it largely depends on the quality of the individual manufacturing runs.

I asked Ogivar about your computer, the Ogivar 286 System 4, and the people there haven't heard about any of their screens dying like that. I would encourage you to return the unit to them for repair. Contact Ogivar at 7200 Trans-Canada Hwy., Ville-Saint Laurent, Quebec, Canada H4T 1A3. Call the company first at (514) 737-3340 to make arrangements. Your unit apparently has a one-year warranty, and you may be able to arrange a warranty repair, even if it's past the period. Ogivar's customer-support people were sympathetic to your problem and seemed eager to resolve it.—H. E.

FIXES

The lapAdapt plug adapter listed in the May What's New section allows devices with a standard American three-blade grounded plug to be connected to British and European grounded plugs while maintaining the integrity of the ground. It doesn't function as a current adapter/converter. ■

Announcing a First in Data Acquisition Software.



Throughput and Ease of Use. Without Compromise.

Data Acquisition

- Selection of channel, gain, clock source, clock rate, and trigger for analog input operations
- Selection of DAC, clock source, clock rate, and trigger for analog output operations
- Errorless data transfers to/from hard disk or memory at speeds up to 250kHz
- Digital I/O and counter/timer operations
- Supports DT2831, DT2821, DT2801 and DT2901 series boards

function; Hamming, Hanning, or Blackman windowing

- Bessel, Butterworth, or Chebyshev filters; low-pass, high-pass, bandpass, bandstop, or allpass; even order (second to tenth); arbitrary configurations
- Arithmetic operations; logical AND, OR; logarithmic, trigonometric functions; squares and square roots; bit mask; scaling; signal generation

- Select, label, and scale display
- Display titles, gridlines, move axes
- Perform statistical analysis
- Import/export data files from/to other industry-standard software packages

Signal Processing with STATPACK™ Module

- FFT; inverse FFT; auto spectrum; cross spectrum; power, spectral analysis, transfer

Display

- Display data at maximum resolution of graphics adapter
- Display data during acquisition
- Display files up to 100 windows
- Browse large files rapidly

—Fred Molinari, President



At last, no more software trade-offs! GLOBAL LAB™ provides fast and easy-to-use mouse/menu control of data acquisition and signal processing functions, while fully supporting the industry's fastest throughput rates.

So, if you're looking for software that will fully support Data Translation, IBM PC and PS/2 Series I/O boards, look to GLOBAL LAB. It's the only software that won't compromise your position.

Call (508) 481-3700

In Canada, (800) 268-0427

DATA TRANSLATION®

World Headquarters: Data Translation, Inc., 100 Locke Drive, Marlboro, MA 01752-1192 USA, (508) 481-3700, Fax (508) 481-8620, Tlx 951646

United Kingdom Headquarters: Data Translation Ltd., The Mulberry Business Park, Wokingham, Berkshire RG11 2QJ, U.K., (734) 793838, Fax (734) 776670, Tlx 94011914

West Germany Headquarters: Data Translation GmbH, Stuttgarter Strasse 66, 7120 Bietigheim-Bissingen, West Germany 7142-54025, Fax 7142-64042

International Sales Offices: Australia (2) 662-4255; Belgium (2) 466-8199; Canada (416) 625-1907; China (1) 868-721 x4017; Denmark 42 27 45 11; Finland (0) 3511800; France (1) 69077802; Greece (1) 361-4300; Hong Kong (5) 448963; India (22) 23-1040; Israel 52-545685; Italy (2) 82470.1; Japan (3) 502-5550, (3) 5379-1971, (3) 355-1111; Korea (2) 718-9521; Netherlands (70) 399-6360; New Zealand (64) 9-545313; Norway (2) 53 12 50; Portugal (1) 545313; Singapore 7797621; South Africa (12) 803-7680; Spain (1) 555-8112; Sweden (8) 761 78 20; Switzerland (1) 723-1410; Taiwan (2) 3039836

GLOBAL LAB and STATPACK are trademarks and Data Translation is a registered trademark of Data Translation, Inc. All other trademarks and registered trademarks are the property of their respective holders.

Circle 83 on Reader Service Card

WHAT'S NEW

HARDWARE • SYSTEMS

Portables Feature Color and Desktop Performance

Full-color VGA 386 portables are now available from several manufacturers.

The new Dauphin has a high-contrast, active-matrix (or thin-film transistor) LCD screen like the Macintosh Portable. But the Dauphin system takes the technology a step further with a just-released color LCD combined with fluorescent backlighting by Hitachi.

The Dauphin system is an 18-pound 386SX laptop. It features a 3½-inch 1.44-MB floppy disk drive, a 20-MB hard disk drive, and a 92-key keyboard.

Price: \$9995.

Contact: Dauphin Technology, Inc., 1125 East St. Charles Rd., Lombard, IL 60148, (708) 627-4004. **Inquiry 1120.**

For a portable with color and 386/486 performance, Dolch Computer Systems offers the Hitachi thin-film transistor, active-matrix color screen with its new 386 TFT-Color Portable and 486 TFT-



Color graphics and your choice of 386 or 486 performance are combined in the 20-pound Dolch portable.

Color Portable. Each system weighs about 20 pounds.

Standard features on the 25-MHz 386 TFT-Color Portable include 32K bytes of RAM cache, 2 MB of RAM, and a 5¼-inch floppy disk drive. The 25-MHz 486 TFT-Color Portable includes 8K bytes of RAM cache, 2 MB of RAM, and a 5¼-inch floppy disk drive.

Price: 386, \$11,990; 486, \$16,990.

Contact: Dolch Computer Systems, 2029 O'Toole Ave, San Jose, CA 95131, (408) 435-1881.

Inquiry 1121.

If you need a lower-cost 386 portable and can forgo color, you might consider the MP200 from Micronics. The 25-MHz 386 measures 4 by 16 by 14¼ inches, weighs 14 pounds, and has a 10-inch 640- by 480-pixel backlit LCD or gas-plasma display.

Standard features include 1 MB of RAM (expandable to 8 MB) and 32K bytes of cache memory. Also included are a 40-MB 25-ms hard disk drive and a 3½-inch 1.44-MB floppy disk drive.

Price: \$6500.

Contact: Micronics Computers, Inc., 232 Warren Ave., Fremont, CA 94539, (415) 651-2300.

Inquiry 1122.

Sun Moon Star Bundles CD-ROM, Disks, and 286

The Sun Moon Star CD-ROM system consists of a 12-MHz 286 with 2 MB of RAM, a 40-MB hard disk drive, two-channel audio output, a 14-inch color VGA monitor, and a CD-ROM drive.

The CD-ROM drive comes with automatic installation software along with Microsoft Bookshelf, Microsoft Small Business Consultant, Microsoft Stat Pak, Hotline II Executive, Software Toolworks Illustrated Encyclopedia, Software Toolworks World Atlas, Software Toolworks CD Game Pack, and the CD Audio Guide.

The hard disk drive comes preloaded with DOS 3.3, GEM/3 Desktop, GEM Draw, PFS:First Choice, and CheckIt.

Price: \$2995.

Contact: Sun Moon Star, Personal Computer Division, 1941 Ringwood Ave., San Jose, CA 95131, (408) 452-7811.

Inquiry 1123.

386SX Touchscreen Portable

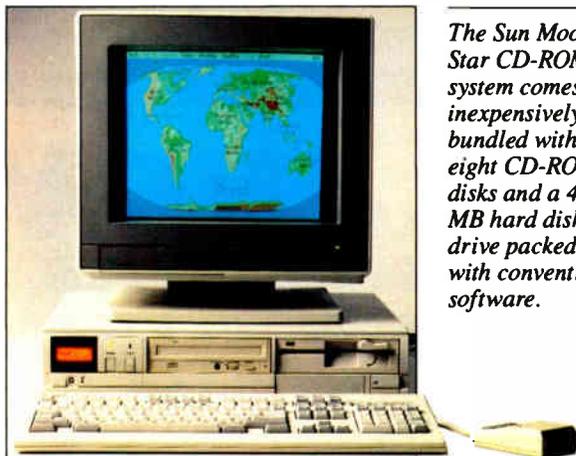
The Datellite 300L is a 7-pound 16-MHz 386SX portable without a keyboard. You enter information via the VGA-resolution touchscreen that you use like a clipboard, saving completed forms on a 3½-inch 1.44-MB floppy disk drive, a 40-MB hard disk drive, or a 120-MB hard disk drive.

Standard features of this 12¼- by 10- by 2¼-inch portable include 1 MB of RAM (expandable to 16 MB), a parallel port, a serial port, a 4-hour battery, and DR DOS. The system also comes with an application-generator software package.

Price: Floppy disk version, \$5995; with 40-MB hard disk drive, \$6995; with 120-MB hard disk drive, \$7995.

Contact: MicroSlate, Inc., P.O. Box 2207, Stamford, CT 06913, (203) 357-9901.

Inquiry 1124.



The Sun Moon Star CD-ROM system comes inexpensively bundled with eight CD-ROM disks and a 40-MB hard disk drive packed with conventional software.

Tiny Printer Doesn't Compromise on Paper or Speed

The BJ-10e is an inexpensive 4-pound portable printer that lets you use standard 8½-inch-wide paper instead of hard-to-handle thermal paper. It uses a 64-nozzle bubble-jet print head and snap-in ink cartridges that each print about 700,000 characters in a high-quality mode.

If you're in a hurry, the BJ-10e prints in both directions at up to 360 dpi. It emulates both the IBM Proprinter X24E and the Canon BJ-130e and offers a high-quality mode in which it can print at up to 83 cps. The input buffer is 3K bytes with an additional 34K bytes reserved for fonts. You connect it to your computer's parallel port, and it draws power from its included 1½-pound AC adapter or from an optional battery.

Pitch selection includes 10, 12, or 17 cpi in addition to proportional spacing. The printer measures 12¼ by 8½ by 1¾ inches.

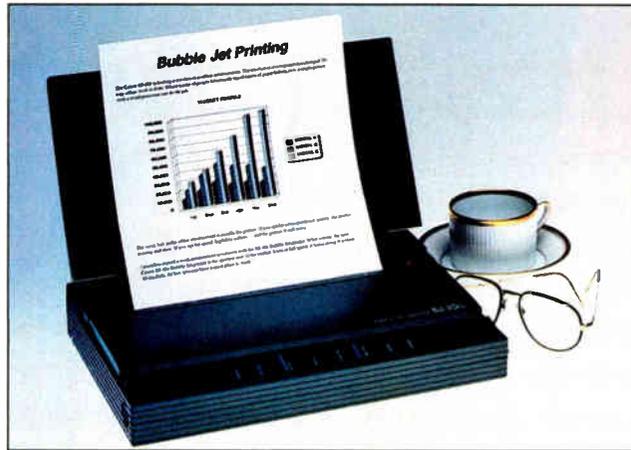
Price: \$499; print cartridge, \$25; battery, \$50.

Contact: Canon USA, Inc., Printer Division, One Canon Plaza, Lake Success, NY 11042, (516) 488-6700.

Inquiry 1125.

Nisca's Gray-Scale Scanner Fits in Your Hand

The Niscan/GS is a handheld scanner that can scan up to 256 levels of gray with hardware gray scaling and at



Canon's BJ-10e printer is small, inexpensive, and light.

resolutions of from 25 dpi up to 400 dpi in either 16 or 256 levels of gray. The width of the scanning window is 4¼ inches, and the unit can scan images up to 11 inches long.

The scanner comes with an interface board for the IBM PC and GEM-based scanner control software. The software offers a number of advanced gray-scale editing capabilities: adjustment of image brightness and contrast without having to rescan; scaling, cropping, and cutting and pasting; flipping, rotating, and zooming; and paint tools for touching up. It also lets you gamma-correct images (gamma correction is a technique for globally adjusting individual shades within an image to enhance details or tone down bright areas). You can save images as PCX, IMG, or TIFF files.

Price: \$369.

Contact: Nisca, Inc., 1919 Old Denton Rd., Suite 104, Carrollton, TX 75006, (800) 245-7226.

Inquiry 1126.

SPREAD THE WORD

Your new product is important to us. Please address information to New Products Editors, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Better yet, use your modem and mail new product information to the microbytes.hw or microbytes.sw conferences on BIX. Please send the product description, price, ship date, and an address and telephone number where readers can get more information.

Contact: Seiko Instruments USA, Inc., Graphic Devices and Systems Division, 1130 Ringwood Court, San Jose, CA 95131, (408) 922-5800. **Inquiry 1127.**

Device Makes Photographic Prints

The UP-3000 color printer produces near-photographic-quality 4- by 3-inch prints with 256 levels of color from a palette of more than 16 million colors. You can use the device, which is about the size of a 9-pin printer, to print from your computer (via the RS-232C port) or from RGB analog, composite video, and still video devices.

Using a dye-transfer thermal printing technique with 512 elements on the thermal head, the UP-3000 can produce full-size 4- by 3-inch images, four images on the same sheet, or 25 "thumbnail-size" images on a single page. It takes about 80 seconds to produce a print, whether you're simply printing from the screen or from a picture (i.e., making a mirror image), or whether you've added comments to the prints outside the picture area.

Standard equipment on the 17- by 5- by 17¼-inch printer includes front-panel controls, remote control, 40 sheets of printing paper, and a menu-driven monitor display. You can adjust image and color with controls for separate red/green/blue mixing, sharpness, picture focus, brightness, and hue.

Price: \$3895.

Contact: Sony Corp. of America, Sony Dr., Park Ridge, NJ 07656, (201) 930-6432.

Inquiry 1128.

continued

Cheaper Color PostScript Printing with Seiko Unit

The ColorPoint PS is a thermal-transfer printer built around a controller based on Intel's i960 RISC processor. For a PostScript interpreter, it uses Phoenix-Page from Phoenix Technologies.

The unit prints at 300 dpi and comes with five communications interfaces: serial, parallel, AppleTalk, and two SCSI. The system scans each port looking for data from the different computers. It also comes with 35 LaserWriter NT-equivalent fonts.

The ColorPoint PS comes with 6 MB of memory. The standard ColorPoint PS prints an 8¼- by 10¼-inch image on an 8½- by 11-inch page. The printer also comes in an optional B size that can print images as big as 10¾ by 16½ inches.

Price: \$6999; B size, \$9999.

Modules Convert 386 Systems to 486 Systems

Interested in high-speed i486-based systems? Two companies have i486 CPU modules that plug into your 386 motherboard and let you take advantage of the i486.

The new Trans486PX CPU Translator Module from TransComputer is a small (2½- by 2½-inch) board that has all the circuitry needed to make a 386 system think it is talking to an ordinary, if somewhat fast, 386. The manufacturer claims that the module can deliver a three- to fivefold increase in performance.

But the module may not work right away with every 386-based system. TransComputer says that right now it works only with "standard" 386-based machines, including most systems that use Chips & Technologies chip sets. Not included in this standard list, however, are computers from IBM, Compaq, AST, Advanced Logic Research, and Epson.

Price: Without an i486, \$486; with an i486, \$1686.
Contact: TransComputer, Inc., 1257 Tasman Dr., Sunnyvale, CA 94089, (408) 747-1355.
Inquiry 1129.

According to Feith Systems, the Feith 486 Gold Card, an i486 CPU module for your AT&T WGS 386, lets your existing software run from two to four times faster and is compatible with all DOS and Unix software.

The module also features an on-chip floating-point pro-



CPU modules from TransComputer and Feith Systems can add 486 performance to your 386-based system.

cessor, a memory cache, and 8K bytes of unified code and data cache.

Price: \$5295.

Contact: Feith Systems and Software, Inc., One Bala Plaza, East Lobby, Bala Cynwyd, PA 19004, (215) 667-5575.

Inquiry 1130.

Accelerate Your Graphics

An inexpensive way to quickly display graphics on VGA and higher-resolution monitors is by using Number Nine Computer's Graph-

ics Xccelerator in conjunction with a video controller. In VGA mode, the #9GX is as much as 25 times faster than VGA cards without a graphics accelerator.

Each #9GX has a 60-MHz TMS34010 processor, 512K bytes to 2 MB of video RAM, and up to 4 MB of DRAM. It speeds graphics on computers with ISA and EISA buses and is compatible with screen resolutions ranging from standard VGA (640 by 480 pixels) up to 1280 by 1024 pixels with 256 colors. It can also address a bit map as large as 4096 by 4096 pixels. You can increase the resolution, color depth, and speed by adding more memory and changing the driver.

Price: \$895.

Contact: Number Nine Computer Corp., 725 Concord Ave., Cambridge, MA 02138, (800) 438-6463 or (617) 492-0999.

Inquiry 1134.

continued

VGA Boards Reduce Eyestrain

Several manufacturers have introduced VGA controllers that are designed to reduce eyestrain, with refresh rates of between 70 and 75 Hz rather than the customary 56 or 60 Hz.

The Sigma VGA Legend, with a refresh rate of 72 Hz, displays graphics at 1024 by 768 pixels, 800 by 600 pixels, and 640 by 480 pixels. Each board includes 512K bytes of RAM and is user-expandable to 1 MB (for high-resolution display with 256 colors).

Supported monitors include the Nanao FlexScan 9070, NEC's MultiSync 4D and 5D, Sony's CPD-1304, Mitsubishi's Diamond Scan 16L and 20L, Hitachi's Hi-Scan 20, and the Relisys RE-1520.

Price: \$449; 1-MB version, \$569.

Contact: Sigma Designs, Inc., 46501 Landing Pkwy., Fremont, CA 94538, (415) 770-0100.

Inquiry 1131.

Genoa Systems says that its Super VGA controller cards provide flicker-free resolution using a new application-specific IC chip. The company's 16-bit (Model 6400A) and Micro Channel architecture (Model 6600A) graphics controller cards provide 70- to 75-Hz screen refresh rates at a screen resolution of up to 1024 by 768 pixels.

Price: Model 6400A, \$499; Model 6600A, \$549.

Contact: Genoa Systems, Corp., 75 East Trimble Rd., San Jose, CA 95131, (408)

432-9090.

Inquiry 1132.

Tatung's inexpensive OmniVGA/HR video controller cards offer a 70-Hz vertical operating frequency, 1024- by 768-pixel resolution, and backward compatibility with Super VGA, VGA, CGA, EGA, Hercules, and Monochrome Display Adapter monitors.

Model 512 can concurrently display up to 256 colors; Model 256 can display up to 16 simultaneous colors.

Price: OmniVGA/HR-256, \$289; OmniVGA/HR-512, \$339.

Contact: Tatung Company of America, Inc., 2850 El Presidio St., Long Beach, CA 90810, (213) 979-7055.
Inquiry 1133.

DBMS Case Study:

Security for the Goodwill Games™*



The Problem

The 1990 Goodwill Games: 2500 athletes in 22 events at 15 locations, drawing hundreds of thousands to watch them perform. A show-place for international goodwill. A potential target for terrorists. A challenge for security agencies.

With only 3,000 off-duty officers to fill 30,000 assignments, there's no room for confusion in scheduling. And scheduling must respond to last minute changes, as event times slip, as dignitaries arrive on short notice, or as threats arise. Hand-scheduling can't meet the challenge. But the Games' Integrated Police Planning Group (IPPG) found that no automated system had ever been developed for securing such events.

The Application

Automated Manpower On-line Scheduling (AMOS) matches personnel to scheduling requirements, taking into account special training, language skills, and other factors. AMOS prepares an assignment sheet for each individual, explaining the assignment, when and where to report, how to get there – even where to park.

AMOS responds to changes quickly. The database is large and complex, yet thanks to the innovative

combined technology of the underlying db_VISTA database engine, search, match, and update times are negligible. Data integrity is assured by avoiding data redundancy. That means the information is reliable.

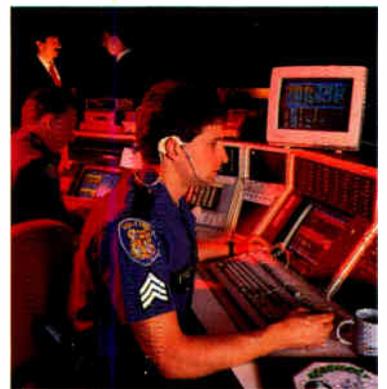
The Solution

AMOS was created by Raima's services subsidiary, Vista Development Corp., using the db_VISTA III DBMS. "We looked for months for a database that was fast, flexible, and could handle a huge volume of data while still maintaining speed," said Sgt. Alan Bernstein of the IPPG. "We also wanted to find a company that could not only furnish the product, but provide the development services." They discovered Raima and db_VISTA III.

Your end users may not be fighting terrorists, but they still need fast, reliable information to get their jobs done. If you develop applications for MS-DOS, MS Windows, UNIX, QNX, OS/2, VMS, Macintosh, and other environments, db_VISTA III is the solution.

Call 1-800-db-RAIMA (1-800-327-2462)

Circle 331 on Reader Service Card



Command center personnel can adjust schedules without delay or confusion, thanks to db_VISTA III's ability to handle large volumes of data with speed and accuracy.

db_VISTA III™ Database Management System

Specifications

High performance. C language portability. Complete C source code available. No royalties.

Network data model Relational B-tree indexing. Relational SQL query and report writer. Single & multi-user. Automatic recovery. Built-in referential integrity. Complete schema revision capability. Supports: VMS, UNIX, QNX, SunOS, XENIX, Macintosh, MS-DOS, MS Windows. OS/2 compatible. Most C Compilers and LANs supported.

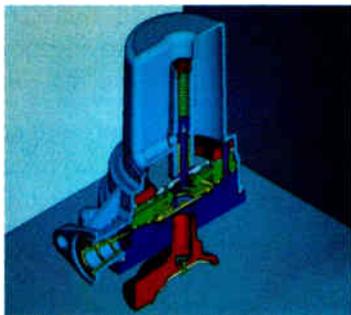
Raima Corporation 3245 146th Place S.E., Bellevue, WA 98007 USA (206)747-5570 Telex: 6503018237 MCI UW FAX: (206)747-1991
International Distributors: Australia: 61 2 419 7177 Brazil: 55 11 829 1687 Central America: 506 28 07 64 Denmark: 45 42 887249 France: 33 1 46092 84 Italy: 39 45 584711 Japan: 81 3 473 7432 Mexico: 52 83 49 53 00 The Netherlands: 31 02159 46 814 Norway: 47 244 8855 Sweden: 46 013 124780 Switzerland: 41 64 517475 Taiwan: 886 2 552 3277 Turkey: 90 1 132 0516
United Kingdom: 44 0992 500919 Uruguay: 598 2-92 0959 USSR: 01 32 35 99 07; 812 292 19 65; 0142 437952 West Germany: 49 07127 5244 Copyright ©1990 Raima Corporation. All rights reserved

* "Goodwill Games" is a trademark of the Turner Broadcasting Company. db_ is registered in the U.S. Patent and Trademark Office.

The IBM RISC System/ Designing on any other workstation



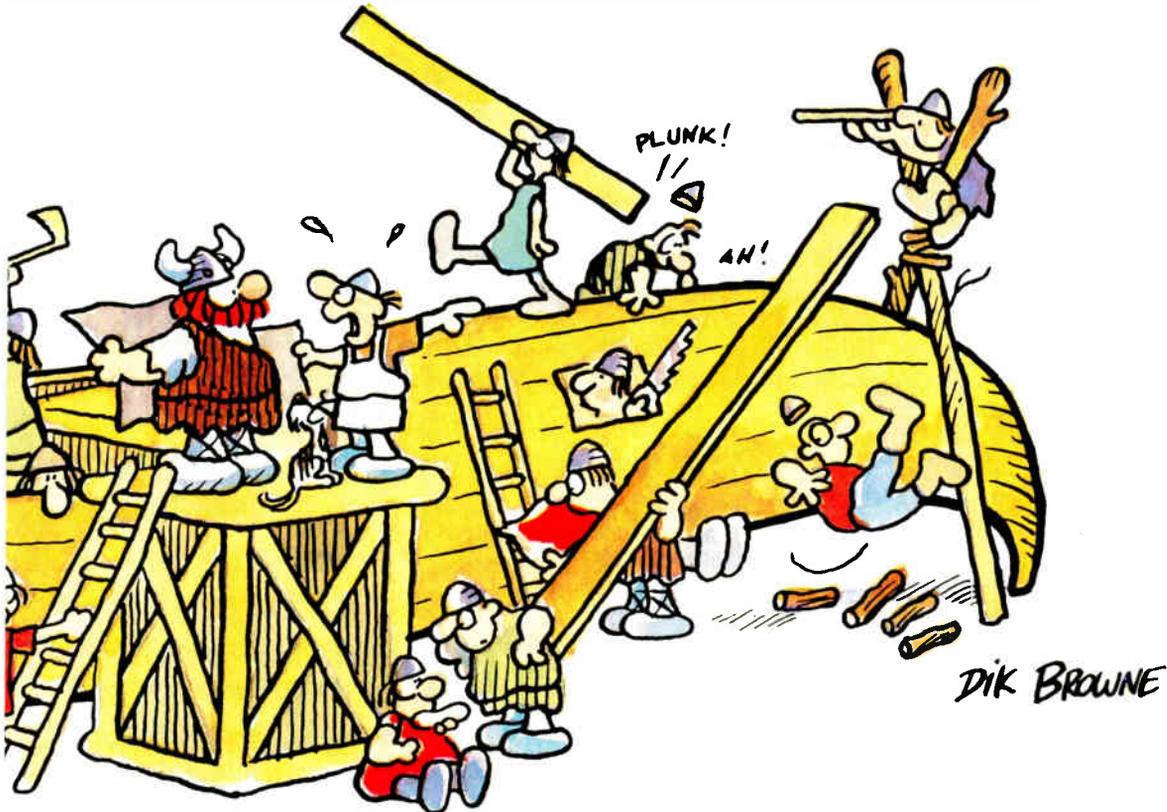
Whatever you're creating, you'll sail into a whole new age with any of the four POWERstations in the RISC System/6000 family. Because POWER (Performance Optimization With Enhanced RISC) processing can give you performance you've probably only dreamed about:



up to four instructions per machine cycle, 42 MIPS and 13 MFLOPS. Suddenly, complex designs don't take eons anymore.

The four RISC System/6000 POWERstations feature a range of graphics processors from grayscale to Supergraphics to satisfy any graphics demand. Great news for Power Seekers working on animation, scientific visualization, medical imaging and engineering solutions like CADAM™, CAEDS™ and CATIA™. And for electrical design automation, there's IBM's all new CBDS™ and an arsenal of over 60 EDA appli-

6000™ family. will seem downright primitive.



cations from more than a dozen vendors.

With every POWERstation, you can get an almost unimaginable palette of 16 million colors, which gives you 3D images so realistic, they fairly leap off the screen, with super sharp resolution of 1,280x1,024 pixels. And when it's time to call in the heavy artillery, the POWERstation 730 draws nearly one million 3D vectors per second. Like all POWERstations, it can come complete with its own graphics processor, freeing the POWER processor to rapidly create and analyze your designs. All at prices that won't sink anybody's budget.

So if you're tired of paddling upstream with yesterday's performance, call your IBM marketing representative or Business Partner to find out more about the RISC System/6000 family. For literature, call 1 800 IBM-6676, ext. 991.

Civilization never looked so good.



For the Power Seeker.

Circle 141 on Reader Service Card

Share a PostScript Printer Among PCs and Macs

If you need to connect both PCs and Macs to a single PostScript printer, you should consider BridgePort, a small peripheral from Extended Systems.

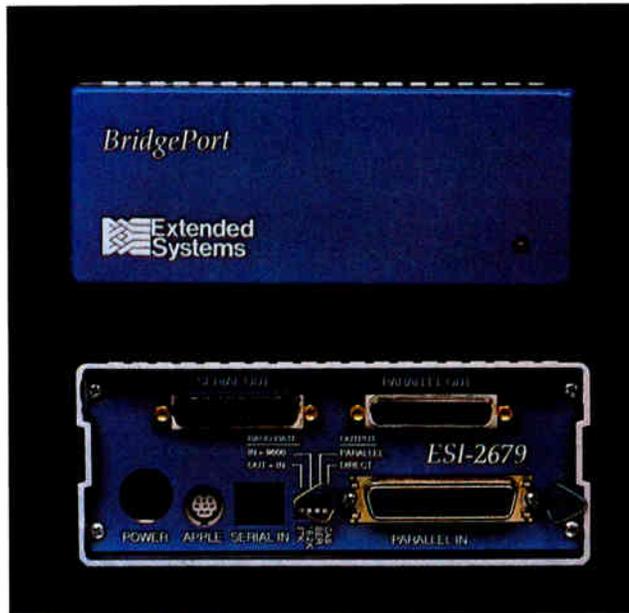
Macintoshes connect to BridgePort through the Local-Talk interface (which supports up to 31 Macs), and as many as two PCs can connect through the serial and parallel interfaces. Integrated Laser-Writer emulation lets your Mac print PostScript files to non-Apple printers.

BridgePort supports several printers, including Hewlett-Packard's II, IID, and III printers equipped with a PostScript cartridge; IBM LaserPrinters equipped with PostScript; QMS PS810 Turbo printers; Apple LaserWriter IINT and IINTX printers; and other compatibles.

Price: \$495.

Contact: Extended Systems, Inc., 6123 North Meeker Ave., Boise, ID 83704, (208) 322-7575.

Inquiry 1135.



One BridgePort lets you inexpensively share a PostScript printer among two PCs and as many as 31 Macs.

"Camera" Prints on a PostScript Printer

The Dycam 1GS is a battery-operated still-video camera you use to take pictures, display and edit them on your Mac, and print them on your PostScript printer. Dycam plans to introduce a PC version later this year.

The charge-coupled device

operates much the same as an ordinary film camera. You point and shoot, and an audio-output shutter click confirms that you've captured the image. The Dycam 1GS has shutter speeds of 1/30 to 1/1000 second, depth of field from 2 feet to infinity, a "perfect portrait" field of view, and a variety of beeps to signal that you're about to take a bad picture, that the Dycam's battery is low, and other

problems.

After you snap your pictures, you drop the unit into a cradle that connects it to your computer's serial port. Software running on the Mac includes a menu selection for uploading the images at a rate of about 20 seconds per photograph. You can then display and edit the image using such packages as Digital Darkroom.

Maximum image quality is rated as 376 by 240 pixels in 256 shades of gray. The unit weighs 10 ounces.

Optional accessories include a kit with a recharger, another recharger that plugs into an automobile cigarette lighter, and a laptop cable and cable adapter.

Price: \$995.

Contact: Dycam, Inc., 9546 Topanga Canyon Blvd., Chatsworth, CA 91311, (818) 998-8008.

Inquiry 1136.

Turn One Parallel Port into Two

The Parallel Port Multiplexer is a tiny device that turns a single parallel port into two, complete with a 1K-byte TSR program to assign the ports to peripherals and a 6-inch cable.

Manufacturer Xircom designed the 3½-ounce device so that laptop users could simultaneously use a printer and its Pocket LAN adapters for Ethernet and Token Ring networking. But the Multiplexer is compatible with all parallel peripherals that need a DB-25 interface. The Parallel Port Multiplexer measures 2½ by 2½ by 1½ inches.

Price: \$95.

Contact: Xircom, Inc., 22231 Mulholland Hwy., Suite 114, Woodland Hills, CA 91364, (818) 884-8755.

Inquiry 1137.

continued

Two New Cartridges for Your LaserJet Printers

The Charisma cartridge, for all Hewlett-Packard LaserJet printers, lets you plug in up to four extra single-chip modules to add functions to your printer.

It contains all the font and symbol sets from the standard HP A-through-Z font cartridges, as well as a number of additional symbols and fonts (including extra large). Elite has announced 12 modules for Charisma, including traditional typefaces.

The company also plans to provide a service to allow you to place any graphics

image on a module. Images include company logos, letterhead, or other commonly used and complex figures.

Price: \$399; modules, \$99 to \$149.

Contact: Elite Business Applications, 28 Route 3 North, Millersville, MD 21108, (800) 942-0018 or (301) 987-9050.

Inquiry 1138.

Pacific Outlines I and II are font cartridges for your LaserJet III printer that Pacific Data Products claims are better than and cost one-third the price of

Hewlett-Packard's outline fonts.

Together, the font cartridges contain 51 typefaces, which are selectable up to 999.75 points in quarter-point increments. They incorporate fast Intellifont font-scaling technology and are fully compatible with LaserJet III drivers used with the HP scaling-font cartridges.

Price: \$299 each.

Contact: Pacific Data Products, Inc., 9125 Rehco Rd., San Diego, CA 92121, (619) 552-0880.

Inquiry 1139.



INSTANT MAINFRAME. JUST ADD SCO.

Not too long ago, a few dozen people sharing the same programs, resources, and information on a single computer at the same time meant only one thing—a mainframe.

Powerful, big, expensive, and proprietary.

More recently, the same people could be found doing exactly the same things—simultaneously sharing programs, resources, and information—on a minicomputer.

A lot cheaper, a lot smaller, yet powerful enough to do the same jobs. And just as proprietary.

Then along came the latest generation of personal computers. And now, the same people are more and more likely to be found doing exactly the same things—simultaneously sharing programs, resources, and information—on a PC.

And not a whole officeful of PCs networked together, either, but *a single PC powering the whole office at once.*

A lot cheaper, a lot smaller, yet still easily powerful enough to do the same jobs. Built to non-proprietary, open system standards that allow complete freedom of choice in hardware and software.

And running the industry-choice multiuser, multitasking UNIX® System V platform that gives millions of 286- and 386-based PC users mainframe power every business day.

The UNIX System standard for PCs—SCO.™

The SCO family of UNIX System software solutions is available for all 80286-, 80386-, and 80486-based industry-standard and Micro Channel™ computers.

Today, SCO UNIX System solutions are installed on more than one in ten of all leading 386 computers in operation worldwide.

Running thousands of off-the-shelf XENIX® and UNIX System-based applications on powerful standard business systems supporting 32 or even more workstations—at an unbelievably low cost per user. And with such blazing performance that individual users believe they have the whole system to themselves.

Running electronic mail across the office—or around the world—in seconds.

Running multiuser PC communications to minis and mainframes through TCP/IP and SNA networks.

And doing some things that no mainframe—or even DOS- or AOS/2™-based PC—ever thought about, such as running multiple DOS applications. Or networking DOS, OS/2, XENIX and UNIX Systems together. Or running UNIX System versions and workalikes of popular DOS applications such as Microsoft® Word, 1-2-3®, and dBASE III PLUS.®

Or even letting users integrate full-featured multiuser productivity packages *of their choice* under a standard, friendly menu interface.

Today's personal computer isn't just a "PC" anymore, and you can unleash its incredible mainframe-plus power for yourself—today.

Just add SCO.

For more information, call SCO today and ask for ext. 8562.



(800) SCO-UNIX (726-8649)

(408) 425-7222

FAX: (408) 458-4227

E-MAIL: ...!uunet!sco!info info@ sco.COM

UNIX is a registered trademark of AT&T. SCO and the SCO logo are trademarks of The Santa Cruz Operation, Inc. Microsoft and XENIX are registered trademarks of Microsoft Corporation. OS/2 and Micro Channel are trademarks of International Business Machines Corporation. 1-2-3 is a registered trademark of Lotus Development Corporation. dBASE III PLUS is a registered trademark of Adhem-Tale. © 1989 The Santa Cruz Operation, Inc., 400 Encinal Street, P.O. Box 1900, Santa Cruz, California 95061 USA. The Santa Cruz Operation, Ltd., Crossley Centre, Hatters Lane, Watford WD1 8YN, United Kingdom, +44 (0)923 816344, FAX: +44 (0)923 817781, TELEFAX: 917372 scoc

Circle 259 on Reader Service Card

World Radio History

Arnet Offers Serial Boards with Surge Protection

Serially networked PCs and peripherals now have more protection from power surges with Arnet's new serial-port expansion boards, the company says.

SurgeBlock protection is now part of five new boards. They include the Octaport, which features 64K bytes of dual-ported RAM, a 10-MHz 80C186 processor, an eight-port cable, and Simul-Print, a software driver that supports multiscreen sessions and lets users of terminals swap programs with a single keystroke while in other applications.

Smartport-8 is an eight-port board with 64K bytes of dual-ported RAM, 64K bytes of RAM (expandable to 512K bytes), a 16-MHz 80C186 processor, SimulPort (terminal paging software), and Simul-Print. You can expand Smartport-8 to 16 or 24 ports.

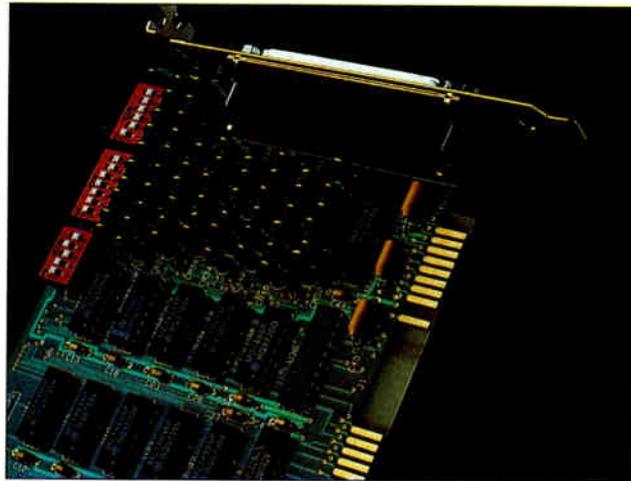
Smartport-16 is a 16-port board that features all the functions of Smartport-8 and is expandable to 24 or 32 ports.

Price: Octaport, \$1095; Smartports, \$1595 to \$2995.
Contact: Arnet Corp., 618 Grassmere Park Dr., Suite 6, Nashville, TN 37211, (800) 366-8844 or (615) 834-8000.
Inquiry 1140.

System Sleuth on the Trail of Windows and the Mac

Dariana Technology Group has modified System Sleuth, its DOS program for analyzing and diagnosing a computer configuration, to work with Windows 3.0 and the Macintosh.

System WinSleuth is a Windows 3.0 program that fer-



Arnet's Octaport is a serial-port expansion board that guards against energy spikes by bleeding off overvoltage before it can reach and damage chips.

rets out information about hardware and software configurations, attached peripherals, and memory. Dariana Technology says that everything from the DOS program has gone into WinSleuth, except where the use of protected mode will interfere. WinSleuth might not be able to find out as much information about areas like interrupts as System Sleuth does, the company concedes.

WinSleuth keeps track of how Windows is managing memory and informs you of the size of the largest remaining contiguous block of memory. This allows you to find out if there is still enough memory left to run Windows.

The program also tracks all the device drivers in the system and can report their capabilities.

System MacSleuth provides information about AppleTalk and the devices connected to a Mac via AppleTalk. It identifies the type of system, desk accessories, INITs, SCSI devices, slots, cdevs, and drivers.

Price: \$149 each.
Contact: Dariana Technology Group, Inc., 7439 La Palma Ave., Suite 278, Buena Park, CA 90620, (714) 994-7400.
Inquiry 1141.

Learn to Enhance Your Group's Schedule

Advanced Concepts says that Office Minder 1.10, a groupware package, works on Novell, 3Com, Banyan, and compatible LANs. Enhancements include support for multiple file servers, wide-area networks, and remote communication with Message Handling System-compatible E-mail products.

Office Minder 1.10 includes a TSR program for E-mail, telephone messaging, group scheduling, project management, and resource management. Standard features are text editing, screen capture, and file attachments; ASCII import and export; shared to-do lists; appointment reminder alarms; and auto-dialing from embedded text. Office Minder runs in 2K bytes of RAM for simple mail notification, 56K bytes for messaging, and 86K bytes for a full-function system.
Price: \$695 per server.
Contact: Advanced Concepts, Inc., 4129 North Port Washington Ave., Milwaukee, WI 53212, (800) 222-6736 or (414) 963-0999.
Inquiry 1142.

Forval's External Modem Speeds Data at 14,400 bps

The SA14400 is an external modem that transmits data without compression at 14,400 bps using an extended V.32 protocol for 14,400-bps data transmission. The CCITT standards body is bound to designate 14,400 transmission as V.32bis, the company says.

The SA14400 also includes the V.42bis compression algorithm that effectively quadruples data transfer rates and allows the modem to transmit at 57,600 bps. If it can't talk to a V.42bis modem, it defaults to the MNP-5 data-compression algorithm for 28,800-bps data transmission rates. And of course it's compatible with the standard V.32 rate of 9600 bps and the older data transmission protocols.

Because you can program the new modem's firmware via a data call over a standard phone line, you can receive updates that improve the modem's performance or add future standards by calling Forval using the modem itself, Forval says.

Some PC systems are no longer able to keep up with data transmissions at higher speeds and start to lose characters, so Forval's internal 14,400-bps modem uses a custom VLSI chip to buffer the data to the AT bus.
Price: Introductory price, \$996; \$1245 thereafter.
Contact: Forval America, Inc., Modem Division, 6985 Union Park Center, Suite 425, Midvale, UT 84047, (800) 367-8251 or (801) 561-8080.
Inquiry 1143.

continued

CARRY-I

The World's First & Original Book-Size Desktop Computer

SAVES YOUR ENVIRONMENT



Good

Wt. (Monitor, CPU, Keyboard) = 59 lb.
Footprint (W/Keyboard) = 4 sq. ft.

BETTER

Wt. (Monitor, CPU, Keyboard) = 13 lb.
Footprint (W/Keyboard) = 1 sq. ft.



CARRY-I 8088

10MHZ XT/AMI BIOS /256K RAM expandable to 640K/One to two 720KB 3.5" FDD/ Serial/Parallel/Game/CGA/MGA/Standard keyboard connector/16Watt Power adapter
Dimension: 240mm x 185mm x 45mm Weight: 1.9kg

CARRY-I KEYBOARD

32 Key/XT-AT Autoswitch
Dimension: 310mm x 145mm x 27mm Weight: 0.7kg

CARRY-I 80286

12MHZ, 0 Wait State AT/AMI BIOS with Diagnostic/1MB RAM/20MB, 40MB HDD optional/One to two 1.44MB 3.5" FDD/2 Serial/1 Parallel/CGA/MGA/Standard keyboard connector/30Watt Power adapter
Dimension: 240mm x 185mm x 45mm Weight: 2.1kg

CARRY-I MONITOR

9", Dual Frequency Weight: 3.4kg



FLYTECH TECHNOLOGY CO., LTD.
(HEAD OFFICE)
2 FL., NO. 8, 1ANE 50, SEC. 3,
NAN-KANG RD., TAIPEI, TAIWAN, R.O.C
TEL: (02)785-2556 FAX: (02)785-2371, 783-7970
TELEX: 22233 FLT*O

FLYTECH TECHNOLOGY (U.S.A.), INC.
3008 SCOTT BLVD., SANTA CLARA, CA 95054 U.S.A.
TEL: (408)727-7373, 727-7374 FAX: (4-6)727-7375

FLYTECH TECHNOLOGY HANDELS-GMBH
MENDELSSOHNSTRASSE 53,
6000 FRANKFURT AM MAIN 1, WEST GERMANY
TEL: (089)7-6-061, 746-453 FAX: (086)749-375

FLYTECH TECHNOLOGY (H.K.) LTD.
B12, 8 FL., BLOCK B, TONIC INDUSTRIAL CENTRE,
19 LAMHING ST., KOWLOON BAY, HONGKONG,
HONG KONG
TEL: 305-1269 FAX: 796-8427

Exclusive Distributors:

CANADA:
BUDGETRON INC.
1320 SHAWSON DRIVE, UNIT 1
MISSISSAUGA, ONTARIO, L4W 1C3
TEL: 1-416-564-7800
FAX: 1-416-564-2679

FRANCE:
M3C L'INFORMATIQUE DU SUCCES
64, AVENUE CHARLES DE GAULLE 95180
MONTMORENCY
TEL: 33-1-34175382
FAX: 33-1-42355916

HONG KONG:
PARKLY TECHNOLOGY LTD.
B12, 8 FL., BLOCK B, TONIC INDUSTRIAL
CENTRE 19 LAMHING ST., KOWLOON BAY,
KOWLOON.
TEL: 852-3051268
FAX: 852-7968427

ISRAEL:
MIL COMPUTERS SYSTEMS LTD.
9 HABONIM ST., RAMAT GAN, P.O.B. 5195
TEL: 972-3-7515511
FAX: 972-3-7516615

ITALY:
PRIMA COMPUTER TRADING ITALIA
VIA UMBRIA, 16/A-42100 PEGGIO EM
TEL: 39-522-518599
FAX: 39-522-518599

NETHERLAND:
KN
SCHIPHOLWEG 343, 1171 PL BADHOEVEDCRP
TEL: 31-2968-84141 FAX: 31-2968-97436

NORWAY:
SECUS DATA A/S
GRENSEVN 88, 0663 OSLO B, NORGE
TEL: 47-2-722510 FAX: 47-2-722515

SPAIN:
AT ELECTRONIC, S.A.
NUNEZ DE BALBOA,
114 OFICINA 717, 28006 MADRID
TEL: 34-1-564-5434
FAX: 34-1-411-0860

U.K.:
CENTERPRISE INTERNATIONAL LIMITED
HAMPSHIRE INTERNATIONAL BUSINESS PARK,
CROCKFORD LANE, CHINEHAM, BASINGSTOKE,
HAMPSHIRE RG24 0GQ
TEL: 44-256-483754
FAX: 44-256-843174

WEST GERMANY:
MACROTRON AG
STAHLGRUBERRING 28, D-8000 MÜNCHEN 82
TEL: 49-89-4208-0
FAX: 49-89-423679

Authorized:

BELGIUM:
CELEM S.A.
BOULEVARD DE L'OURTHE, 29
B-4820 EMBOURG
TEL: 32-41-676434
FAX: 32-41-676515

BELGIUM:
DATATECH MICROSYSTEMS S.P.R.L.
CHAUSSEE DE VLEURGAT 184
B-1050 BRUSSELS
TEL: 32-2-6462290
FAX: 32-2-6460937

Circle 120 on Reader Service Card

Share Your PS/2 with Unix and a C/X System

DigiBoard says that the DigiChannel MC C/X System now lets your PS/2 inexpensively support 16 Unix users through one add-in slot and a C/CON-16 concentrator box, a small peripheral. You can also expand the basic package to support 32, 48, and 64 users with more C/CON-16 concentrator boxes.

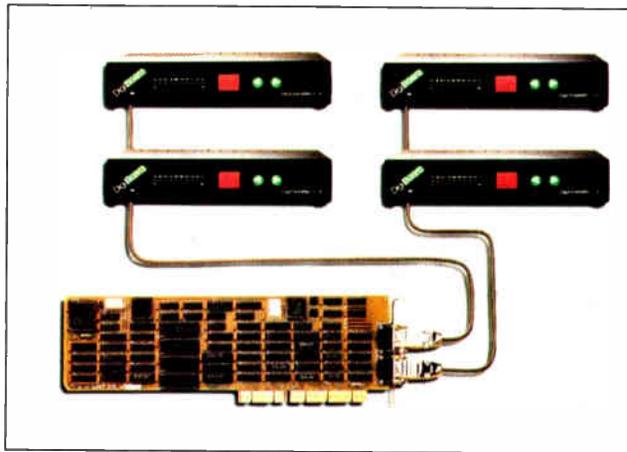
Two synchronous channels link the DigiChannel C/X adapter card with two concentrator boxes. You can daisy chain an additional concentrator box to each original concentrator to provide flexibility and allow for up to 64 concurrent users. Microprocessors on the DigiChannel C/X adapter card and the concentrator boxes work together to decrease the workload on the host CPU and to increase system throughput.

The C/X adapter card includes its own 10-MHz 80186, 128K bytes of RAM, and an 85C30 serial communications controller driving two full-duplex RS-422 synchronous channels.

Price: Basic package, \$2195; separate C/CON-16, \$1395.
Contact: DigiBoard, Inc., 6751 Oxford St., St. Louis Park, MN 55426, (612) 922-8055.
Inquiry 1144.

Fax Server Alerts You to Received Faxes

NetFax is an add-in card and software you use with a dedicated PC to create a fax server for your NetWare network. It gives you the normal features of plain-paper printing when connected to a printer, plus remote faxing to or from



The DigiChannel MC C/X System, with one board and one C/CON-16 box, lets your PS/2 inexpensively support 16 Unix users; with four boxes, you can support 64 users.

any PC on the network. What's unique about this new version of NetFax is its ability to alert you when it receives certain faxes, All The Fax says.

When you're waiting for a particular fax, you simply tell NetFax the Transmit Terminal Identification line (i.e., the header) that the sending fax

transmits at the top of every page it sends. (Most fax machines have a setup utility that lets you automatically transmit the date, time, and company name—up to 20 characters—on the TTI line of each transmitted fax.) NetFax watches for that TTI line and sends you a "fax waiting" message through NetWare's

message/broadcast facility when the fax comes in. Then you use DOS commands (NetFax uses no TSR program) to download the fax to your workstation from the fax server.

In practice, many companies don't use the TTI line for more than the time and date, and in those cases NetFax won't help you. But the company says that its TTI method is a less expensive routing method than using other companies' fax routing equipment designed for the telephone company service called Direct Inward Dialing.

You load about 50K bytes of NetFax software on the NetWare server, on the NetFax server, and on each workstation. For your NetFax server you must dedicate at least an XT with 640K bytes of RAM and a 20-MB hard disk drive. **Price:** \$995 per network.
Contact: All The Fax, Inc., 917 Northern Blvd., Great Neck, NY 11021, (800) 289-3329 or (516) 829-0556.
Inquiry 1145.

Disk and File Management

XTree Co. now offers two new versions of its disk and file management software for NetWare ELS and NetWare Advanced/SFT/386.

XTreeNet 2.0 gives administrators a visual display of their directory tree. There they can manipulate the files to access, edit, view, delete, rename, list, print, or copy any combination of files anywhere on the network. XTreeNet 2.0 is designed to help users eliminate duplicate files, access the most recent copy of any document, and move or copy files to local storage devices.

Peer-to-peer capabilities allow you to view, copy, delete, and edit files on distant workstations from designated workstations (rather than from the file server). With the Autoview feature,

you can split the screen and browse through multiple files on the left while displaying their contents on the right. And each copy of XTreeNet 2.0 comes with file viewers that enable you to see formatted views of files in Lotus 1-2-3, dBASE, XyWrite, Microsoft Word, WordPerfect, Multimate, Paradox, and other popular programs.

System requirements are DOS 3.1, 256K bytes of RAM, and NetWare ELS or Advanced/SFT/386.

Price: NetWare ELS, \$249; NetWare Advanced/SFT/386, \$495.

Contact: XTree Co., 4330 Santa Fe Rd., San Luis Obispo, CA 93401, (800) 634-5545 or (805) 541-0604; in California, (800) 551-5353; in Canada, (416) 866-8592.
Inquiry 1147.

UPSes for NetWare Broadcast Alerts of Power Failures

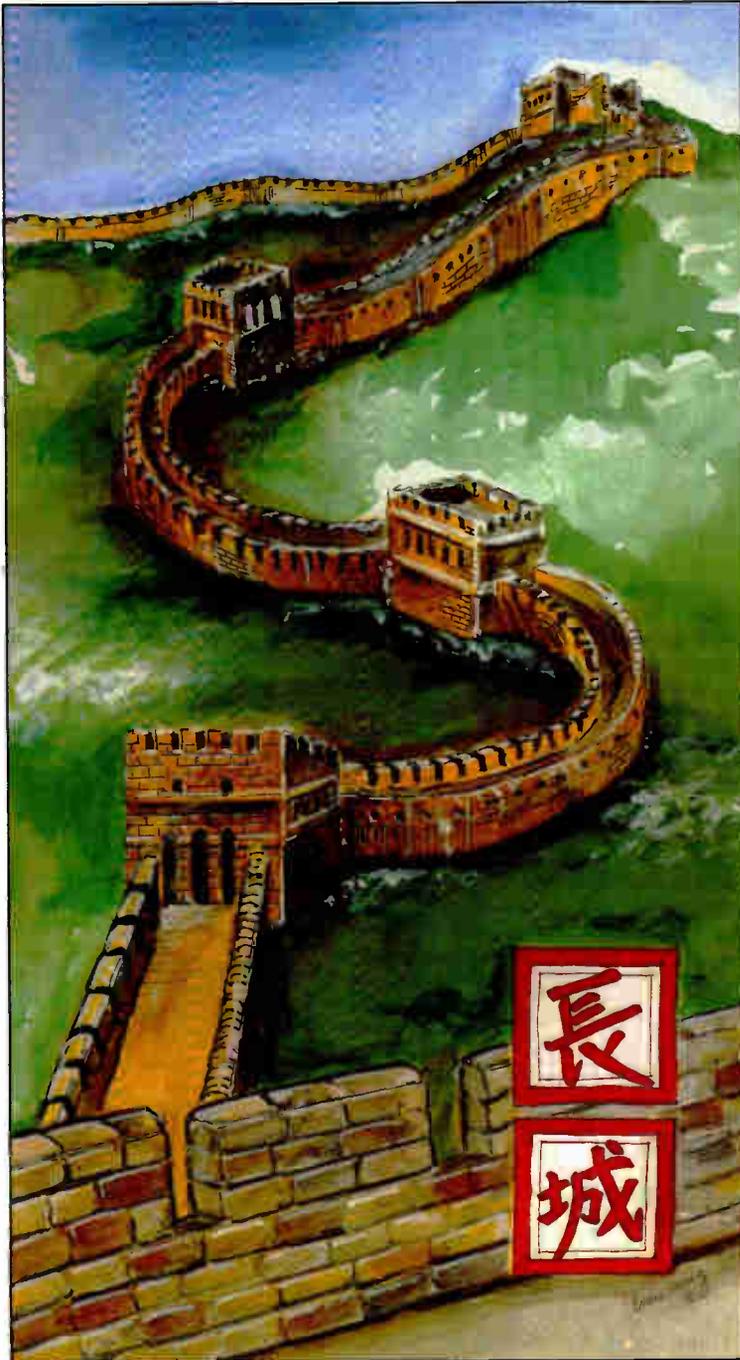
The MPS 1200 and 1500 are uninterruptible power supplies (providing on-line power rather than backup power) for your Novell LAN. They supply 1200 VA and 1500 VA of on-line power, respectively.

Network Monitor, the associated software, alerts all LAN users of impending power failures. It works as a value-added process on a file server running NetWare.

Price: MPS 1200, \$1699; MPS 1500, \$2199.

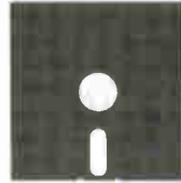
Contact: Unison Technologies, Inc., 23456 Madero, Mission Viejo, CA 92691, (714) 855-8700.
Inquiry 1146.

continued



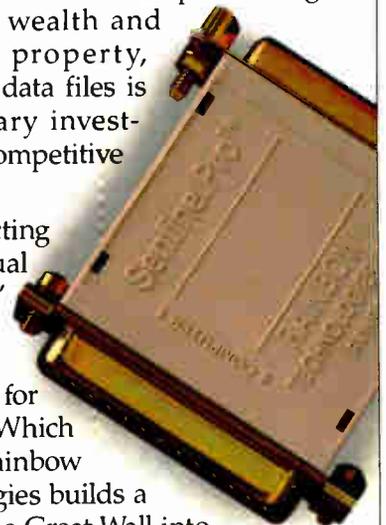
Whether you're protecting frontiers and temples in Manchuria, or software and data on the PC or Mac, the Great Wall is a lesson Rainbow Technologies has learned very well.

Software developers must deal daily with the consequences of unauthorized copies and millions of dollars in lost revenue. At the same time, both individual and corporate users must be able to make and distribute copies within legal guidelines.



Today's information-driven companies must secure their data files against theft and unauthorized access. No less than protecting personal wealth and tangible property, guarding data files is a necessary investment in competitive survival.

Protecting "intellectual property" is the security challenge for the '90s. Which is why Rainbow Technologies builds a little of the Great Wall into every key it makes.



For developers, the Software Sentinel™ family of keys protects IBM, PS/2 and compatible software, while Eve™ guards software for the Mac. Rainbow's DataSentry™ is the solution for PC data protection.

Software and data protection from Rainbow Technologies. Information on how you can have a little piece of the Great Wall to protect your software and data worldwide is as close as a toll-free call.

Copyright ©1990 Rainbow Technologies, Inc.

Times Change. The Need To Protect Doesn't.



9292 Jeronimo Road, Irvine, CA 92718
 TEL: (714) 454-2100 • (800) 852-8569 (Outside CA)
 FAX: (714) 454-8557 • AppleLink: D3058
 Rainbow Technologies, Ltd., Shirley Lodge, 470 London Road
 Slough, Berkshire SL3 8QY, TEL: 0753-41512 • FAX: 0753-43610

SAMSUNG/NOVELL
PCterminal/286

SAMSUNG/NOVELL
PCterminal/286

SAMSUNG/NOVELL
PCterminal/286

SAMS
PCterminal

SAMSUNG/NOVELL
PCterminal/286

SAMSUNG
386AE FILE S

How to plan your LAN.

You'll need a pencil.

That's to write down the telephone number on the next page. Which will connect you with Samsung's nationwide network of resellers. And the Samsung/Novell co-labeled line of LAN hardware.

It's pretty much that simple.

With one call you can plan on substantial savings over the big name computers which, despite high clock rates and even higher price tags, are not really optimized for networking.

And you can plan on 100 percent compatibility with all versions of Novell's NetWare, because Samsung's LAN hardware was co-designed by Novell. Just like the label says.

THE TESTING WENT IN BEFORE THE LABEL WENT ON.

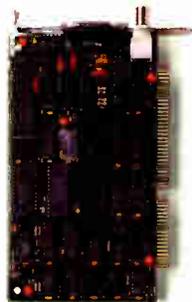
Both the Samsung 386AE and PCterminal/286 have

been tested exhaustively and certified by Novell for compatibility with all popular networking hardware and software products. As a matter of fact, Samsung's 386AE is one of 3 file servers certified by Novell to run NetWare 386.

For example, engineers at Novell successfully tested the PCterminal/286 LAN Workstation in no less than 1200 different network configurations... with 50 units running at once! That's a claim no other computer manufacturer can make.

NETWORKING VS. NETWORKING.

What's the difference? Take our 386AE Fileserver, for instance. It includes Novell's Advanced BIOS, and eight expansion slots to accommodate multiple network interface cards and disk controllers. Plus an oversize power supply capable of driving dual high capacity hard disks and tape



SAMSUNG/NOVELL

PCterminal/286

SAMSUNG/NOVELL

PCterminal/286

SAMSUNG/NOVELL

SAMSUNG/NOVELL

PCterminal/286

SAMSUNG/NOVELL

PCterminal/286

SAMSUNG/NOVELL
SERVER

back-up system. Plus 4 megabytes of main memory for disk caching.

Then there's Samsung's PCterminal/286 Diskless Workstation which includes a built-in Ethernet interface and Novell's Remote Boot EPROM.

And not to be overlooked is our 16-bit SE2100 Ethernet Interface Card which provides up to twice the throughput for the price of an 8-bit card.

THE SAMSUNG COMMITMENT.

With 4 million monitors and half a million PC and LAN computers sold in 1988 alone, it's clear that Samsung has made a serious commitment to the marketplace. In all, Samsung offers no less than nine different PC and LAN computer models with seventeen color and monochrome monitors! And, as a 31-billion dollar international corporation, Samsung has the resources to provide continuous support for its customers.

So why not begin your network planning today? For the name of the Samsung reseller nearest you, write:

SAMSUNG, 3655 North First Street, San Jose, CA 95134, or call **1-800-446-0262**.



 **SAMSUNG**

Circle 257 on Reader Service Card (RESELLERS: 258)

MetaWindow Puts TV in Your Computer Screen

With the MetaWindow graphics toolkit, you can develop applications that let an end user work in one application while viewing live video that appears in a resizable, movable window. A program that lets stockbrokers view a live feed from Financial News Network while using another program to buy and sell stocks is one possible MetaWindow application.

MetaWindow applications can run on DOS, Unix, OS/2, and Windows systems that include a New Media Graphics VideoWindows digital video card. The card supports live or taped video.

A program written in C or Pascal can call the more than 250 routines of the object module library.

Price: \$250.

Contact: Metagraphics Software Corp., 4575 Scotts Valley Dr., P.O. Box 66779, Scotts Valley, CA 95066, (408) 438-1550.

Inquiry 1148.

Two Parallel Programming Environments

Top Level Common Lisp (TopCL) 2.0, for developing Unix System V- and X Window System-based multiprocessing programs, relieves you of the programming hassles of synchronicity through its use of future objects.

Top Level describes a future object as a promissory note or blank check. Once you specify a fork, the system immediately returns a future object, the value of which is undetermined until a computation is complete.

TopCL reduces the num-



Applications created with the MetaWindow graphics toolkit let you watch full-motion images from a standard American or European video source.

ber of function calls required to fork a computation, allowing you to fork small computations efficiently, with little overhead.

The program includes Meta Debug, an external debugger, and a foreign function interface for calling existing software.

TopCL runs on PCs and workstations based on the Intel 80x86 and i860, Motorola 88000, and National Semiconductor 32x32 chips. The company also plans to release a version for OS/2.

Price: \$3300 for a system for a two-processor PC.

Contact: Top Level, Inc., 196 North Pleasant St., Amherst, MA 01002, (413) 256-6405.

Inquiry 1149.

An Abstract Machine in the Strand 88 parallel programming language encapsulates hardware-dependent features so that applications can run across all platforms that Strand Software supports.

Strand's foreign function interface supports sequential C and FORTRAN applications.

Strand 88 Buckingham, the newest version, includes a

profiler, a task scheduler, and a resolvent analysis tool. It also runs 50 percent faster than the previous version.

Strand runs on PC-based transputer systems, multiprocessor machines, and workstations running on Unix/V 386.

Price: \$1500 and up.

Contact: Strand Software Technologies, Inc., 15220 Northwest Greenbrier Pkwy., Suite 350, Beaverton, OR 97006, (503) 690-9830.

Inquiry 1150.

New Linker Gives DOS Programs Virtual Memory

The Virtual Memory Linking feature of the .RTLink/Plus 4.0 linker gives DOS applications virtual memory capabilities similar to those of OS/2 and Windows without requiring a hardware upgrade. With VML, DOS programs execute in conventional memory and up to 32 MB of expanded memory.

In most situations, one command during link time adds VML capability to a program without requiring source code changes or the programming analysis of overlays. The linker manages

available memory and discards infrequently accessed pages when more memory is needed to bring in a page.

Instead of bringing pages into memory through a reference to a piece of data, the VML feature does it through calls or jumps to code symbols.

The VML feature of the linker initially supports Microsoft C, while the linker itself is compatible with all DOS programming languages.

Pocket Soft will continue to add VML support for other programming languages.

Price: \$495.

Contact: Pocket Soft, Inc., 7676 Hillmont, Suite 195, Houston, TX 77040, (713) 460-5600.

Inquiry 1151.

Develop SQL Applications in Windows

With two products from Coromandel, you can build and run transaction-based or Structured Query Language-based data management applications under Windows 3.0.

Integra SQL offers a high-level programming interface based on embedded SQL statements and a low-level interface for directly manipulating tables and performing record operations. It automatically handles data management, query optimization, and data integrity, the company says.

C-Trieve/Windows is a library of routines for building transaction-based applications.

Price: Integra SQL, \$695; C-Trieve/Windows, \$395.

Contact: Coromandel Industries, 108-27 64th Rd., Forest Hills, NY 11375, (718) 997-0699.

Inquiry 1152.

continued

Programmer's Paradise

... for the
***guaranteed
best prices
and
fast delivery!***

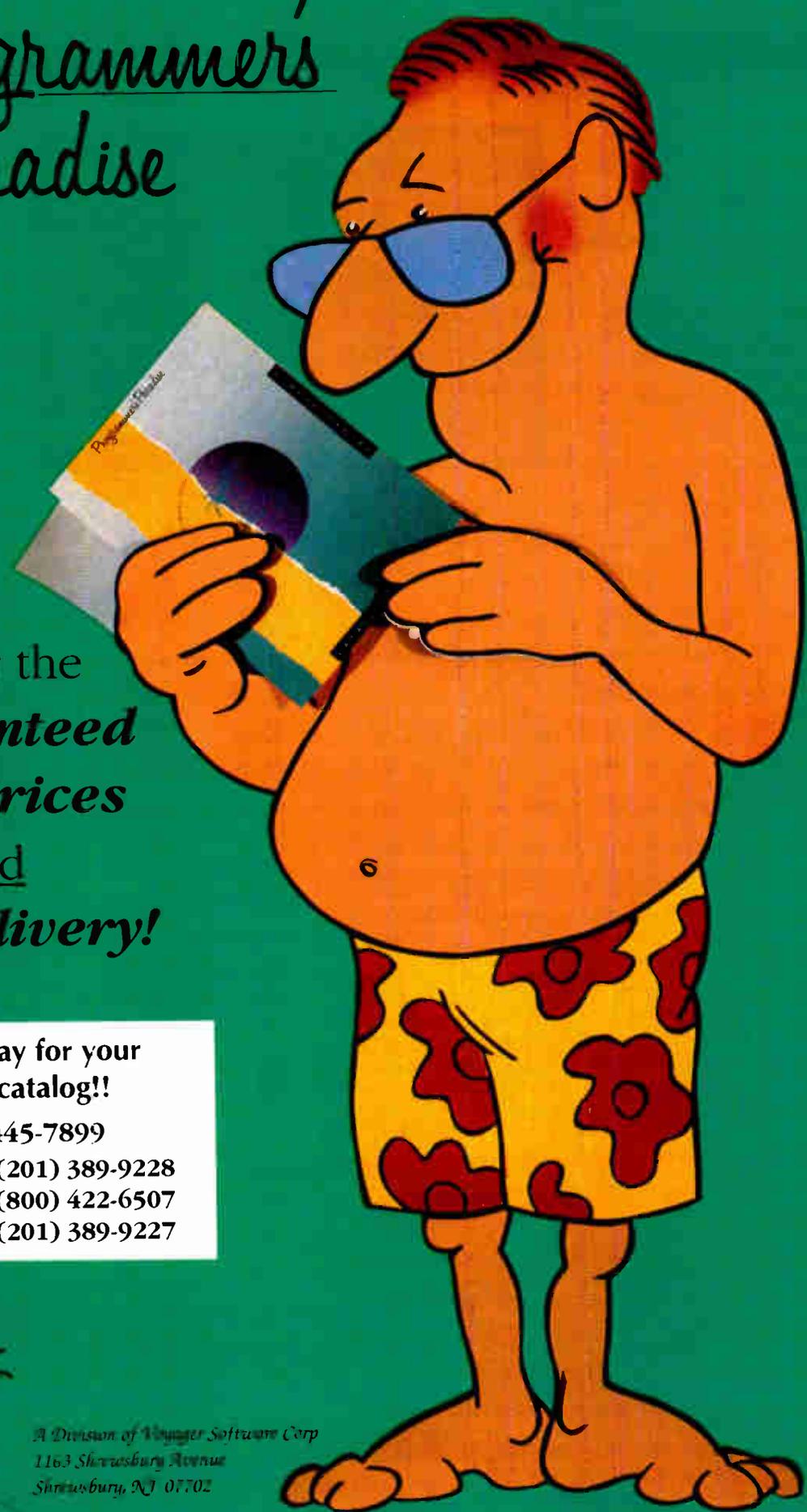
Call today for your
FREE catalog!!

(800) 445-7899

International: (201) 389-9228

Corporate: (800) 422-6507

Fax: (201) 389-9227



*A Division of Wingler Software Corp
1163 Shrewsbury Avenue
Shrewsbury, NJ 07702*

Sketch Out Projects with Qwiknet

Project Software & Development has added a graphical user interface to Qwiknet Professional 2.0, a multiproject management program for in-depth scheduling and cost analysis on the IBM PC.

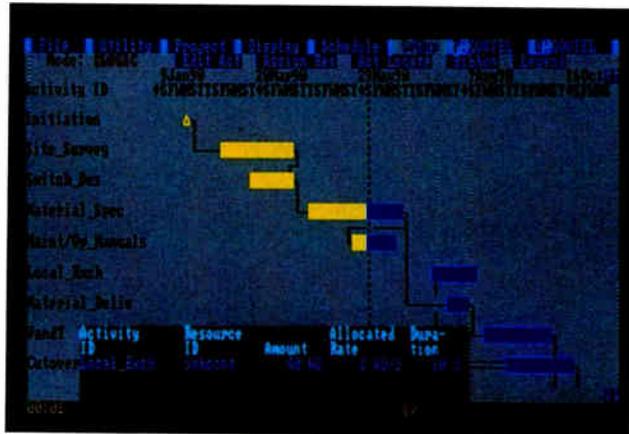
The program's drawing-board feature lets you sketch out a project, instead of requiring that you build critical-path method schedules with tabular forms and advanced constructs. A windowing system lets you navigate through screens, and a pick-and-drop function lets you copy information from one field, screen, or file to another without typing.

Version 2.0 lets you define an activity's duration as a function of its resource allocation where appropriate. What-if analysis and the ability to schedule up to 250 projects with a common resource pool, so that all resources are used without being double-booked, are included in the program.

Price: \$2500; \$8600 per four-concurrent-users package.

Contact: Project Software & Development, Inc., 20 University Rd., Cambridge, MA 02138, (617) 661-1444.

Inquiry 1153.



Qwiknet's new drawing-board interface for managing projects. Tasks and portions of tasks in yellow are complete, while those in blue haven't been finished.

A Database/Spreadsheet Companion

Feldstar says that Analyst 1 combines the calculation ability of spreadsheets with the historical tracking of databases so that you can develop and maintain analyses over extended periods of time in a single model. The program doesn't replace a DBMS or spreadsheet, but it lets you identify and graph trends from historical data.

With the program's relational database capabilities, you can track the performance of your sales staff by various products and multiple time periods that you choose. You compare these relationships using reports and line,

bar, pie, and wave charts.

You can export data from a spreadsheet to Analyst 1 by printing the spreadsheet to a file unformatted. You then insert a date into the first column so that Analyst can use it.

Analyst 1 runs on the IBM PC with 512K bytes of RAM.

Price: \$199.
Contact: Feldstar Software, Inc., P.O. Box 871564, Dallas, TX 75287, (214) 407-1006.

Inquiry 1154.

Softview's Intelligent Business Forms Package

Softview, developer of the MacInTax tax preparation program for the Mac and IBM PC running Windows, has released a forms-design program with an underlying technology that lets you create and modify forms without having to start from scratch.

The if:X Forms Designer lets you make last-minute changes, such as adding a company logo or resizing a form, without requiring you to rearrange its elements. The program can insert, copy, and move pieces of a form with a single command. As you design the form, you can trans-

pose columns and exchange noncontiguous elements.

When you transfer data from the if:X Forms Designer to another application, such as Excel, through the Clipboard, text retains its font style and style information. Tabular data exchanged either way retains its structure.

The if:X Forms Designer runs on the Mac Plus with 1 MB of memory. The current version of the program doesn't have the calculating capabilities present in MacInTax, but that feature will be added in the next version, scheduled to ship next year.

Price: \$279.

Contact: Softview, 1721 Pacific Ave., Suite 100, Oxnard, CA 93033, (800) 525-1065 or (805) 385-5000.

Inquiry 1155.

Date Sensitivity Added to Accounting Package

Cyma's new versions of its Professional Accounting Series 2.0 for Unix, Xenix, and AIX running on the IBM RISC System/6000 let you create entries or generate reports for previous or future periods without disturbing current period data, which removes the pressure of period closings. PAS 2.0, which is also available for DOS, includes a report generator and a macro feature.

You can run the program's seven modules separately or integrated with other modules: general ledger, accounts payable, accounts receivable, payroll, inventory and order processing, job control, and system manager.

Price: \$495 to \$1195 per module.

Contact: Cyma, 1400 East Southern Ave., Tempe, AZ 85282, (800) 292-2962 or (602) 831-2607.

Inquiry 1156.

continued

Intex Breaks the 640K-byte Barrier for 1-2-3 release 2.0

With Beyond 640 for 1-2-3, users of Lotus 1-2-3 release 2.0 can exploit expanded memory, accessing up to 4 MB of memory for their spreadsheets, Intex reports. The program monitors your memory use, and as you approach the conventional memory limit, Beyond 640 kicks in and lets 1-2-3 store its entire spread-

sheet in expanded memory, making the Memory Full error message obsolete. The program works with 1-2-3 releases 2.01 and 2.2, and EMS 3.2 or 4.0.

Price: \$95.

Contact: Intex Solutions, Inc., 161 Highland Ave., Needham, MA 02194, (617) 449-6222.

Inquiry 1157.

Programmer's Paradise

(800)
445-7899

Windows™ Developers...

Windows™ is proving to be a worthy environment in which to invest your time and dollars. Programmer's Paradise has the progressive programmer in mind, stocking the best tools available for creating Windows applications.



Actor 3.0— The Fast Route to Windows™ 3.0

If you need to develop Microsoft® Windows applications fast, Actor can cut your development time in half. Actor, by The Whitewater Group, is the most popular object-oriented development system for the Windows environment. Actor 3.0 provides you with comprehensive windows classes that offer complete support for all Windows 3.0 functions, messages, and styles.

List: \$695 Ours: \$559

CASE:W is the development tool of choice for professional windows programmers and has become the de facto standard for windows C code generation tools. The new 3.0 version by CASEWORKS, includes animation, multi-level comment and example code, extended code support for input/output panels, application migration to PM, page generation and other feature extensions.

List: \$995 Ours: \$439



Microsoft® Windows™ 3.0

IT'S HERE! The Microsoft Windows 3.0 Graphical Environment gives you the ability to work with all your applications within an exciting visual environment. Version 3.0 breaks the 640k EMS memory barrier. Run multiple large applications that can exploit up to 16MB of memory. And the visual user shell makes it easy to complete directory, application and file management tasks from within the environment.

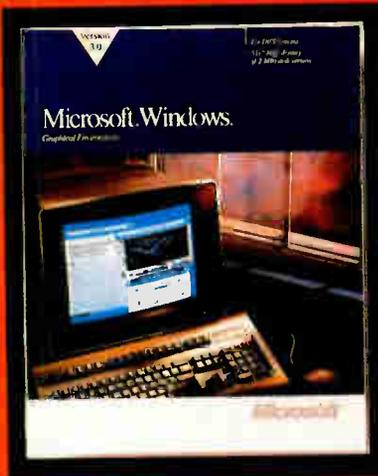
Windows 3.0 was designed to work under networks. Network resources are readily available since 3.0 allows you to connect and disconnect to file servers and printers from within the Windows environment.

A variety of useful desktop applications such as CardFile, Windows Write, a keystroke recorder and a full color painting program are also included.

So get ready to get much more done with less effort with Microsoft Windows 3.0, the graphical environment that offers truly personal computing.

List: \$150

Ours: \$99



Zortech C++ Developer's Edition 2.1

The first and only native C++ compiler supporting Microsoft Windows 3.0. Extensive documentation is provided on how to write C++ programs for Windows... and 50K of example Windows code is included! Version 2.1 also features improved optimization and code generation, a custom C++ development environment with browsers... and a virtual 386 debugger.

List: \$450 Ours: \$399



C++talk/Views

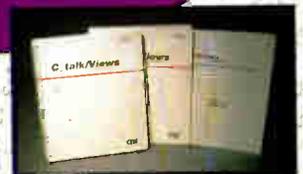
A complete application development environment for Microsoft Windows. Over 80 object classes are provided to act as building blocks for a Microsoft Windows program. The C++talk/Views framework provides an architecture for program design and a structure for building reusable program parts.

List: \$400 Ours: \$275

NEW! C++/Views

Over 60 C++ object classes such as Containers, Dialogs, Menus, Containers and Files, Streams, and user interface objects supporting menus, graphics, dialog boxes, windows, menus, printers and more. A perfect complement to Zortech's C++ Developer's Edition and the Microsoft Windows Development Kit.

List: \$475 Ours: \$419

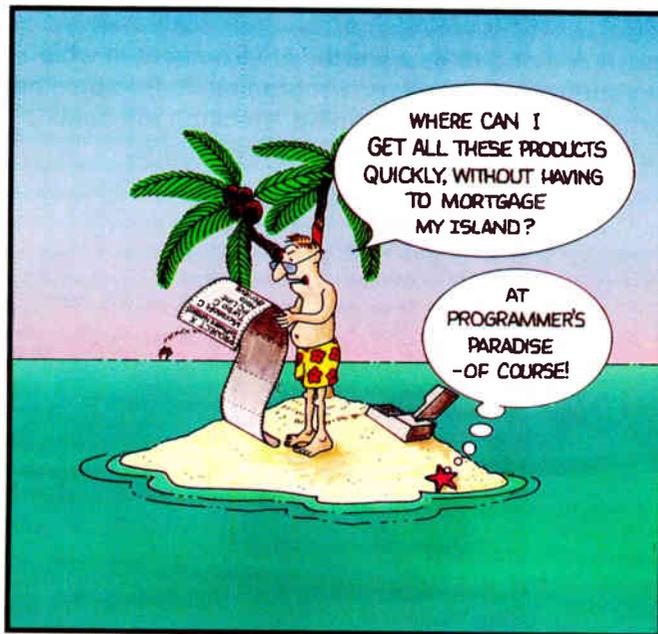


SPECIAL BUNDLE:

Zortech C++ Developer's Edition	\$450
C++/Views	\$495
Together:	\$945

Programmer's Paradise SPECIAL!
Both for only \$595

Programmer's Paradise® ...



We'll Beat The Competition's Advertised Prices!

	LIST OURS
386 CONTROL PROGRAMS	
DESQview 386 w/ QEMM	220 169
Microsoft Windows 3.0	150 99
VM/386	245 209
VM/386 MultiUser	895 839
VM/386 MultiUser Starter	395 339
386 DEVELOPMENT TOOLS	
386 ASM/LinkLoc	1295 1145
Lahey F77L-FM/32 (w/ OS/386)	1290 1035
MetaWare High C 386	895 849
Novell C Network Compiler/386	995 799
Paradox/386	895 629
PC-lint 386	239 179
Phar Lap 386 ASM/LINK	495 435
WATCOM C 8.0/386 Prof.	1295 1099
WATCOM C 8.0/386 Standard	895 719
ASSEMBLY LANGUAGE	
Advantage Disassembler	295 279
ASMFlow	99 89
MS Macro Assembler	150 105
OPTASM	150 129
Re:Source	150 129
Sourcer w/ Pre-Processor	170 149
Spontaneous Assembly	395 359
Turbo Debugger & Tools	150 99
Visible Computer: 80286	100 89
BASIC COMPILERS	
MS BASIC Prof. Devel. System	495 349
Power Basic	129 89
QuickBASIC	99 69
True BASIC	100 69
BASIC LIBS/UTILITIES	
db/LIB	139 125
DiaLogic	95 85
GraphPak	79 70
GraphPak Professional	149 129
P.D.Q.	129 115
ProBas	159 149
ProBas Toolkit	99 94
ProMath	99 94
QBase and Quickscreen	149 125
QuickComm	149 119
QuickPak	79 70
QuickPak Professional	169 149
QuickPak Scientific	79 70
QuickScreen	99 90
QuickWindows Advanced	149 119
C COMPILERS	
C Network Compiler	695 559
Lattice C 6.0	250 155
Lattice C 286 (w/ extension)	495 395
Microsoft C 6.0	495 339
MS QuickC 2.5	99 69
MS QuickC w/ QuickAssembler	199 139
Top Speed C Standard	199 155
Extended Edition	395 315
OS/2 Professional	495 445
Turbo C 2.0	99 69
WATCOM C 8.0 Professional	495 419
WATCOM C 8.0 Standard	395 335

	LIST OURS
C++	
C++/Views	495 419
NDP C++	495 479
Turbo C++	200 CALL
Turbo C++ Professional	300 CALL
Zortech C++ Debugger	150 129
Zortech C++	200 165
Developer's Edition	450 399
Zortech C++ Video Course	150 129
C-COMMUNICATIONS	
Breakout II	249 189
C Asynch Manager 3.0	189 139
Essential Communications	329 259
Greenleaf CommLib	359 287
Greenleaf ViewComm	399 319
SilverComm C Asynch Library	249 209
View-2	189 149
C-FILE MANAGEMENT	
AccSys for dBASE or Paradox	395 349
Btrieve Devel. System	595 449
C-ISAM	225 209
Codebase IV	295 219
CQL w/ PASS	395 349
c-tree	395 315
dbc III	250 229
dbc III Plus	500 439
db_FILE Bundle	295 249
Essential B-Tree w/ source	198 149
FairCom Toolbox - Prof. Edition	1095 789
FairCom Toolbox - Special	695 509
Informix Products	CALL CALL
Paradox Engine	495 349
Xtrieve PLUS	595 459
C-GENERAL LIBRARIES	
Blackstar C Function Library	99 79
C TOOLS PLUS/6.0	149 109
C Utility Library	249 199
Greenleaf Functions	229 179
Greenleaf SuperFunctions	299 239
Power Search	149 109
Turbo C TOOLS/2.0	149 109
C SCREENS	
Greenleaf DataWindows	395 315
Hi-Screen XL	149 129
Panel Plus	495 395
QuickWindows Advanced (C)	169 149
Vermont Views	495 CALL
Vitamin C	225 165
VC Screen	149 125
C-UTILITIES/OTHER	
Clear +	200 169
C Shroud	198 149
C-Terp	300 219
Code Runner	149 135
Code Expander	80 70
PC-lint	139 105
PCYACC Professional	495 459
PDK #3	99 89
TimeSlicer	295 279

	LIST OURS
CASE TOOLS	
EasyCASE Plus	295 265
Professional Pack	395 355
Personal CASE	199 179
COBOL LANGUAGE	
Micro Focus:	
COBOL/2 w/ Toolset	1800 1499
Personal COBOL	149 129
MS COBOL	900 629
Realia COBOL	995 849
SCREENIO	400 375
CODE GENERATORS	
Logic Gem	99 69
Matrix Layout 2.0	200 159
dBASE Black Box	59 50
PRO-C	399 339
DATABASE DEVELOPMENT	
Clarion 2.1	CALL CALL
Clipper 5.0	795 519
Data Junction Advanced	299 269
dBASE IV	795 489
dBFast/PLUS	345 295
dGE	295 249
FlashTools!	89 79
Flipper	195 169
FoxPro	795 489
FUNCKey Library	195 179
Magic PC	499 429
R&R Report Writer	150 129
R&R Code Generator	150 129
Say What!	50 39
SilverComm Library 2.0	249 209
Tom Rettig's Library	100 80
UI2 Version Two	595 479
DEBUGGERS (DOS)	
MultiScope	179 135
OPTDEBUG	150 129
Periscope I/512K	595 475
Periscope II	175 125
Periscope II-x	145 105
Periscope IV/16, 25 MHz	CALL CALL
Turbo Debugger & Tools	150 99
DOCUMENTING/ FLOWCHARTING	
Clear+	195 169
C-Clearly	130 115
Flow Charting III	250 199
Interactive Easyflow	150 125
Pageinate	100 79
Source Print	99 74
The Documentor	295 245
Tree Diagrammer	99 74
EDITORS	
BRIEF 3.0	199 CALL
Edix	195 155
EDT+	295 269
EMACS	325 265
Epsilon	195 159
KEDIT 4.0	150 125
MKS Vi	149 129
Multi-Edit Professional	179 159
Norton Editor	75 59
SLICK Editor	195 154
Sage Professional Editor	295 249
w/ Mouse	395 319
SP/PC	245 199
VEDIT PLUS	185 CALL
EMBEDDED SYSTEMS	
Link & Locate ++	395 349
Link & Locate ++ Extended	479 395
Paradigm Locate	295 265
FORTAN LANGUAGE	
Grafmatic	135 119
Lahey F77L	595 535
Lahey Personal FORTRAN 77	99 89
MS FORTRAN	450 299
Plotmatic	135 119
RM/FORTRAN	595 499
WATCOM FORTRAN 77/386	1095 CALL
GRAPHICS LIBRARIES	
Baby Driver	250 199
Essential Graphics	399 319
Font-Tools	150 119
Font Window	125 109
Graph/Drive Plus Developer's	299 269
Graphic 5.0	395 319
Graphics-MENU	179 159
Data Entry	99 89
Data Entry w/ source	224 199
GSS Graphics Devel. Toolkit	595 509
HALO	395 279
HALO Window Toolkit	595 419
Icom-Tools/Plus	150 119
Menuet	325 279
MetaWindow	250 209
MetaWindow Plus	325 289
PCX Effects	99 89
PCX Programmer's Toolkit	195 175
PCX Text	149 135
Slate w/ graphics	448 415
Turbo Geometry Library	200 179

	LIST OURS
LINKERS/LIBRARIANS	
Plink86plus	495 395
Plink/LTO	695 619
PolyLibrarian II	149 135
.RTLink	295 265
.RTLink/Plus	495 419
OS/2 TOOLS	
Brief	199 CALL
CASE:PM for C	1495 1420
Epsilon	195 159
MS OS/2 Pres. Manager Softset	150 105
MS OS/2 Pres. Manager Toolkit	500 349
MultiScope for OS/2	449 345
PCYACC	695 625
Repository Explorer	995 895
Smalltalk/V PM	495 369
TopSpeed Modula-2 (OS/2)	495 449
Vitamin C (OS/2)	345 279
Zortech OS/2 Compiler Upgrade	150 129
PASCAL LANGUAGE	
Asynch PLUS	149 115
B-tree Filter	125 109
MS QuickPASCAL	99 69
Object Professional	150 109
Power Tools PLUS/5.0	149 109
Topaz	75 67
Turbo Analyst	99 89
TurboMAGIC	199 179
Turbo Pascal 5.5	150 105
Turbo Pascal 5.5 Professional	250 175
Turbo-Plus 5.5	199 159
Turbo Professional 5.0	125 109
SMALLTALK	
Smalltalk-80 (386)	595 535
Smalltalk/V	100 85
Smalltalk/V 286	200 169
Smalltalk/V PM	495 395
SOURCE MAINTENANCE	
MKS Make	149 119
MKS RCS	189 149
MKS Software Mgmt. Team	299 239
PolyMake	149 125
PVC's Professional	495 419
SMS	495 399
TLIB	139 109
5 Station LAN	419 339
WINDOWS (MS) TOOLS	
Actor 3.0	695 559
Asymetric Toolkit	395 CALL
Bridge Toolkit	695 559
Case-W	795 759
C-Talk/Views	450 375
dBFast/Windows	395 335
DialogCoder	499 435
MS Windows Development Kit	500 349
MultiScope for Windows	379 289
Object Graphics	395 319
ProtoView	695 625
RFFlow	79 69
Whitewater Resource Toolkit	195 169
WindowsMAKER	595 535
WinTrieve	395 339
WNXD GUI Toolkit	499 449

NEW RELEASES

GUIDO by South Mountain
 Graphical user interface library for C. Includes pull-down, pop-up, vertical and horizontal menus, windows, text and list boxes. Create high-level objects.
 List: \$249 Ours: \$199
 w/ source List: \$499 Ours: \$399

C Shroud by Gimpel
 Source code obfuscation tool. Translates a program from its original C source into an encoded format that can be compiled but not readily understood by humans. Distribute to a wide variety of computer equipment without risking your investment in proprietary software.
 List: \$198 Ours: \$149

MICROPORT UNIX
 Recently purchased by Abraxas. Microport products are again available including Microport System V/386, Release 3 multi-tasking, multi-user UNIX, and DOS Merge which allows two operating systems, DOS and UNIX to operate on one computer.
 - Call for pricing -

Guaranteed Best Prices! (800) 445-7899

FAXcetera

Want more product information on the items in the gold box to the right? Try **FAXcetera**!! Just pick up your FAX phone and dial **201-389-8173**. Enter the **FAXcetera** product code listed below each product description—information will be faxed back to you instantly!

XENIX/UNIX

	195	169
Epsilon	CALL	CALL
Interactive Products	1495	1199
LPI-COROL	995	799
LPI-FORTRAN	895	849
MetaWare High C	899	809
Microport Complete-286 (unltd.)	1198	1079
Microport Complete-386 (unltd.)	CALL	CALL
Microport - Other Products	395	335
MKS RCS	119	105
MKS Trilogy	1495	1195
SCO 286 Complete	1595	1275
SCO 386 Complete	CALL	CALL
SCO (All other products)	285	249
VEDIT PLUS		

ADDITIONAL PRODUCTS

API PLUS	695	549
Dan Bricklin's Demo II	199	159
IntegrAda	795	719
Ianus Ada/C Compiler System	360	319
Lattice RPG	1600	1285
Meridian AdaStudent	50	45
Meridian Ada Developer's Kit	1195	1095
MKS AWK	99	79
Personal Rexx	150	139

APPLICATION SOFTWARE

COMMUNICATIONS	
BLAST II	250 239
Carbon Copy Plus	199 129
Laplink III	150 99
PC Anywhere III	145 99
Procomm Plus	99 63
SideTalk	120 99

DESKTOP PUBLISHING

Adobe Products	CALL	CALL
Corel Draw!	595	399
Gem Desktop Publisher	299	169
HALO DPI	195	139
Lattice HighStyle	375	319
MKS SQPS	495	479
PageMaker	795	509
Ventura Publisher	895	549

MATHEMATICS

Derive	200	179
MathCAD	495	315
Mathematica 386	695	625

SCIENCE & ENGINEERING

AutoCAD Release 10	3000	CALL
AutoSketch	150	95
ChiWriter	150	129
CSS	495	469
DADISP	895	759
Design CAD 3-D	400	292
Drafix Windows CAD	695	CALL
EXACT	475	380

Our Guarantee...

Products listed here are backed by the following guarantee:

Should you see one of these products listed at a lower price in another ad in this magazine, **CALL US!** We'll beat the price, and *still* offer our same quality service and support.

Terms of Offer:

- Offer good through September 30, 1990
- Applicable to pricing on current versions of software listed; Sept. issue prices only.
- Offer does not apply towards obvious errors in competitors' ads.
- * Subject to same terms and conditions.

SCIENCE & ENGINEERING (continued)

Genenc ADD Level 3	350	289
LABTECH Acquire	195	179
LABTECH Notebook	995	779
MICRO-C AP III	1495	1269
Orcad PCB	1495	CALL
PC TEX	249	229
SCHEMA III	495	449
STATGRAPHICS	895	586
Systat	595	449
Tango PCB Series II	595	559
TECH*GRAPH*PAD	395	319
TJ	595	479

SPREADSHEETS

Lotus 1-2-3 Release 3.0	595	389
Microsoft Excel	495	319
Quattro Professional	495	329
SuperCalc 5	495	319

UTILITIES

386 MAX Professional	129	114
above DISC	119	64
Dr. Switch DeveloperPak	99	89
FASTBACK Plus	189	109
HeadRoom 2.0	130	109
Help Build	249	179
Hold Everything	199	159
MAACE 1990	149	129
Magellan	195	CALL
Memory Mate	70	47
MKS Toolkit	249	199
Move'em	89	79
Norton Commander	149	99
Norton Utilities	100	65
Norton Utilities Advanced	150	99
PC Tools Deluxe	149	95
Pizazz Plus	149	79
SitBack	99	90
Software Carousel	90	72
SpinRite II	89	75
XTreePro Gold	129	109

WORD PROCESSING

Ami	199	129
Microsoft Word for Windows	495	349
WordPerfect 5.1	495	CALL

SOFTWARE FOR SUN WORKSTATIONS

Basmark QuickBASIC	CALL	CALL
C Programmer's Toolbox/Sun	495	449
Edix	425	339
EMACS for Sun	395	369
Froft	CALL	CALL
Informix	CALL	CALL
Lotus 1-2-3 for Sun	695	CALL
Lotus 1-2-3 for Sun Server	995	CALL
Lotus 1-2-3 for Sun Node	495	CALL
Mathematica for Sun	CALL	CALL
MetaWare High C	895	849
NeuralWorks Professional II	4095	CALL
Panel Plus (Sun 3)	1595	1355
WordPerfect for Sun	495	CALL

Programmer's Policies

Phone Orders

Hours 8:30 AM-7 PM EST. We accept MC, Visa, AMEX. Domestic shipments, please add \$5 per item for shipping/handling by UPS ground. For domestic COD shipments, please add \$3. Rush service available.

Mail or FAX Orders

POs are welcome. Please include phone number.

International Service

Phone number required with order. Call or FAX for additional information.

Dealers and Corporate Accounts

Call for information.

Unbeatable Prices

We'll beat the competition's advertised prices. Prices subject to change without notice.

Return Policy

30 days. Due to copyright laws, we cannot take back software with the disk seal broken unless authorized by the manufacturer. Returned product must include R.A. number.

LIST OURS

Spontaneous Assembly

Spontaneous Assembly is a must-have product for the serious software developer. This assembly language library lets you produce the fastest, tightest possible programs with the same ease you'd expect from a high-level language. It includes an impressive collection of over 700 functions and macros for high-speed text windowing, heap management, array searching and sorting, critical error management, 32/64 bit integer math and much more! Comprehensive 750+ page manual. Full source code. No royalties. Easy integration with C. **"If you program in assembly language, you gotta have Spontaneous Assembly."** - Michael Abrash



base two
DEVELOPMENT

List: \$ 395 Ours: \$ 199 FAXcetera # 2614-0001

TLIB™ 5.0

TLIB™ 5.0 is the world's best Version Control System for source code, documentation and binary files. It has the sophisticated features you need at a price you can afford. It creates and maintains compact, annotated libraries containing all past and current versions of each file and a complete revision history including date, author, comments, etc., for each version. TLIB also has: check-in/out locking, manual & automatic branching, integration with Opus™ MAKE and Slick™ MAKE, and truly amazing speed.

List: \$ 139 Ours: \$ 109
FAXcetera # 1611-0001

Burton Systems Software

BRIEF 3.0 - The Programmer's Editor

Edit Your Programs More Productively Than Ever Before

Solution Systems

The program that set the standard for program editing continues to lead the industry. New BRIEF 3.0 features include: multiple keystroke macros, a new C-like macro language, a source level macro language debugger for both macro languages, "smart" indenting and template editing for Ada, C, Cobol, BASIC, FORTRAN, Modula-2, and Pascal, and the ability to "zoom" your current window to full screen size. You'll also get the features over 60,000 current users have come to rely on: unlimited windows, Undo, compile within BRIEF, a LISP-like macro language, and much more.



List: \$ 199 Ours: CALL FAXcetera # 1271-0001

ATTENTION CORPORATE CUSTOMERS, Call Your Corporate Hotline (800) 422-6507

- Select from over 4,500 titles—and we special order too!
- Get quick delivery at great prices on Microsoft, Borland, Lotus...etc. (We buy software directly from all the major publishers, and keep plenty of stock on hand.)
- Ask about volume purchase agreements, contracts, and personally assigned inside and outside sales representatives (CORSOFT Division).

International: 201-389-9228
Customer Service: 201-389-9229
Fax: 201-389-9227

Corporate: 800-422-6507
Canada: 800-445-7899
FAXcetera: 201-389-8173

Call or Write for Latest Free Catalog!

1-800-445-7899

Programmer's Paradise

A Division of Voyager Software Corp
1163 Shrewsbury Ave., Shrewsbury, NJ 07702



Graphically Programmed Motion Control on the Mac

National Instruments and nuLogic have teamed up to provide an environment for developing motion-control programs for the Mac without requiring you to write a single line of code.

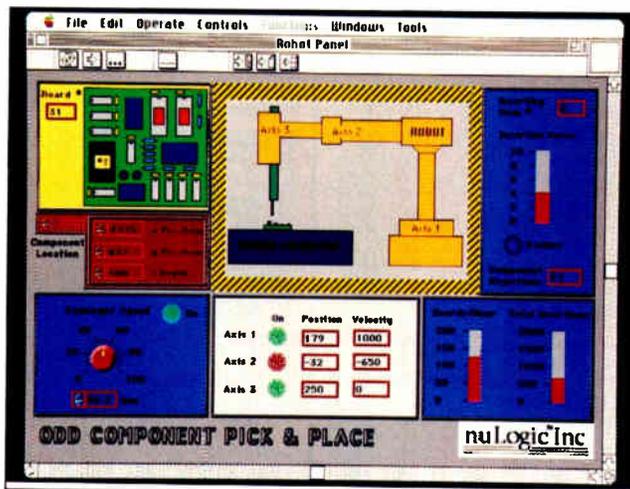
The system combines nuLogic's three-axis servo motion-control card for NuBus-based Macs and its interface for LabView 2, the graphical programming environment for data acquisition, analysis, and instrument control. With the system, you can program applications for robotics control, machines, and production automation systems by placing and connecting icons that represent controls such as knobs, slides, and switches.

The number of machines a system can control depends on how many slots your Mac has and how many axes must be controlled for each machine. With two controller cards, you can control three two-axis machines, for example.

You need a Mac II with LabView 2, the controller card, and the Virtual Instrument Library for Motion Control.

Price: LabView 2, \$1995; VI Library, \$195; nuControl controller card, \$1795.

Contact: nuLogic, Inc., 945 Great Plains Ave., Needham, MA 02192, (617) 444-7680. **Inquiry 1158.**



As LabView 2 controls a pick-and-place machine for odd-shaped components, it displays at right information on insertion force, number of boards completed per hour, and total insertions while letting you control the conveyor speed in the lower left window.

Solve Heat-Transfer Problems with Your PC or Mac

Whether your field of engineering is mechanical, electrical, chemical, or civil, you'll likely encounter a heat-transfer problem that requires several hours or days to solve. A program called Heat Transfer on TK can reduce the time it takes to solve such problems by a factor of 100, according to Universal Technical Systems.

The menu-driven program is based on, and ships with, the textbook *Fundamentals of Heat and Mass Transfer* and 200 heat-transfer models. Once you find the correct model and insert the real-life numbers, the program's equation solver returns the

solution.

The program is available for the IBM PC, the Macintosh, and Sun, IBM, Hewlett-Packard, and Apollo Unix workstations. TK Solver Plus is required.

Price: Heat Transfer on TK, \$595; TK Solver Plus, \$395.

Contact: Universal Technical Systems, Inc., 1220 Rock St., Rockford, IL 61101, (800) 435-7887 or (815) 963-2220.

Inquiry 1159.

Analyze and Manipulate Signals on the Mac

BV Engineering's Signal Processing Program (SPP) can perform linear and nonlinear time-domain waveform analysis, forward and

reverse fast Fourier transforms, and other analyses on analog signals. It can graphically display signals, spectra, and transfer function data, and it can generate and simulate analog signals.

SPP runs on the Mac 512KE or higher with Finder 5.3 and System 3.2 or higher.

Price: \$349.95.

Contact: BV Engineering, 2023 Chicago Ave., Suite B13, Riverside, CA 92507, (714) 781-0252.

Inquiry 1160.

Acquire Data While You Do Something Else

Trilobyte has released a product for engineers and scientists who need to acquire data from lengthy experiments but don't want to tie up their PCs.

Data Demon lets you receive data from instruments while you perform other tasks. The program can hold up to 32K bytes of received data in one buffer.

A memory-resident portion of the program performs the actual data collection, while another portion downloads the information.

Price: \$99.

Contact: Trilobyte, Inc., 596 Abolicon, Hato Rey, Puerto Rico 00918, (809) 758-0341 or (809) 767-1839.

Inquiry 1161.

continued

Find the Hidden Information with IXL

IntelligenceWare says that its IXL program for induction in extremely large databases can find unexpected patterns and correlations in large data sets. Unlike a query language, which requires you to formulate and test a hypothesis, IXL

forms its own queries and automatically tests for them.

By combining AI, statistics, and database capabilities, the program saves you from having to test numerous hypotheses when you're trying to pinpoint the reasons for problems like sporadic

defects on an assembly line. The program has uses in any application involving large data sets.

The program supports up to 64,000 columns per database and runs on the IBM AT or higher. The program is compatible with dBASE,

Lotus 1-2-3, XDB, and Interbase file formats.

Price: \$490.

Contact: IntelligenceWare, Inc., 9800 South Sepulveda Blvd., Suite 730, Los Angeles, CA 90045, (213) 417-8896.

Inquiry 1162.

We've got a new 2MB W.O.R.M.

Now we're fishing for ideas from you.



Introducing the Optical Card, the remarkable new personal data storage and retrieval medium from Canon. An IBM AT-compatible RW-10 Reader/Writer uses a laser to read and write up to two Megabytes of digitized text, graphics or sound on the Optical Card (shown here actual size). Data can be added, but not erased, and isn't susceptible to magnetic or electrostatic fields.

The Optical Card and RW-10 combine speed, high reliability and convenience that just cry out for the development of entirely new systems applications. And that's where you come in.

Don't let this "big one" get away. Find out more about the Optical Card by calling Bruno Dosso at Canon at 516-488-6700.

© 1990 Canon U.S.A., Inc., One Canon Plaza, Lake Success, NY 11042

Canon

Circle 57 on Reader Service Card

NRI's new at-home training gives you the computer, the software, and the hands-on skills to start a high-paying career as a computer programmer

Now NRI gives you hands-on experience in computer programming with a powerful IBM XT-compatible computer system and software you keep. One easy step at a time, you build full-featured, powerful programs in BASIC, Pascal, C, and COBOL—today's hottest computer languages. One easy step at a time, you train to be a high-paid computer programmer!

Your NRI training includes a computer, modem, and invaluable programming software you keep

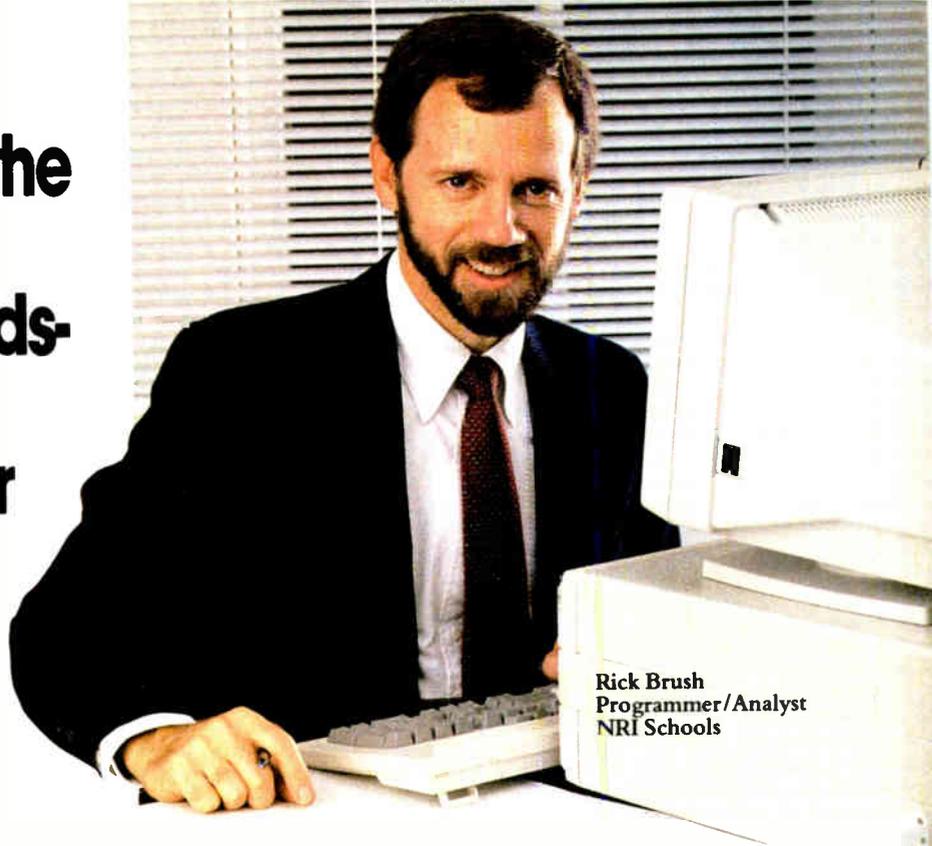
Unlike any other course, NRI's at-home training in Computer Programming gives you hands-on experience with a powerful, IBM XT-compatible West Coast 800 ES computer system, including 2400 baud internal modem, 640K RAM, disk drive, and invaluable programming software—BASIC, Pascal, C, and COBOL—all yours to keep.

With NRI, you get the skills and the confidence, the computer and the software to build real-world, working programs for a wide variety of business, personal, and professional applications . . . in all, everything you need to step into today's top computer programming jobs.

No previous experience necessary

No matter what your background, NRI ensures you get the know-how you need to take full advantage of every exciting opportunity in computer programming today.

With your experienced NRI instructor always available to help, you quickly cover the fundamentals, then



Rick Brush
Programmer/Analyst
NRI Schools

move on to master all four of today's key computer languages—BASIC, Pascal, C, and COBOL—step by easy step. Before you know it, you have what it takes to handle any programming problem you're likely to encounter in your professional career.

Now, as never before, you can succeed as a computer programmer

The best news comes from the Bureau of Labor Statistics: As a programmer trained in a variety of computer languages you

can land the programming position of your choice—even make it on your own as an independent programmer. There's no doubt about it—with NRI's complete, at-home, four-language training in Computer Programming, you can write your own ticket to success in this high-paying, top-growth computer career field!

See other side for highlights of your NRI hands-on training in BASIC, Pascal, C, and COBOL →

SEND CARD TODAY FOR FREE NRI CATALOG



Your NRI training in computer programming includes an IBM XT-compatible West Coast 800 ES computer with internal modem, 640K RAM, disk drive, monitor, and programming software—BASIC, Pascal, C, and COBOL—all yours to keep!

YES! Please rush me my FREE catalog describing NRI's at-home training in Computer Programming.

- | | |
|--|--|
| <input type="checkbox"/> Computer Programming | <input type="checkbox"/> Bookkeeping and Accounting |
| <input type="checkbox"/> Computers and Microprocessors | <input type="checkbox"/> Travel Careers |
| <input type="checkbox"/> TV/Video/Audio Servicing | <input type="checkbox"/> Paralegal |
| <input type="checkbox"/> Telecommunications | <input type="checkbox"/> Writing |
| <input type="checkbox"/> Robotics | <input type="checkbox"/> Desktop Publishing and Design |
| <input type="checkbox"/> Basic Electronics | <input type="checkbox"/> Word Processing |

Name (Please print) Age

Address (No P.O. Box numbers please)

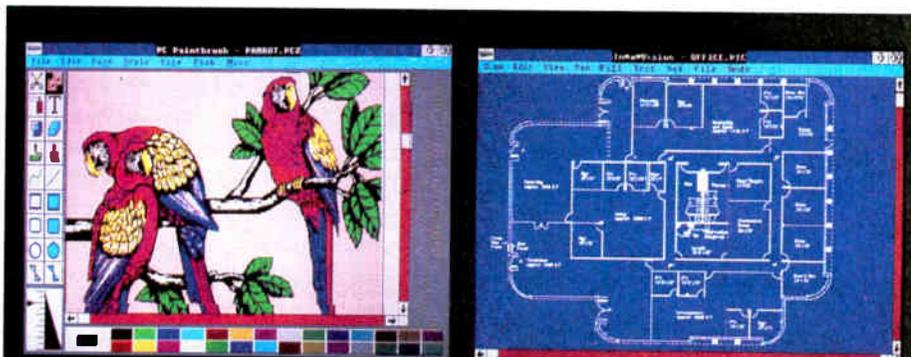
City State Zip

For career courses approved under GI Bill check for details

Accredited Member National Home Study Council

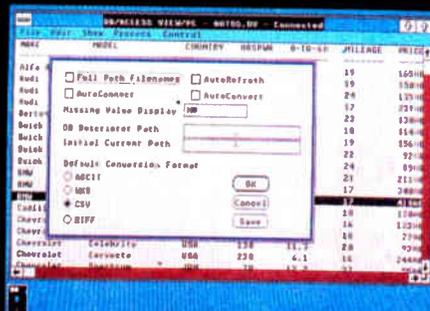
5401-090

Now, with NRI, you can learn to program in today's hottest computer languages— BASIC, Pascal, C, and COBOL

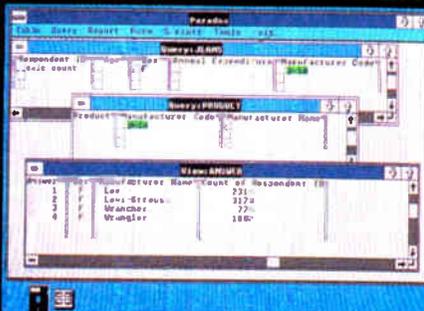


You start with BASIC, an extremely popular language used for graphics, teaching, personal, and small business applications.

Next, you master Pascal, a multipurpose language often used to develop software for computer-aided design (CAD).



You move on to C—hands down, today's hottest computer language—used for everything from systems programming to artificial intelligence.



You wrap up your training in programming with COBOL, the language of business and the most widely used computer language in the world.

NRI's new at-home training in Computer Programming starts by walking you step by step through the fundamentals, easing you into programming with brilliantly detailed instructions, charts, and diagrams.

In no time at all, you have a complete understanding of the programming techniques used every day by successful micro and main-frame programmers. And then the fun really begins.

With your personal NRI instructor on call and ready to help, you use the computer system included in your training to actually design, code, run, debug, and document programs in BASIC, Pascal, C, and COBOL. Then, following easy-to-read instructions, you use your modem—also included—to "talk" to your instructor, meet other NRI students, even download programs through NRI's exclusive programmers network, PRONET.

Send for your FREE catalog today

For all the details about NRI's at-home training in Computer Programming, send the postage-paid reply card today. Soon you'll receive NRI's fascinating, information-packed, full-color catalog.

Open it up and you'll find vivid descriptions of every aspect of NRI training. You'll see the IBM XT-compatible computer included in your course up close in a special, poster-sized foldout section. And, best of all, you'll find out how your NRI training will make it easy for you to build a high-paying career—even a business of your own—in computer programming.

If the card is missing, write to NRI at the address below.

IBM is a registered trademark of the IBM Corporation

NRI
School of Computer Programming

McGraw-Hill Continuing Education Center
4401 Connecticut Avenue
Washington, DC 20008

SEND CARD TODAY FOR FREE NRI CATALOG



BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 10008 WASHINGTON, D.C.

POSTAGE WILL BE PAID BY ADDRESSEE

NRI SCHOOLS

McGraw-Hill Continuing Education Center
4401 Connecticut Avenue NW
Washington, D.C. 20077-3543

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



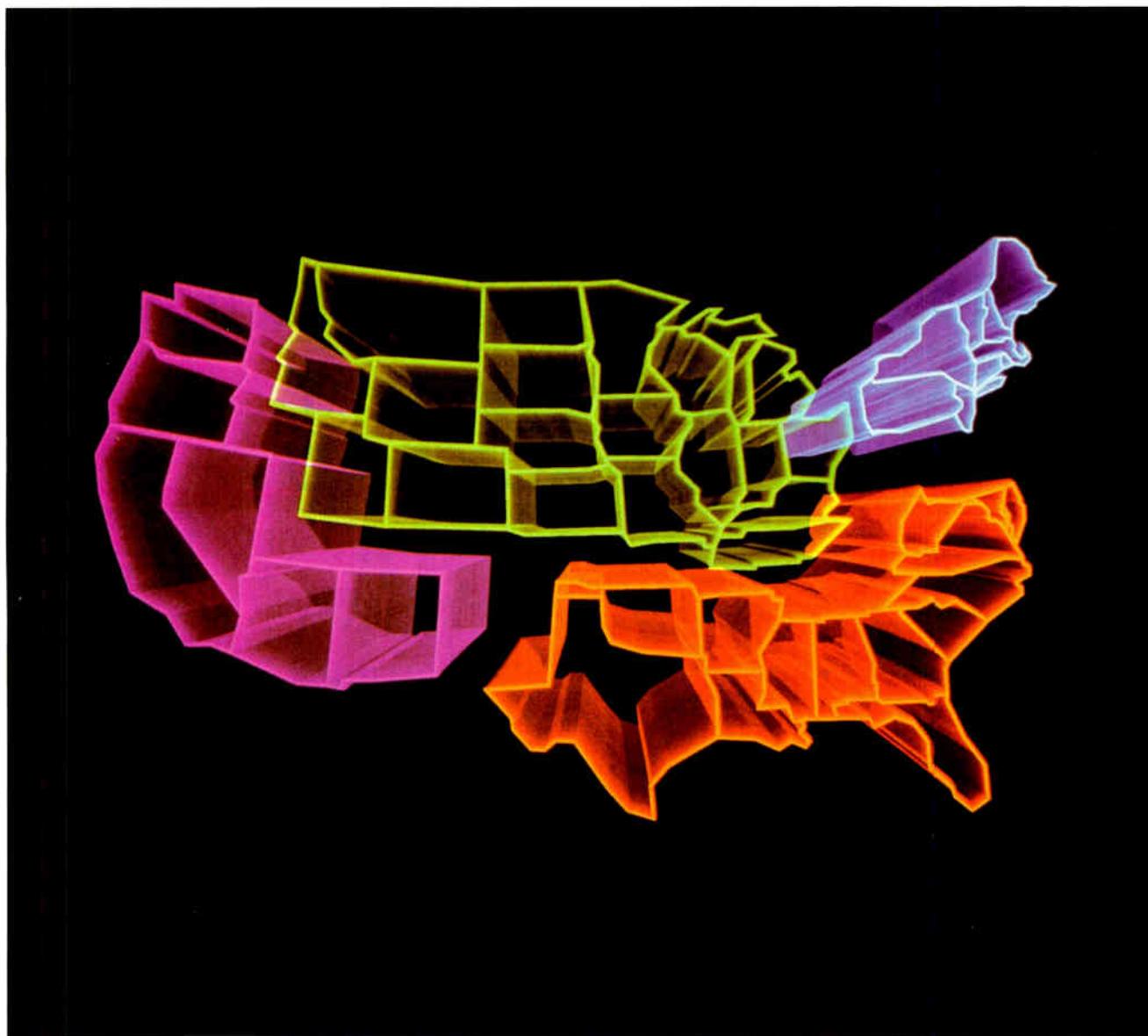
World Radio History



BYTE

REGIONAL

NORTHEAST



WHAT'S NEW

METRO NEW YORK • NEW ENGLAND

Users Groups Past, Present, and Future

Well, what do I do now?" This question has been asked countless times as new PC users stare at the just-unwrapped collection of parts that they must assemble into a working computer. From the beginning of the PC revolution, the answer has often been, "Join a users group."

What began as an assembly of users trying to learn more about the new machines is now a social institution. From the beginning, users groups have provided technical support to novices and expert users, beta testers for new products, feedback to hardware and software vendors on their new products, and much more.

The first issue of *BYTE* dedicated two pages to users group news, including a notice that the Amateur Computer Group of New Jersey had held its first meeting on June 13, 1975. That group continues to operate to this day and is often associated with the Trenton Computer Festival. For our 15th anniversary issue, *BYTE* asked several users group officers across the U.S. to reflect on the status of users groups and their challenges in the future.

Playing Mom to 700 People

With the responsibility of coordinating more than 50 users groups and 700 volunteers of the Boston Computer Society, Pam Bybell says that her job is "sort of like Mom, with lots

of children screaming at once."

As manager of users group support for the BCS, which currently boasts a membership of about 40,000, Bybell helps volunteers refine their ideas and find the necessary resources for putting their ideas into action.

Bybell says that the BCS struggles to some degree with the same problems facing smaller groups and offers several strategies to deal with common problems, particularly volunteer burnout.

"One thing we try to get across to a group is that you have to have a deep bench," she says. Often, a person who starts a users group or special-interest group is by nature creative, exciting, and driven. At first, this person may think nothing of orga-

nizing meetings, putting out a newsletter, and running the group mailing list. Several months into the job, however, you've got a prime candidate for burnout. That's why delegating tasks, though difficult, is so important, she says.

"If you learn nothing else as a volunteer, you better learn to delegate," Bybell stresses. She often cites the Truck Theory to drive this point home. The Truck Theory says that if a volunteer were hit by a truck and died, and the group too would die, then that person is doing too much. She also says that if an activity isn't fun, you shouldn't be doing it, and notes that group members are quick to recognize trouble and political infighting.

As for the challenges for

continued

We do one thing, and we do it well.



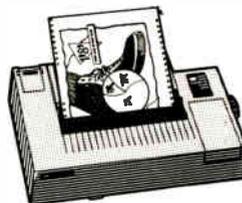
HEWLETT PACKARD



HP Vectra 486 PC



HP LaserJet III Printer



HP PaintJet



HP Vectra 386/25

Some computer dealers try to be all things to all people. Not Deerfield Data Systems. Since 1981, we have provided high-quality Hewlett-Packard computer equipment to the entire New England region. We carry the full line of HP PCs and peripherals, including the LaserJet family of printers. Our knowledgeable sales staff can support you long after your purchase. Deerfield Data Systems is a HP Authorized Service Center for all Vectra PCs, LaserJets, DeskJets, PaintJets and desktop plotters. We perform warranty repairs and offer a variety of service contract options. Call for more information!

**Deerfield
Data
Systems**
INC.
"New England's HP Specialists Since 1981"

**hp HEWLETT
PACKARD**
Authorized Sales
& Service Center

Toll Free: (800) 444-5049
Western Mass. (413) 665-3742
■ Sunderland, MA ■ Hartford, CT

WHY GET A HOLE IN ONE?



WHEN YOU CAN HAVE A WHOLE IN ONE?

The computer industry never stands still. And if you want to stay on top, neither can you.

But now you can stop chasing from one show to another to find the products and information you need to keep up.

**INFO '90.
THE ONLY
INFORMATION
RESOURCE YOU'LL
NEED.**

INFO '90 is the only exhibition and conference that brings you face to face with all the computer products you need to see.

With everything you have to know about. From the latest in PC and large system products, to what's hot in connectivity and networks, to the software and integrated systems making headlines every day.

**SEE THE PRODUCTS.
GET THE KNOWLEDGE.**

At INFO '90, you won't just see everything you

need, you'll also learn how to make it work, and work together.



Keynote Speaker, Bill Machrone, Editor-in-Chief and Publishing Director of PC Magazine, kicks off the strongest PC and connectivity conference ever to hit New York. The keynote address is open to all show attendees.

- Connectivity
- Networking
- Interoperability
- MCA vs. EISA
- OS/2 vs. UNIX
- Windows vs. Mac

They're all part of the strongest computer conference ever to hit New York. If you plan to succeed through the '90s, plan now to be at INFO.

INFO '90. It's timely. It's topical. It's the only show of its kind. And definitely the most important event you'll go to all year long.

**FREE ADMISSION — BE OUR
GUEST AT INFO '90.**

Call right now to register, or bring this ad to the show registration booth and you and your computer buyers will get the following:

- Free admission worth \$25 each.
- Plus free shuttle service throughout Manhattan, sponsored by BusinessWeek.
- Free admission to Imaging '90, held concurrently with INFO '90.

Don't miss out on your one chance to see it all, and learn it all, at a single spectacular event. Register by calling today.

Photocopy for additional registrations



For registration and
conference information call

800-255-7798

In CT call (203) 964-8287

XD

SEPTEMBER 1990 • B Y T E 64NE-3

the BCS and other groups in the next few years, she cites a few. One is that groups must serve an expanding range of users, from novice to corporate member. Another is reconciling the role of the group to the corporate environment. Many times, she says, corporate members "tend not to understand that a volunteer can't be called at work" for technical support.

One improvement Bybell sees is in the area of support provided by hardware and software vendors. Here, she says, "things are light-years better" than in earlier days.

Like other groups, the BCS is also becoming involved in community service to non-members, matching mentors to other nonprofit organizations, acquiring used equipment for the organizations,

and, in some cases, donating time to get the machines up and running.

So what makes the BCS so successful? According to Bybell, the secret is "letting volunteers do the things they want."

Computing Down East

Rowan Wakefield remembers the first computer fair sponsored by the Island/Reach Computer Users Group and how surprised participating vendors were by the early-morning rush of people. By 8:15 a.m., he says, the hall was packed "shoulder to shoulder with people. Around here, people just get started early." The fair, which attracted about 30 exhibitors and 800 people, was going strong until a blizzard hit around

4:30 p.m., sending people home.

The "here" that Wakefield refers to is the area near Bangor, Maine, where group members live in towns such as Deer Isle, Blue Hill, and Bar Harbor. In three years, the group has increased its membership from 30 to more than 300. Wakefield, president of the club, says the occupations of members range from "lobstermen to retired newspaper editors . . . to teachers and writers."

Wakefield saw the need for a multiplatform group when he attended an Epson users group meeting and only one other person showed up. He and two others envisioned a generic users group in a rural area that could provide useful services. About 30 people showed up for the first meet-

ing, and the group was on its way.

Wakefield says that one way the group fights burnout is to contract out the production of its newsletter to a prepress production house. Members write the stories, which are transmitted to the editor via the Celebration Station BBS, a popular BBS run by Noel Stookey, of Peter, Paul, and Mary fame. However, burnout is still an issue: Wakefield says he will not seek reelection for the next term.

As the group matures, Wakefield sees the emphasis shifting from growth to providing more services for current members. The group plans to sell a book called *50 Ways to Make Money With Your PC*, which is based on one of the group's most suc-

continued

HOW TO FREEZE YOUR COMPUTER AND NEVER BE LEFT OUT IN THE COLD

Install a POWERCARD IPS

It's as simple as that. Powercard IPS is an internal back-up power system for PC or compatible computers that will let you stop your work and preserve it in a suspended state until you are ready to go back to it. (That's why we like to think of it as "freezing.")

Nothing is lost. Everything saved.

Powercard IPS eliminates memory loss and the nightmare of power outages. Through its strong 180W output capacity Powercard IPS automatically initiates an orderly save of everything in the computer environment whenever power is out; in much less time than the closest similar product. Then it shuts itself off.

Powercard IPS does not use your operating system or memory, making it completely transparent. So, how about it? Aren't you interested in POWERCARD's "cold storage." The price won't freeze you out either. Call or write for more information.

1 (800) 637-2797

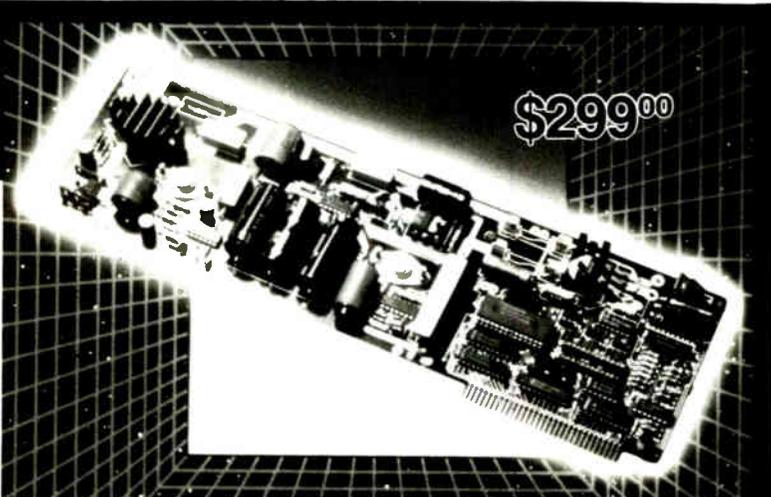
See us at

COMDEX/Fall '90

November 12-16, 1990 Las Vegas, Nevada

© 1990 Powercard Supply Patents Pending

Distributor inquiries welcomed.



12231 S.W. 129 Ct., Miami, Florida 33186

Name _____
 Address _____
 State _____ Zip _____
 Telephone _____

B9/90

Now You Don't Have To Be An Egghead To Understand UNIX® And Open Systems.

If you're a business or technical manager, senior executive, power user or reseller, finally there's a UNIX/open systems trade show just for you.

UNIX SOLUTIONS was developed to provide the practical knowledge and useful information you need to better understand the power and flexibility of a corporate open computing environment operating under UNIX.

Come see all the latest business applications as well as those currently under development. Evaluate the hardware, networking equipment, peripherals and services that can get your company up and running.

Come learn from a truly unique conference program. The 40-session

agenda has been expressly designed to de-mystify open systems computing. Discover how and why you should implement a system of your own. Hear consultants, corporate end-users and resellers discuss their first-hand experiences building cost-effective corporate systems.

Come to UNIX SOLUTIONS. Where you don't have to be an egghead to appreciate the benefits of UNIX and open systems.

Don't pass up this valuable, once-a-year opportunity. To receive your free information package, return the coupon. For immediate action, call (617) 449-6600; fax (617) 449-6953; or telex 174273.

I need answers.

Tell me more about UNIX SOLUTIONS in Anaheim, October 3-5, 1990.

Send me information about:

- Attending the conference.
- Attending the exhibit floor.
- Exhibiting.

Name _____

Title _____

Company _____

Address _____

City _____

State _____ Zip/Postal Code _____

Country _____

Phone (____) _____

Fax (____) _____

Best time to call _____

Mail to: UNIX SOLUTIONS, Direct Marketing Services, BM 9/90
300 First Ave., Needham, MA 02194 USA

UNIX
SOLUTIONS
EXPOSITION AND CONFERENCESM

Introducing The Open Systems Trade Show Where UNIX Gets Down To Business.

October 3-5, 1990 • Anaheim Convention Center • Anaheim, CA

Circle 1342 on Reader Service Card

©1990 • The Interface Group • 300 First Avenue, Needham, MA 02194 USA • UNIX is a registered trademark of AT&T.





Microcom Computers

A HRW Technologies Company



Custom Configuration Computer Systems

Standard System Features:

- * Teac 5.25" 1.2 MB or 3.5" 1.44 MB Diskette Drive
- * 1:1 Interleaved Hard/Floppy Drive Controller
- * Enhanced 101-key Keyboard w/Tactile Click Feedback
- * 2 Serial, 1 Parallel & 1 Game Port
- * High Capacity 200 Watt System Power Supply
- * Real Time Clock/Calendar with Battery
- * Small Footprint Case (14.875" W x 16.25" D x 6.75" H) (Optional Cases Available)

Options/Upgrades:

- Mini-size Desktop Tower Case Add \$50
- Full-size Tower Case Add \$150
- 2 MB RAM (Upgrade from 1 MB) Add \$125
- 4 MB RAM (Upgrade from 1 MB) Add \$350
- Second 5.25" 1.2 MB or 3.5" 1.44 MB Diskette Drive \$85
- Microsoft Mouse with Windows 3.0 \$189
- Internal 2400 Baud Modem \$99
- DOS 3.30 or 4.01 \$69

Pre-Configured Computer Systems

Our Commitment to Service

- * Free 4 Month On-Site Servicing Nationwide
- * 1 Year Warranty on Parts & Labor
- * Toll-free Technical Service & Support
- * No Surcharge on Credit Card Purchases
- * Comprehensive 72 Hour Burn-in Testing on All Systems
- * All Systems Made with pride in the USA
- * Guaranteed 100% IBM Compatible
- * Best Quality at an Affordable Price

286/12 Standard System \$499

- * Standard System Features plus:
- * 80286 Processor running at 12 MHz
- * 512 KB RAM Standard (Expandable to 8 MB RAM)
- * 0 Wait State Performance for 16 MHz Effective Throughput
- * Landmark = 16.0 MHz - Norton SI = 15.4x
- * AMI BIOS with MS-DOS, Novell & Windows Support
- * for 1 MB RAM, add \$50

MICROCOM 286/12

286/12 System Features, Hard Drive, Monitor & Video Card

Hard Drives:	20/40	42/28	65/28	80/18	105/18
MB/Ms					
No Video	\$749	\$849	\$949	\$1,149	\$1,249
Mono	\$874	\$974	\$1,074	\$1,274	\$1,374
VGA-Mono	\$1,049	\$1,149	\$1,249	\$1,449	\$1,549
SVGA	\$1,299	\$1,399	\$1,499	\$1,699	\$1,799
Hires	\$1,399	\$1,499	\$1,599	\$1,799	\$1,899

286/12 Super VGA System \$1,499

- * 286/12 Standard System with 1 MB RAM
- * 42 MB Hard Disk w /Quick 28 ms Access Time
- * Second 5.25" 1.2 MB or 3.5" 1.44 MB Diskette Drive
- * High Performance 16-bit 512K VGA Graphics Card w /1024 x 768 Capability
- * 14" Color Super VGA Monitor with 800 x 600 Resolution and 0.31 dot pitch
- * DOS 3.30 or 4.01 Included

386SX/16 Standard System \$699

Standard System Features plus:

- * Intel 80386SX Processor running at 16 MHz
- * 1 MB RAM Standard (Expandable to 8 MB RAM)
- * 0 Wait State Performance for 21 MHz Effective Throughput
- * Landmark = 21.0 MHz - Norton SI = 18.4x
- * AMI BIOS with MS-DOS, OS/2, XENIX, UNIX, Novell, Windows & 386-Specific Software Support

MICROCOM 386SX/16

386SX/16 System Features, Hard Drive, Monitor & Video Card

Hard Drives:	42/28	65/28	80/18	105/18	205/18
MB/Ms					
No Video	\$1,049	\$1,149	\$1,349	\$1,449	\$1,799
Mono	\$1,174	\$1,274	\$1,474	\$1,574	\$1,924
VGA-Mono	\$1,349	\$1,449	\$1,649	\$1,749	\$2,099
SVGA	\$1,599	\$1,699	\$1,899	\$1,999	\$2,349
Hires	\$1,699	\$1,799	\$1,999	\$2,099	\$2,449

386SX/16 Super VGA System \$1,699

- * 386SX/16 Standard System
- * 42 MB Hard Disk w /Quick 28 ms Access Time
- * Second 5.25" 1.2 MB or 3.5" 1.44 MB Diskette Drive
- * High Performance 16-bit 512K VGA Graphics Card w /1024 x 768 Capability
- * 14" Color Super VGA Monitor with 800 x 600 Resolution and 0.31 dot pitch
- * DOS 3.30 or 4.01 Included

386/25 Standard System \$1,199

Standard System Features plus:

- * Intel 80386DX Processor running at 25 MHz
- * 1 MB RAM Standard (Expandable to 8 MB RAM)
- * 0 Wait State Performance for 34 MHz Effective Throughput
- * Landmark = 34.5 MHz - Norton SI = 29.7x
- * AMI BIOS with MS-DOS, OS/2, XENIX, UNIX, Novell, Windows & 386-Specific Software Support
- * for 64 KB Cache, add \$300
- * Landmark = 45.9 MHz - Norton SI = 39.6x

MICROCOM 386/25

386/25 System Features, Hard Drive, Monitor & Video Card

Hard Drives:	42/28	65/28	80/18	105/18	205/18
MB/Ms					
No Video	\$1,549	\$1,649	\$1,849	\$1,949	\$2,299
Mono	\$1,674	\$1,774	\$1,974	\$2,074	\$2,424
VGA-Mono	\$1,849	\$1,949	\$2,149	\$2,249	\$2,599
SVGA	\$2,099	\$2,199	\$2,399	\$2,499	\$2,849
Hires	\$2,199	\$2,299	\$2,499	\$2,599	\$2,949

386/25 Super VGA System \$2,199

- * 386/25 Standard System
- * 42 MB Hard Disk w /Quick 28 ms Access Time
- * Second 5.25" 1.2 MB or 3.5" 1.44 MB Diskette Drive
- * High Performance 16-bit 512K VGA Graphics Card w /1024 x 768 Capability
- * 14" Color Super VGA Monitor with 800 x 600 Resolution and 0.31 dot pitch
- * DOS 3.30 or 4.01 Included

386/33C Standard System \$1,699

Standard System Features plus:

- * Intel 80386DX Processor running at 33 MHz
- * 1 MB RAM Standard (Expandable to 8 MB RAM)
- * 64 KB Static RAM Cache for Increased Performance
- * 7 Million Instructions Per Second (MIPS) Operation
- * Landmark = 56.0 MHz - Norton SI = 45.9x
- * AMI BIOS with MS-DOS, OS/2, XENIX, UNIX, Novell, Windows & 386-Specific Software Support

MICROCOM 386/33C

386/33C System Features, Hard Drive, Monitor & Video Card

Hard Drives:	42/28	65/28	80/18	105/18	205/18
MB/Ms					
No Video	\$2,049	\$2,149	\$2,349	\$2,449	\$2,799
Mono	\$2,174	\$2,274	\$2,474	\$2,574	\$2,924
VGA-Mono	\$2,349	\$2,449	\$2,649	\$2,749	\$3,099
SVGA	\$2,599	\$2,699	\$2,899	\$2,999	\$3,349
Hires	\$2,699	\$2,799	\$2,999	\$3,099	\$3,449

386/33C Hires System \$2,999

- * 386/33C Standard System
- * 105 MB Hard Disk w /Quick 18 ms Access Time
- * Second 5.25" 1.2 MB or 3.5" 1.44 MB Diskette Drive
- * High Performance 16-bit 512K VGA Graphics Card w /1024 x 768 Capability
- * 14" Color Hi-Res VGA Monitor with 1024 x 768 Resolution and 0.28 dot pitch
- * DOS 3.30 or 4.01 Included

486/25C Standard System \$4,299

Standard System Features plus:

- * Intel 80486 Processor running at 25 MHz
- * 4 MB RAM Standard (Expandable to 8 MB RAM)
- * 64 KB Static RAM Cache for Increased Performance
- * Over 11 Million Instructions Per Second (MIPS) Operation
- * Landmark = 117.0 MHz
- * AMI BIOS with MS-DOS, OS/2, XENIX, UNIX, Novell, Windows & 386-Specific Software Support

MICROCOM 486/25C

486/25C System Features, Hard Drive, Monitor & Video Card

Hard Drives:	80/18	105/18	205/18	340/18	650/16
MB/Ms					
No Video	\$4,949	\$5,049	\$5,399	\$6,099	\$7,099
Mono	\$5,074	\$5,174	\$5,524	\$6,224	\$7,224
VGA-Mono	\$5,249	\$5,349	\$5,699	\$6,399	\$7,399
SVGA	\$5,499	\$5,599	\$5,949	\$6,649	\$7,649
Hires	\$5,599	\$5,699	\$6,049	\$6,749	\$7,749

486/25C Hires System \$5,999

- * 486/25C Standard System
- * 205 MB Hard Disk w /Quick 18 ms Access Time
- * Second 5.25" 1.2 MB or 3.5" 1.44 MB Diskette Drive
- * High Performance 16-bit 512K VGA Graphics Card w /1024 x 768 Capability
- * 14" Color Hi-Res VGA Monitor with 1024 x 768 Resolution and 0.28 dot pitch
- * DOS 3.30 or 4.01 Included

Microcom Computers' Customers Include: Xerox, GTE, Motorola, Raychem, General Electric, Eastman Kodak, SEGA of America, Toshiba, Genetech, Holiday Inn, U.S. Court of Appeals, U.S. Food & Drug Administration, U.S. Department of Energy, U.S. Department of Agriculture, Lawrence Livermore National Laboratory, U.C. Berkeley, U.C. San Francisco and many, many more

To Order - Call Toll Free 1-800-248-3398

Open from 9:00 A.M. to 6:00 P.M. PST, Monday-Friday

Microcom Computers

48890 Milmont Drive, Fremont, CA 94537 - Tel: (415)623-3628 - Fax: (415)623-3620

3650-18th Street, San Francisco, CA 94110 - Tel: (415)255-2288 - Fax: (415) 255-8873



Prices are subject to change without notice. Not responsible for typographical errors. CA residents please add 7.25% sales tax. No surcharge on credit card purchases. Personal and company checks require 2 weeks clearance. All trademarks acknowledged. Tower is a registered trademark of NCR Corporation. Microcom Computers reserves the right to substitute any and all items with equivalent or better parts. All benchmarks and specifications are for your information only and may vary from system to system. Prices do not include shipping and handling.

Call for Outstanding Pricing on Tailored Computer Systems

ALWAYS AT A DISCOUNT

MOTHERBOARDS • AT • 286 • 386 • 486

XT 8mb Turbo, 0k, 640k Max, 8 Slots, w/BIOS & CPU	67
XT 8mb Turbo, 0k, 640k Max, 8 Slots, w/BIOS & CPU	70
XT 10mb Turbo, 0k, 640k Max, 8 Slots, w/BIOS & CPU	74

OUR BEST SELLING VL12mb MOTHERBOARD

12mb 286, 0k, to 4mb, 8 Slots, AMI BIOS, Baby Size	139
--	-----

AT 286 12, Baby Sz, 0k, 0k to 4mb, NEAT CHIP, FEEMS, Shad	238
AT 286 12, Baby Sz, 0k, 0k to 4mb, NEAT CHIP, FEEMS, Shad	245
AT 286 12, Baby Sz, 0k, 0k to 8mb, NEAT CHIP, FEEMS, Shad	269
AT 286 12, Baby Sz, 0k, 0k to 8mb, NEAT CHIP, FEEMS, Shad	309
AT 386 16x, Baby Sz, 0k, 0k to 16mb, NEAT CHIP, FEEMS, Shad	365
AT 386 20/25, Baby Sz, 0k, 0k to 16mb, 8 Slots, AMI BIOS	699/809
AT 386 25/33, 32k Cache, Baby Sz, 0k, 0k to 16mb, 8 Slots, AMI BIOS	1139/1375

THE FASTEST PC MOTHERBOARDS IN THE WORLD

AT 486 25, Full Sz, 0k, 0k to 16mb, 8 Slots, Opt 128k Ext Cache, or AT 486 25, Baby Sz, 0k, 0k to 16mb on Memory Card	3595
---	------

CONTROLLERS

FDC-2 360K / 720K, XT Only	13
LONGSHINE FDC, 360K/720K / 2mb / 1.44mb, XT/AT	31

SUPER I/O, Control 4 Internal Drives, XT/AT, All Drive Types

COMPACT I/O, 4 Drives, 360K/720K / 2mb / 1.44mb	94
COMPACT I/O II, Coolest Chk 7 Drives, All Types	75
COMPACT I/O IV, 4 Drives, All Types, Coolest or Stand Alone, Boot From Any Drive, Easy Installation	112
LONGSHINE 6210D, Chk 2 Hard Drives, MFM, XT Only	43
WESTERN DIGITAL XT-GEN, Chk 2 Hard Drives, MFM, XT	53
WESTERN DIGITAL 27K, Chk 2 Hard Drives, RLL, XT	61
WESTERN DIGITAL 1003-AM2, 2HD/2HD, 2.1 MFM, AT	102
WESTERN DIGITAL 1003-AM2, 2HD/2HD, 2.1 MFM, AT	116
WESTERN DIGITAL 1003-SR2, 2HD/2HD, 2.1 RLL, AT	142
LONGSHINE 6220, 2HD/2HD, XT ONLY	129
LONGSHINE 6220, 2HD/2HD, XT ONLY	79
LONGSHINE 6220, 2HD/2HD, 1.1 MFM, AT	85
WA-6, 2HD/2HD, 2.1 MFM, AT	77
WA-16, 2HD/2HD, 1.1 MFM, AT	99
DK 2780, 2HD/2HD, 1.1 MFM, AT	131
DK 2787, 2HD/2HD, 1.1 RLL, AT	130
ASM 1100-SM4, 4HD/2HD, 1.1 MFM	91
ASM 1100-SR4, 4HD/2HD, 1.1 RLL	116

HIGH PERFORMANCE CONTROLLERS

SPECTRUM ARLL Controller, Increases Drive Capacity by 90%	269
Prestar PS180-161, 2HD/2HD, 1.6 Bt	269
TENTIME Intelligent Caching Floppy/Hard Disk Controller, Sims Access Time, Increases Throughput, Increase Disk Life, Disk Mirroring Option, MFM, RLL & ESDI Models Available	CALL FOR PRICING

POWER SUPPLIES

150w XT, Standard Size For PC/XT Systems	38
150w XT, UI Approved	45
200w XT, Standard Physical Size For PC/XT	48
200w XT, UI Approved	52
220w AT, Standard Physical Size For IBM AT	62
220w AT, UI Approved	69
220w AT, Standard Physical Size For IBM AT	54
220w AT, For Floor Stand Vertical Cases	58
220w AT, UI Approved	65
280w AT, For Floor Stand Vertical Cases	109
EMI Filter, Rechargeable Battery, Optional S/W	365

FLOPPY DISK DRIVES

TEAC 360K, 5 1/4, FDS58R, Black/Beige, (Best)	66/68
TEAC 1.2mb, 5 1/4, FDS58R, Beige/Black (Best)	78/80
TEAC 720K, 3 1/2, FDS25H, with 5 1/4 Kt, Beige Only	66
TEAC 1.44mb, 3 1/2, FDS25H, with 5 1/4 Kt, Beige Only	78
FUJITSU 360K, 5 1/4, M2551A, Black/Beige	63/65
FUJITSU 1.2mb, 5 1/4, M2551A, Black/Beige	73
TOSHIBA 720K, 3 1/2, M0335V, w/ 5 1/4 Kt, Black/Beige	69
TOSHIBA 1.44mb, 3 1/2, M0335V, w/ 5 1/4 Kt, Black/Beige	80
MINI MICRO 1.2mb, 5 1/4, MMSD560E, Beige, Mfg Samsung	74

HARD DISK DRIVES

40mb, RLL, Mini-Micro—Mfg by Samsung, 3.25 HH w/5.25 kit, 35ms	239
40/60mb, MFM-RLL, MITSUBISHI M0535, 5.25 HH, less than 28ms Shockmount, Vol Coil, Surface Mount Technology	347

SEAGATE

20mb, MFM, ST225, 5.25 HH, 65ms, Dr Only w/cftr	205/259
20mb, MFM, ST125, 5.25 HH w/5.25 kit, 40ms/28ms	235/280
20mb, RLL, ST125SR, 5.25 HH, 70ms, Dr Only w/cftr	199/249
30mb, RLL, ST123SR, 5.25 HH, 65ms, Dr Only w/cftr	219/287
30mb, RLL, ST133R, 3.25 HH w/5.25 kit, 40ms/28ms	288/299
30mb, MFM, ST133R, 3.25 HH w/5.25 kit, 40ms/28ms	294/312
40mb, RLL, ST1250R, 5.25 HH, 70ms with controller (KT)	312
40mb, MFM, ST1251, 5.25 HH, 40ms/28ms	394
40mb, MFM, ST151, 5.25 HH w/5.25 kit, 24ms	388
60mb, RLL, ST1271R, 5.25 HH, 20ms (65mb)	585
80mb, MFM, ST1402R, 5.25 HH, 28ms	585

MEMORY CARDS & CHIPS

576K Memory Exp Card from 128K to 640K	25
384K Multifunction Card, OK, Ser, Par, Game, Cd/Clk	69
EVEREX RAM-3000 OK 3mb Max, Uses 256k Chips	99
EVEREX RAM-10000 OK 10mb Max, Exp 2mb Increments Min	149
64K 150ns, 1 X 64K DRAM (4164)	150
64K 120ns, 1 X 64K DRAM (4164)	195
64K 100ns, 1 X 64K DRAM (4164)	250
64K 100ns, 4 X 64K DRAM (4464)	300
64K 100ns, 4 X 64K DRAM (4464)	375
256K 150ns, 1 X 256K DRAM (41256)	275
256K 120ns, 1 X 256K DRAM (41256)	320
256K 100ns, 1 X 256K DRAM (41256)	375
256K 80ns, 1 X 256K DRAM (41256)	420
1meg 100ns, 1 X 1mb, DRAM (41000)	900
1meg 80ns, 1 X 1mb, DRAM (41000)	1000

VIDEO DISPLAY CARDS

MONOCHROME GRAPHICS Card, w/ Parallel Port, (PPI), Good	21
MONOCHROME GRAPHICS Card, Parallel Port, (PPI)-2 or 3	29
DUAL VIDEO Card, Allows 2 Mon to Run on a Single Card	75
DUAL MONO/COLO (COLO Graphics Card, 2 in One Card)	35
CGA Color Graphics Adapter, No Printer Port	112
CGA Color Graphics Adapter, w/ Printer Port	126
EVEREX ENHANCER 640x350, No Printer Port	119
EVEREX ENHANCER 640x350, w/ Printer Port	175
SUPER VGA DEM, 800x600, Auto Switching	112
VGA GRAPHICS 600x600, SUPER VGA 1024x768 16 Bt	189
VIP AT 800x600, 8Bit, 256K	179
PARADISE VGA, DEM, 800x600, 08Bit, 256K	149
PARADISE VGA, DEM, 800x600, 16Bit, 256K	205
ATI VGA, DEM, 1024x768 16Bit, 256K, (VIMV PERFECT)	230
ATI VGA, DEM, 1024x768 16Bit, 256K, w/ Mouse, (VHF)	230
SOIA VGA, 1024x768, 16Bit, 256K/512K	90
VGA 800 x 600 (08b)	25

MONITORS

12" MM DEM 1252, 720x350, Amb, Tilt & Swivel	76
14" MM DEM 1457, 720x350, Amb, W/mt, Flat Scr, 1/5	112
14" VOITRON GM 1489, 720x350, Amb, W/mt, Flat Scr, 1/5	130
14" FIVE STAR 720x350, Amb, Flat Screen, 1/5	130
14" MM DEM 1464, 640x200, 52 Dot, Analog, 1/1, 5	244
14" MM DEM 1464, 640x200, 52 Dot, Tilt & Swivel	244
12" TAXAN Composite, 640x200, Analog, Works w/CGA Adp	349
14" MM DEM 1453M, 640x350, 31 Dot, Tilt & Swivel	379
14" RELYSIS RE 9513, 640x350, 31 Dot, (Best Value)	649
14" NEC 30, 1024x768, 33 Dot, Analog, 1/1, 5	539
14" VIEW PERFECT, 1024x768, 39 Dot, SONY Tube, Sharp	925
14" RELYSIS RE 9515, 900x600, 31 Dot, AT/AT, 1/5	495

CAD MONITORS

16" NEC 40, 1024x768	1275
16" NANAD 9070S, 1024x768, 31 Dot, Tilt/Analog, 1/5	1069
16" MITSUBISHI I1660S, 1280x1024, 26 Dot, Analog	1375
20" MITSUBISHI 3905, 1024x1024, 31 Dot, Analog	1875
20" MITSUBISHI 6205, 1280x1024, 31 Dot, Analog/TTL	2548

INPUT/OUTPUT • MULTIFUNCTION CARDS

SERIAL Card, 2 Ports, 2nd Port Opt, COM 1 & 2, For XT	13
SERIAL Card, 2 Ports, 2nd Port Opt, COM 1 & 2, AT	18/21
SERIAL Card, 4 Ports, 3rd & 4th Port Opt, COM 1, 8 (XT/AT)	59/95
2nd SERIAL Port Opt—Cable & Chip Set—Pin Connector Config. Needed	10/15
PARALLEL PRINTER Card, (PPI) 10/11/23 (XT & AT)	9/15
GAMM Card, 2 Ports, Allows Attachment of 2 Joysticks	11
CLOCK Card, Calendar & Clock Only, Fits into a Slot (formerly XT)	12
AT I/O #1, 1 Ser, 1 Par, 1 Game, COM 1-4, LPT 1-2	27
AT I/O #3, 2 Ser, 1 Par, 1 Game, COM 1-4, LPT 1-2	27
AT I/O #4, 2 Serial, 2 Parallel, COM 1, 2, LPT 1, 3	31
10/10 PLUS, Clock, Calendar, Parallel, Serial, Game (for XT)	37
32K RAM I/O, OK, to 384K, Cd, Clk, Ser, Par, Game (XT)	37
MULTI I/O, w/ Floppy Ctl, Cd, Clk, Ser, Par, Game (XT)	33
HIKRO G/ASH, Mono or CGA Video, 1 Ser, 1 Par, 1 Game (AT)	75

MODEMS

1200 GVC, Internal, with PC TALK III Software	45
1200 EVEREX, Internal, with BICOM Software	74
1200 GVC, External, with PC TALK III Software	59
1200 GVC, External Packet Modem	70
2400 OEM, with PROCOM Software, U.S. Made, Com 1 & 2	139
2400 OEM (20M), Internal with PROCOM Software	79
2400 GVC, Internal with PC TALK III Software	98
2400 EVEREX, Internal with BICOM Software	138
2400 EVEREX Internal w/MAPS & Bitrom Software	175
2400 GVC, External, with PROCOM Software	105
2400 GVC, External, with PC TALK III Software	109
2400 GVC, External, with PC TALK III MNP Class 5	185
2400 EVEREX, External, with BICOM Software	199
2400 ETECH, External, MNP Class 5	249
2400 GVC, External, Packet Size for Portables/Laptops	132

ACCELERATOR CARDS

SOIA 286 XT/COMPAD AIR/ ZENITH CACHE MEMORY SUPPORT LM 4.0 NORTON SI 13.3 See opt memory card	275
SOIA 386 XT/COMPAD AIR/ ZENITH CACHE MEMORY SUPPORT LM 4.0 NORTON SI 19.7	415

BACK UP TAPES

SOIA 16i Memory Upgrade For 286 w/OK exp to 8mb total	275
---	-----

SOFTWARE

MS DOS 3.3 w/ GW Basic, DEM Ver	59
MS DOS 3.3, Actual MICROSOFT	84
MS DOS 4.01 w/ GW Basic, DEM Ver (No Basic Manual)	65
MS DOS 4.01 w/ Actual MICROSOFT Slim-No Basic Manual	82
ARCIVE CD-ROM, 2.1, 3.5, 5.25, 8" Disks, Depend on Utility Software To Run 1.44 used with Hi Density Ctr	18

SPINRITE - The Best Reformating/Pre-Cash Program on the market.

Non-Destructive low level formatting, master program change, fully auto analysis, work with 401 and large hard drives.

PR SUPERWRIT Disk Caching, 7-8 B Screen Accelerator	52
HEADROOM, Memory Management, Rated High by PC MAG	79
PC KWIK POWER PACE Ultimate in Disk Caching, S/W & Utilities, Print Spooler, RAM Disk, Keyboard Accelerator, Screen Accelerator, Support Lum 3 2/4 D EMS Managers	94
HYPERPAD, Similar to HYPERCARD in an APPLE	99
386 MAX, Unless the Power and Potential of 386s	43
386 MAX PROFESSIONAL, Enhanced Version	75
LIROD LMS for PC/XT/AT/386	89
WORDPERFECT 5.0, Top Rated Word Processor	250

MOUSE • TRACKBALL • SCANNERS

OMOUSE X-30M Stream Line 2 Button Serial	24
OMOUSE X-30M Stream Line 2 But Ser Deluxe w/ DR Halo	31
OMOUSE X-30S Stream Line 3 Button Serial	25
OMOUSE X-30S Stream Line 3 But Ser Deluxe w/ DR Halo	33
GENIUS GM-6000, DR Halo III, 2 or 3 Button Operation, 350-1050 Res, 9.25 Pin Adapter	38
GENIUS GM-6K, DR Halo	25
LOGITECH C-9, Pop-Up DOS S/W, 50-190,000 Res, Ser/Bus	75/85
FT 100, MICROSOFT Compatible	59
NIGHTLY TRACKBALL, DR Halo S/W, 9.25 pin adapter	49
LOGITECH TRACKMAN, 50-15000, DPM, 3 But, S/W, Ser/Bus	300
Mouse Pocket, Store Your Mouse When Not in Use	300
Mouse Pad, Soft or Hard	300
Mouse Stage, Padded Stage Placed over K/B For Mouse Use	9.50
PS/2 Mouse Adapter	4.00
GENIUS GS4500 4" Hand Scanner, 4 Disk, Scan Edn S/W, 400 DPI, Dr Genius S/W	195
GENIUS GS4500 4" Hand Scanner, w/ OCR Software	235
Joystick Magic, 909 IBM & Compatible/Mac/909A IBM/Apple	15/17

MATH CO-PROCESSORS

8087 2, 8mb, XT	139
80287 B, 8mb, 286-8/10/12	215
80287-10 10mb, 286-10/12	239
80287-16 16mb, 386-16	349
80387-20 20mb, 386-20	399
80387-25 25mb, 386-25	495
80387-33 33mb, 386-33	629
80387SX 16 16mb, 386SX 16	329

KEYBOARDS

MAXI SWITCH 84 Key (The Best)	40
MAXI SWITCH 101 Key (The Best) AT Only	50
KEYTROW'S 101 Key (Excellent)	48

NTC SPECIAL 101 KEYBOARD, Toggle/Click, 12 function keys on left	565
Other Suppliers Add P. 599 Keyboards Our Price	

84 KEY KEYBOARD, Non-Click	79
84 KEY KEYBOARD, Toggle / Click	45
01 KEY Non Click Capable Toggle 12 Function Keys	40
101 KEY KEYBOARD, Toggle / Click, 12 Function Keys	43
KT-30 101/102 KEY with Microsoft Compat (Serial or Bus)	349
Trackball Mouse, 20 DPI, 6400 Variable Resolution	95

Special—GAMMIE PLUS KEYBOARD from NORTHGATE—too many features to list, call or write for feature listing	99
--	----

DESKTOP CASES

XT SLIDE, Standard PC/XT, 4 Exposed Drive Bays	29
XT All Lge, 2 Exp Dr, 2 Int Dr, LED/Reset/Key/Turbo	33
XT/AT Lge, Flip Top Case (Some as Above)	44
BABY AT, 3 Exp Drive, 2 Int Dr, LED, Reset, Key, Turbo, XT Sz, P/S, 50	50
w/ Digital Display	58
AT STD Desktop, 3 Exp / 2 Int Dr, LED/Reset/Key/Turbo	52
AT DIDDLE II, Same as Above, Heavier Duty, Better Qual	54
w/ Digital Display	62
MINI AT, Compact, w/200w P/S, 3 x 5 1/4 & 1 x 3 1/2 Exp Dr	109
Boys - 1 Int 3 1/2 HD Dr Bay, 1 Int 8 & XT Size Motherboards	109
w/ Digital Display (Less Int 3 1/2 HD)	119

FLOOR STAND VERTICAL CASES

VERT, w/220w P/S, 6 x 5 1/4 Exp Drives, Non Digital	210
w/240w UI Approved Power Supply	239
VERT, w/200w P/S, 2 x 5 1/4, 2 x 3 1/2 EXP DR, 2 x 5 1/4 Int Hard Drive Bays, Digital Display	199
VERT, w/220w P/S, 3 x 5 1/4 Exp Dr, 4 x 5 1/4 1/2 Int Hard Drives, Digital Display	215
w/215w P/S	259

MID SIZE VERT, w/200w P/S, 3 x 5 1/2 & 2 x 3 1/2 Exp Dr, 2 x 3 1/2 Int Bay, 1 Int XT & AT Size M/B, Digital	149
MINI VERT, w/200w P/S, 2 x 5 1/4 & 1 x 3 1/2 Exp, 2 x 3 1/2 Int, Fits XT Size Motherboard Only	125

SPECIAL - PORTABLE

LCD Lunch Box, CGA, Video Card, 640 x 400, 200w Power Supply, 86 Key K/B, Beige, Double Cord,

cessful workshops.

Wakefield claims that he isn't a high-tech person but is fascinated by the role of technology in society. "Regardless of the subject, the group's role has been keeping up with the leading edge of change and helping members understand it. Users groups have the responsibility to interpret or translate these impending changes and what they mean for the guy on the street."

The \$20,000 Question

Take a users group that's growing by leaps and bounds. Add an all-volunteer staff, particularly a treasurer who volunteered for the job thinking it might require just one weekend a month. Add a \$100,000 annual budget, and you get a recipe for a disaster waiting to happen.

In the case of the Portland Macintosh Users Group, this combination resulted in a discrepancy of about \$20,000 between what the group thought it had and what it really had, according to former PMUG president Allan Foster. He says that the discrepancy fueled a very nasty political battle that polarized the board of directors and general members alike. [Editor's Note: *After a lengthy internal investigation, no formal charges were filed in the case.*]

Of course, PMUG is not the only users group to suffer from inner turmoil. Almost every users group at some time sees clashes among members with different agendas. For example, the Houston Area League of PC Users last year revised its bylaws, a process that generated considerable controversy among special-interest group leaders and other officers. The process also resulted in the abrupt resignation of key officers.

According to Foster, these growing pains are natural as users groups evolve from club status to something that more closely resembles a professional society. And as new members enter the group, conflicts arise concerning the purpose of the group.

When PMUG first formed, Foster says, the group met in someone's living room. At that time, the group consisted "basically of people who'd just hooked up their 128K Macs and were wondering what to do with all that power." The group now has about 1300 members.

Often, as a group's membership increases, you still have the same people volunteering their time for the group. But as Foster points out, "It's easier to manage a group of 200 with four or five volunteers than a group of 2000."

During the missing-funds controversy, Foster says, he decided he'd had enough. As accusations and counter-accusations were made at meetings and in the newsletter, Foster thought, "Hang on, I've got a real life and there are other things I can be doing."

"What the controversy told me was 'Oh, I don't want to be a part of this,'" he says. He describes the new leadership as "a decent bunch, ones who care about the group."

What can a group do when faced with massive growth? Foster says that one possible solution is to hire a paid staff, as the Berkeley Macintosh Users Group and the Boston Computer Society do. "But you have to get above a critical mass to be able to do that," he points out. Another solution is to pay consultants their usual fee for conducting work-

shops and cover the fee with a nominal tuition charge. A more obvious solution is to recruit more volunteers.

But, somehow, the group's management structure has to change. As Foster says, "There's no way that a person who stood up and was going to [act as treasurer] on the weekends is going to manage a \$100,000 budget."

Ask Not What Your Group Can Do for You

"What's in it for me?" The next time you're asked this as you try to recruit a new member, instead of explaining the virtues of the general meetings, software library, and free advice, you might try this response: "If you have to ask, we're not sure you're our kind of member."

This approach seems to work just fine for the Central Kentucky Computer Society. According to newsletter editor David Reed, the group encourages new members to get involved from the beginning instead of just showing up for the main meetings.

The group, which will celebrate its sixth anniversary next month, now has about 600 members. Attendance at the monthly general meetings has increased from about 40 to 150.

The attitude of the group as a whole was reflected last April, when the CKCS sponsored a computer show. According to Reed, the board of directors expected about 20 volunteers to help run the show. But on the day of the show, the number was closer to 50 volunteers.

It's this kind of enthusiasm that pays off: Reed estimates that the group added 100 new members as a result of the computer show. He notes that the group encountered burnout

two years ago. "So we just expanded the board of directors," he says.

In addition to editing the newsletter and working as a news editor for the Lexington *Herald-Leader*, Reed moderates the Users Group Exchange (UGX) on BIX and participates in the Association of PC Users Groups BBS. He says that the BBSes are becoming a good way for group editors and presidents to share information, discuss problems, and, in UGX, download daily news feeds for their own BBSes and newsletters.

Reed thinks that BBSes are also a good vehicle for users groups to use to iron out ethical problems. "The good groups are trying to influence the less-than-pure groups," he says.

Flipping Between Two Sides of the Coin

One side of the coin says that users groups need to be entertained by vendors with slick product demonstrations and free products. The other side says that the groups provide valuable technical assistance for users while helping vendors in the product development process by acting as beta testers and suggesting new features. Jay Bartlett is intimately familiar with both sides of the coin.

As president of the Gold Coast Macintosh Users Group of Miami, Florida, and marketing manager for Tactic Software, he understands the importance of the users group as a marketing vehicle for vendors. He also knows how hard it can be to schedule the monthly meetings at which so many members expect to be entertained.

continued

SOUTHWESTERN

NETWORK SYSTEMS INC.

SNS 38625 Network Server

- 4mb RAM
- 64 k cache
- 100mb ESDI hard disk drive
- 32k hard disk cache
- 2 serial, 1 parallel
- Monochrome monitor with graphics card
- 101 enhanced keyboard
- Large vertical case
- 1.44mb floppy disk drive
- 230 watt power supply
- Novell 16-bit NE-2000 NIC

Server price starts at \$3150
or \$89. per month



NOVELL

Southwestern Network Systems is able to custom configure your network to meet your ever changing needs. We do software and hardware consulting. Call us with your computing problems. Custom software applications can be written under the new Microsoft Windows™ Environment.

Call for details...

Phone 800-347-6574
Fax (714) 957-8323

VISA/Mastercard Accepted

SOUTHWESTERN NETWORK SYSTEMS INC.

3183-G Airway Ave., Costa Mesa, CA 92626

Circle 1354 on Reader Service Card (RESELLERS: 1355)

RESOURCE CONCEPTS COMPUTER OUTLET

MONITORS

14" VGA MULTI SCAN
1024 x 768 .28 DOT
NEW 18 MO. WARRANTY **\$395.00**

12" AMBER MONOCHROME NEW 90 DAY WNTY.	\$59.95
12" GREEN MONOCHROME NEW 90 DAY WNTY. (OEM DISCONTINUED)	\$49.95
12" VGA MONO PAPER WHITE PHOSPHORUS DEMO 90 DAY WNTY.	\$49.95

GRAPHIC BOARDS

EGA I - HERC. COMP. AUTO. SWITCH, XT/AT	79.00
EGA MIII - 640X480, 16 COLORS, 132 COL, HERC. COMP	91.00
VGA 640 - 640X480 W/256K 8 BIT	103.00
AVGA - AUTOSWITCHING VGA 800X600 W/256K 8 BIT	115.00
VGA EM-16 PLUS — 1024 x 768 256 COLOR, 256K EXP TO 1 MEG, 16 BIT	195.00
VGA 800/16 - 800x600 W/256K 16 BIT	128.00
EVGA - 16/256K - 800X600 W/256K 16 COLOR UPGRADE TO 512K & 1024x768	176.00
EVGA - 16/512K - 1024X768 W/512K 16 COLOR	212.00
ML-VSI - 800X600 W/256K-EXP TO 512K & 1024x768, 16 BIT	215.00
ML-ADV - 640X480 FASTEST 8 BIT AVAILABLE XT/AT/PS2	130.00
VGA/T1017 - 800x600 W/256 EXP TO 1024x768 16 BIT	119.00

HARD DRIVES & CONTROLLERS

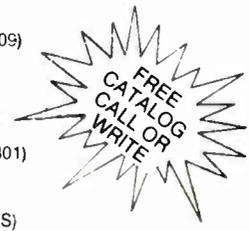
KALOK - KL320 3.5" 20MB 40MS (MFM)	229.95
KALOK - KL330 3.5" 30MB 40MS (MFM)	254.95
MINISCRIBE - M8438 3.5" 32MB 68MS (RLI)	239.95
MINISCRIBE - M8051/AKS 3.5" 42MB 28MS (IDE) KIT W/CONTROLLER	429.95
CONNER - CP3044 3.5" 40MB 25MS (IDE)	412.00
WD GEN2-PLUS XT (MFM) 2HD	49.95
WD 1004-27X XT (RLI) 2HD	49.95
WD 1006V-SR2 AT (RLI) DUAL FD/HD 1:1	129.95
WD 1003-WA2 AT (MFM) DUAL FD/HD 2:1	55.00
PTI-217 AT (IDE) W/MULTI I/O	69.95
PTI-215 AT (IDE) DUAL FD/HD	33.95
WD 1007A-WA2 AT (ESDI) OEM PK. NO MANUAL	125.00
PTI-158 XT/AT HI DEN FLOPPY CONTROLLER (4 DRIVES)	47.00

MOTHER BOARDS

V20/12MHZ XT TO 1 MB	(T-10112)	72.00
8088/10 MHZ XT	(PIM-TB10)	83.00
286/12MHZ AT MINI (2 SER/1PAR) W/CPU TO 1 MB	(PTM-1230C)	201.00
286/12MHZ AT NOT MINI VLSI CHIP SET W/CPU TO 8 MB	(T-1011)	152.00
286/12MHZ AT G2 CHIP SET W/CPU ID TO 8 MB	(T-1012)	169.00
286/12MHZ AT NEAT CHIP SET W/CPU TO 8 MB	(PTM-1233)	215.00
286/16MHZ G2 CHIP SET W/CPU TO 8 MB	(T-1013)	196.00
386/20MHZ ACC CHIP SET SER NO CPU TO 8 MB	(T-1014)	294.00
386/25MHZ ACC CHIP SET NON CASH NO CPU TO 8 MB	(T-1015)	316.00
386/25MHZ VLSI CHIP SET W/CPU TO 8 MB	(PEM-2500)	1100.00
386/25MHZ OPTI CHIP SET W/64K CASH NO CPU	(T-1016)	496.00
386/33MHZ VLSI CHIP SET W/CPU TO 8 MB	(PEM-3300)	1600.00

ADD ON CARDS

MONOCHROME TEXT ONLY CARD (MTO)	6.00
MGP (PII-143C)	35.00
CLOCK CARD (PII-146)	22.00
CGA CARD OEM PK	29.95
RS 232 CARD XT/AT (PII-108)	19.00
NO SLOT CLOCK ON CHIP XT	20.00
PRINTER CARD PAR XT/AT (PII-109)	12.00
I/O PAR, SER - XT/AT (PTI 210)	26.00
FDC XT W/CABLE (PII-101)	19.00
XT/AT HI DEN 4 DRIVES (PII-158)	47.00
640K RAM CARD XT (PII-129)	22.00
386 RAM CARD EXP TO 8M (PEI-301)	74.00
ETHERNET CARD	167.00
GAME CARD (PII-116)	12.00
ELIMINATOR GAME CARD (GRAVIS)	31.33
AT IDE CONT. WITH S/P/G (PTI-217)	69.95
AT IDE HD/FD CONT (PTI-215)	33.95
JOY STICK PC/XT/AT ROC	13.33
ANALOG JOYSTICK XT/AT (GRAVIS)	45.00
ENBEDDED H/D CONT. AT (PTI-216)	47.00
2400 BAUD INTERNAL MODEM	73.95
MICROSOFT BUSS MOUSE	39.00
XT FLOPPY CONTROLLER OEM PK	14.00



CABLES

KEYBOARD EXT (KB-0506)	2.86	SERIAL F/F 10FT (RSA-2510F)	5.50
MONITOR EXT (MR-0906)	3.93	SER. MOD. 9F/25M 6' (SR-06)	4.20
PAR. PRINTER 6FT (PA-1806)	3.50	VGA EXT CABLE (PS15M15F)	8.67
PAR. PRINTER 10FT (PA-1810)	4.95	LINE CORD (LC)	3.00
RS232 M/F 6FT (RSA-2506)	5.00	MONITOR/CPU POWER EXT	2.87
RS232 M/M 6FT (RSA-2506M)	5.00	XT HARD DRIVE (XTHD) 2 PC	3.95
RS232 M/M 10FT (RSA-2510M)	6.33	AT HARD DRIVE (ATHDFD) 3 PC 5.00	

RAM UPGRADE

	150NS	120NS	100NS	80NS-
256K x 9 IBM SIMM	15.00	20.00	28.00	35.00
1M x 9 SIMM	—	—	85.00	95.00
1M x 1 DIP	—	—	7.50	8.75
256K x 1 DIP	2.00	2.25	2.50	3.00
256K x 4 DIP	—	8.75	9.25	9.75
64K x 1 DIP	.75	1.25	1.75	—
64K x 4 DIP	2.50	2.75	3.25	—

COPROCESSORS

V-30 REPLACES 8086	5.00	80287-10 (10MHz)	210.00
8087-3 (5MHz)	85.00	80387-16 (16MHz)	300.00
8087-2 (8MHz)	115.00	80387-20 (20MHz)	350.00
8087-1 (10MHz)	159.00	80387-25 (25MHz)	450.00
80287-6 (6MHz)	120.00	80387-33 (33MHz)	550.00
80287-8 (8MHz)	180.00		

SPECIALS

SERIAL MOUSE	29.95
MICROSOFT BUS MOUSE	39.95
IBM AT 512 MEMORY EXP BOARD FOR 5170 AT	50.00
WORDSTAR 2000 PLUS 3.0	75.00
KEYTRONICS 101 KEYBD XT/AT DEMO'S 90 DAY WNT.	25.00
KEYTRONICS 101 KEYBD PS/2 DEMO'S	25.00
200W POWER SUPPLY AT (RECONDITIONED)	25.00
WD 1007A ESDI CONTROLLER, OEM PK	125.00
MONITOR TILT & SWIVEL BASE	3.95
HARD DRIVE MOUNTING KIT 3.5 TO 5.25	7.00
MITSUBISHI 1.2 FLOPPY	50.00
SONY 1.44 FLOPPY W/5.25 MOUNTING BRACKET	75.00
TEAC 1.44 FLOPPY W/MOUNTING BRACKET	78.00
OVER COUNTER KEYBOARD DRAWER	28.00
UNDER COUNTER KEYBOARD DRAWER	18.67
POWER SUPERVISOR & SURGE PROTECTION	25.33
CPU STAND (PLASTIC)	6.67
40 M INTERNAL TAPE BACKUP (WANGTEK)	175.00

AD# 9026

CALL OR WRITE FOR FREE CATALOG

P.O.s Accepted from Government, Universities and Fortune 500 Companies Only

WE BUY EXCESS AND OVERSTOCK INVENTORIES!!! SEND LIST OR CALL!!!

15203 Midway Road • 1 Block North of Beltline • Addison, TX 75244 • FAX (214) 386-5642 • Phone (214) 386-5515 • Toll Free (800) 962-7795

TEXAS RESIDENTS ADD SALES TAX • PRICE MAY VARY FROM RETAIL STORE • PRICES SUBJECT TO CHANGE WITHOUT NOTICE • SOME ITEMS LIMITED TO STOCK ON HAND • TERMS: COD, CASH, MC/VISA OR PRE-PAID

WE'RE EXTENDING OUR WORLDWIDE QUALITY INTO WORKSTATIONS



- **Industrial Strength Quality**
- **386/33 MHz Performance**
- **At a PC Price**

Aydin Quality

Moving up to workstation performance? Make the right move to Aydin Controls' Industrial Grade Workstation for peace of mind.

For nearly a quarter century Aydin has provided durable Graphics Display and Control products to the Utilities, Defense and Process Industries. Today, Aydin brings its reliably designed products, full support and guaranteed dependable service to you, our most demanding customer.

Now you can have maximum performance (Norton SI - 46, Landmark - 59), a 386/33 MHz processor and a full-size 19" VGA monitor, at a PC price. Experience a workstation that is built for tough industrial use by an Industrial leader. The 4310 is available in **Tower, Desktop and Industrialized Rackmount** configurations to meet any requirements.

Get to know Aydin's excellence in quality and performance. **Call 1-800-366-8889**

Circle 1551 on Reader Service Card
(RESELLERS: 1332)

 **AYDINCONTROLS**

European Headquarter:

414 Commerce Drive • Fort Washington, PA 19034-2602
TEL: 215-542-7800 • FAX: 215-628-4372

1/3 Hunting Gate, Hitchin, Hertfordshire, SG4 0TJ, England
TEL: Hitchin 462-458804 • TLX: 826626 AYDIN G • FAX: (0462) 456761

World Radio History

Bartlett says that in addition to providing input for product features, users groups act as a proving ground for hardware and software products. "Vendors can't possibly test their applications with every other application out there, especially in the Mac market," he observes. (Tactic Software sells a number of utilities for the Mac, including Icon-It, which puts icons on the screen for easy access, and Clairvoyant, a tool for writers.)

Because his users group is located in a large metropolitan area, Bartlett says, he can often attract good speakers from major developers. Eventually, however, members come to expect high-quality presentations every month, but they don't provide much input as to what they want to see.

"We need their input," he says. "But these people are sitting in the back with their shades on, and as soon as the break comes, they're gone."

Bartlett thinks that users groups aren't the only organizations with this problem. "There are always going to be those who do the work and others who follow, be it computers or Little League."

Three Meetings Are Better Than One

One of the realities of attending users group meetings is the dog-and-pony show, in which vendors extol the virtues of their products to an attentive audience and then sell or donate the product to members after the meeting. These shows are valuable to the vendors as a marketing tool and to the users who want to see the latest products.

Conflict occurs when you take a users group such as the

New York Personal Computer Group, which tries to stay away from product-oriented talks for its general meetings while booking speakers with a wide knowledge of the industry. The group solves this conflict with the sponsored general meeting concept.

In sponsored general meetings, which are arranged on an as-needed basis, the group makes personal invitations to individual members to attend company presentations. According to NYPC president David Hoffman, one reason for the group's success is its independence. The group holds its mailing list tightly to its vest.

Founded in 1982, NYPC has more than 50 special-interest groups. The SIGs' monthly meetings provide a third type of meeting format. For the past three years, the group has also sponsored the Intergalactic Users Group meeting, which, among other things, features a newsletter competition.

The North Texas PC Users Group, based in Dallas, does a variation of the three-format meeting. For its general meetings, the group meets at the Infomart with about 50 other users groups and sponsors three programs over the course of the day. Each program revolves around a general theme or a specific product.

Over the years, users groups have gained respect from the user community, vendors, and local dealers, Hoffman says. "The concept of users groups is still alive and well. Although many of

the groups have leveled off, it's still a great idea, and it's amazing to see what the volunteers can do."

From Humble Beginnings to Supergroup

Jonathan Rotenberg remembers the first few months of the Boston Computer Society, when the group consisted of just a few people, some of whom didn't even own a computer, meeting in a high school library. "It would be so discouraging. At times I thought, if I don't show up tonight, this will be the end of the BCS."

As a tenth grade student, Rotenberg was trying to convince his high school to buy a computer so that he and others could learn how to program. To make himself more credible to school authorities, he decided to research computers. He soon discovered, though, that the kind of information he needed was scarce.

In late 1976, Rotenberg saw a flyer for a radio talk show starting on the Boston University radio station and contacted the host of the show to ask if he knew of any local users groups. He didn't, but he mentioned that several other people had asked him the same question. The two decided to form such a group. Rotenberg still hadn't convinced his school administrators to buy a computer, but they did let him use the library for the first meeting of the BCS.

Two people showed up for the first meeting. "One of them had wandered in by accident," Rotenberg says. However, six people showed up for the second meeting, and by the fifth meeting, the group

was inviting guest speakers.

At one of the meetings, the radio show host, who had been introducing the guest speakers, failed to show up for the presentation by Wang. Rotenberg, whose voice at the time was changing, got up and very nervously introduced the guest speaker. The next day, the radio show host said that his priorities had changed and he could no longer run the meetings. Rotenberg says he later learned that the host had shaved his head and joined a commune in Austria.

Rotenberg thought the BCS would fold when he left Boston to attend Brown University. But members of the group moved the BCS paperwork and equipment out of Rotenberg's parents' house to a tiny storefront space at Center Plaza. Occasionally, street people wandered into the office, which occupied about 400 square feet.

The group hired a part-time receptionist, and Rotenberg took a bus home from school on the weekends to help run things. Rotenberg returned one day to find a letter of resignation from the receptionist. Her replacement, Mary McCann, eventually became the group's executive director and editor of the *BCS Update*.

It was from these inauspicious beginnings that the BCS eventually became the world's largest computer users group.

"I had no idea the BCS was going to turn into a real organization," Rotenberg says. "There was really no master plan behind it. In the tenth grade, I was just trying to convince school officials to buy a computer."

More Bytes for the Buck!

from *CompuLynk*!

Three Reasons Why You Get More for Less...

- ☑ Brand Name Computers
- ☑ Revolutionary Prices
- ☑ Two Year Warranty

The Powerful Tall 386-25™

- 2 Megs RAM
- 1.2 or 1.44 Mb Floppy Drive
- 40 Meg Hard Drive
- 1:1 HD/FD Controller
- 16 Bit VGA Card
- 14" VGA Color Monitor
- 1 Parallel & 2 Serial Ports
- 101 Enhanced AT Keyboard
- MS DOS 3.3 or 4.01

ONLY \$2695.

FREE Software!
(\$100 Value)

Switch-It®
Time-Saving Software that lets PC Users Instantly Switch between up to 100 Programs & Files.

The Indus 386-SX

- 1 Megs RAM
- 1.2 or 1.44 Mb Floppy Drive
- 40 Meg Hard Drive
- 16 Bit VGA Card
- 14" VGA Color Monitor
- 1 Parallel & 2 Serial Ports
- 1:1 HD/FD
- EVEREX Motherboard
- 101 Enhanced AT Keyboard
- MS DOS 3.3 or 4.01

ONLY \$1895.

FREE MS Windows 3.0
with every 386-25 purchased

Compare Features-Then Call *CompuLynk*

Standard Features	386-SX Based Computers			386 Based Computers		
	CompuLynk	Dell	Zeos	CompuLynk	Dell	Northgate
Speed	16 MHz	16 MHz	16 MHz	25 MHz	25 MHz	25MHz
On Board Memory	1 MB	512K	512K	2MB	1MB	1MB
Total Memory on Board	8 MB	8 MB	8 MB	8 MB	4 MB	8MB
Floppy	1.2 or 1.44	1.2 or 1.44	1.2	1.2 or 1.44	1.2 or 1.44	1.2 or 1.44
16 Bit VGA & VGA Color	✓	X	X	✓	X	X
Standard Hard Disk	40 MB	20 MB	32 MB	40 MB	40 MB	200 MB
DOS	4.01	Optional	Optional	4.01	Optional	4.01 or 3.3
Price	\$1,895	\$1,899	\$1,395	\$2,695	\$4,199	\$3,434

System Upgrades

Additional 1 MB RAM.....	\$95
Additional 1.2 or 1.4 MB Drive.....	\$95
80 MB Hard Disk 28 msec.....	\$250
110 MB Hard Disk 26 msec.....	\$350
150 MB Hard Disk with ESDI Controller	\$895

On-site service by **TRW**

CompuLynk

"The Computer Solution Company"

180-B Turnpike Road • Westboro, MA 01581

Tel. 508 898-3731 • Fax 508 898-2548

"Call us for any of your software needs"

Order Now Toll Free!

1-800-969-9889

C.O.D. Orders Accepted

Complete Networked Systems Available



Hours: Mon.-Fri.
9 am-7 pm
Sat. 10 am- 3 pm
Eastern Standard Time



*FREE Switch-It is offered with a purchase of any Computer System ** Registered Trademarks are proprietary to their respective manufacturers.

Circle 1339 on Reader Service Card

SEPTEMBER 1990 • BYTE 64NE-13

Step Back 550 Million Years

If Bill and Ted had used this time machine on their excellent adventure, they could have found themselves surrounded by dinosaurs rather than French nobility. The Time-Machine Earth lets you view Earth's geological history as far as 550 million years in the past or 40 million years in the future.

The program lets you see the land the dinosaurs walked or view the results of the comet that may have caused their extinction. You can view maps of the globe that show the positions of the oceans and continents at any period. A blink comparison function lets you toggle between views of two eras, and you can superimpose images of different time periods.

The program runs on the IBM PC with 256K bytes of RAM.

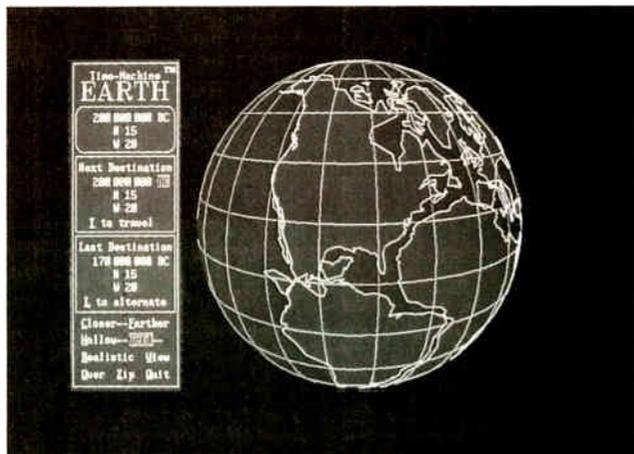
Price: \$69.95.

Contact: Sageware Corp., 1282 Garner Ave., Schenectady, NY 12309, (518) 377-1052.

Inquiry 1004.

Put a Stock Analyst in Your IBM PC

An on-line stock trading program called MyWay helps you manage diverse portfolios by providing buying



According to the theory of continental movement, shown by Time-Machine Earth, the continents may soon, in geological terms, fit together like a puzzle. For you and me, that means tens of millions of years from now.

and selling recommendations based on your trading style and financial resources, Money-Won reports.

MyWay acts like an analytical decision support system, calibrating stock positions and issuing precise recommendations.

MyWay can calculate rates of return on an annual basis and includes commission costs in all its figures. It also oversees your position in the market through a profit report module and lets you do what-if analyses.

MyWay runs on the IBM PC with 512K bytes of RAM and a modem. The program interfaces with most on-line financial information systems.

Price: \$395.
Contact: MoneyWon, Inc., Ten Tower Office Park Dr., Woburn, MA 01801, (800) 463-6639 or (418) 622-2211.
Inquiry 1006.

Fetch Missing Files from Within DOS Applications

Zaphod Industries' File Fetch utility lets you find missing files without having to exit your current MS-DOS application. You can search for other files across subdirectories, local drives, and network drives while you're still within your current application, the company reports. When the program finds the file, it returns the file path to your current application's prompt line, awaiting further action by you. This saves time and helps to prevent typos.

Price: \$39.95.

Contact: Zaphod Industries, P.O. Box 442, Northwood, NH 03261, (603) 942-5077.
Inquiry 1005.

Create Fractal Images from Simple Patterns

Cedar Software's new fractal drawing program for the IBM PC starts with a simple pattern that you create and draws the rest, generating complex fractal images.

Once the program is done drawing the image, you can spin, skew, grow, shrink, and otherwise manipulate any part of it. You can then carry all the changes through all levels of the drawing.

Fractal Graphics consists of templates of abstract art, lettering, scientific models, and other fractals.

Price: \$79.

Contact: Cedar Software, Morrisville, VT 05661, (802) 888-5275.

Inquiry 1008.

Write a Will with Your PC

Jacoby & Meyers Law Offices has teamed up with programmers of the College Explorer program to create WillPower, which helps you write your will.

WillPower provides legal information about the state in which you live or own property and helps you plan financially for spouses and children, establish trusts, name guardians, designate an executor, and address other considerations in creating a will.

The program runs on the IBM PC with 512K bytes of RAM.

Price: \$49.95.

Contact: Jacoby & Meyers Law Offices, 1156 Avenue of the Americas, New York, NY 10036, (800) 233-3109 or (212) 536-7600.

Inquiry 1009.

Why Put Great Ideas on Boring Paper?

OK, so you can't measure it by MIPS, megahertz, or MFLOPS, but that doesn't mean that your laser or dot-matrix printer paper must always be the same old unglamorous, plain vanilla stock.

PaperSelect offers a paper

kit that contains hundreds of sheets of paper and envelopes in many styles, colors, weights, and finishes. The kit includes a paper selector that contains swatches and specifications of every paper available from the company and a catalogue.

Price: \$14.95, refundable with your first order; free with orders of \$25 or more.

Contact: PaperDirect, Inc., 57 Romanelli Ave., South Hackensack, NJ 07606, (800) 272-7377 or (201) 342-6432.

Inquiry 1007.

Built for Speed, Priced for Comparison!

Please Call Toll Free: **1-800-562-1071**

MYODA LT5200 SERIES

Flexibility of a Laptop with the true power and expandability of a high-performance Desktop computer. MYODA has designed and built these machines with the needs of today's demanding users in mind. Just look at our features and then compare them with other machines costing twice as much and you will see why we are the clear choice for professional users. We offer true expandability with 2 FULL SIXTEEN BIT SLOTS, MEMORY IS EXPANDABLE TO 8MB, VGA SCREEN, EXTERNAL VGA, MONITOR PORT, EXTERNAL FLOPPY, DRIVE PORT. There is even a true 386-25 running at 0 WAIT STATE available with 32KB CACHE MEMORY. And they all come with a CONNER,40 MB HARD DRIVE & a 3.5/1.44MB FOPPY DRIVE, AMI BIOS

FREE DOS 4.01 or 3.3 with every LT5200 order

Model	cpu	Internal Slots	Screen	FD	HD	EXT. FD Port	Max Memory	Price
5200CD	386-25	2x16 Bit	VGA GAS plasma	3.5/1.44	40MB IDE	YES	8MB	\$3599
5200SX	386-16	2x16 Bit	VGA GAS plasma	3.5/1.44	40MB IDE	YES	8MB	\$2999
5200NV	286-16	2x16 Bit	VGA GAS plasma	3.5/1.44	40MB IDE	YES	8MB	\$2399

Larger Hard Drives Also Available. Call for Details

Get up to
\$300
in rebates



MYODA LT-3500 \$1499

Here is your chance to pick up on the biggest bargain in Laptops anywhere. The LT-3500 is packed with features. The 80286-12 MHz CPU runs at 0 wait state, ready to blaze through those tough applications. There is also a 40MB fast hard drive and an internal 3.5/1.44MB diskette drive

- Intel 80286 CPU 0 wait state
- 3.5/1.44MB floppy drive
- 6/12 MHz clock speed
- 40MB(28ms) hard drive
- EGA GAS plasma display
- 2 serial/1 parallel/CRT port
- 1MB installed 4MB max
- Free carrying case

Laptop Accessories

- External 5.25/1.2MB floppy drive
- 5 hour battery pack with 12V inverter
- Expansion chassis 2x8 bit, 2x16 bit (For LT-3500 only)
- Numeric keypad

MYODA MD7240 \$1799

- Intel 80386-25 microprocessor, 0 wait state
- 8MHz/25MHz clock speed
- 1MB memory installed, expandable to 16MB
- 64KB cache memory
- One 5.25/1.2MB floppy drive
- 1:1 interleave dual floppy/hard drive controller card
- 1 serial and 1 parallel port
- Large vertical case
- 220 power supply
- 101 enhanced keyboard



MYODA MD3410S \$649

- Intel 80286-12 microprocessor, 0 wait state
- Suntac chipset with EMS hardware
- 6/12 MHz clock speed
- 1MB memory installed, expandable to 4MB
- One 5.25/1.2MB floppy drive
- 1:1 interleave dual floppy/hard drive controller card
- 1 serial & 1 parallel port
- 8 expansion slots
- Mini vertical case,
- 200W power supply
- 101 enhanced keyboard
- 386SX version also available



we will configure each system to your exact requirement.
Call us today with your specifications

Circle 1348 on Reader Service Card (RESELLERS: 1349)

Prices and Availability subject to change without notice

We carry a full line of computer components. Call us for details!

Hours:

Mon-Fri: 8:30-5:00 Sat: 8:30-1:30
(central time)

MYODA Inc.

1053 Shore Rd, Naperville IL 60563 Tel: (708) 369-5199/Fax: (708) 369-6068

1-800-562-1071

Call Toll Free:
World Radio History

OEM Inquire: Alex Chen Taipei Office 3F No. 191 Sec. 3 Roosevelt Road
Taipei R.O.China TEL: 886-2-3628445 FAX: 886-2-3626283

Dealers/Vars Inquires: 1053 Shore Road Naperville Illinois 60563
TEL: (708) 369-5199 FAX: (708) 369-6068



FAX MANIA



FAX MACHINES

PANAFAX	
UF-120E (NEW!)	\$599
UF-160 (NEW!)	\$719
UF-170	\$969
UF-250	\$1149
UF-260	\$1299
UF-650 (NEW!)	CALL
UF-750D(NEW!)	\$3195
SHARP	
FO-215	\$599
FO-230	\$595
FO-333	\$759
FO-510	\$879
FO-550	\$1290
FO-750	\$1599
UX-110	\$475
EPSON	
1000	\$559
2000	\$599
3000	\$789
MURATA	
M900	\$399
M1400	\$529
M1750/1800	\$619
M1850	\$789
F25	\$799
F37	\$899
F40	\$1149
F45	\$1399

CANON	
FAXPHONE 15CD	CALL \$849
FAXPHONE 23	CALL \$849
FAXPHONE 26	CALL \$899
FAXPHONE 35	CALL \$899
FAX 222	\$1129
FAX 245	\$1199
FAX 270	\$1399
FAX 350	\$1569
FAX 450	\$1799
FAX 630	\$1995
FAX 705	\$1995
FAX 750	\$2695
FAX L770	\$3295
FAX 850	\$2895
FAX L920	\$4995
RICOH	
RF810	\$409
RF860	SAVE
RF910	SAVE
RF920	\$859
R-15	\$769
R-80	\$1299
R-85	CALL
R-90	\$1599
R-95	\$1899
R-105	\$1999
R-1010L	\$2999

LAPTOPS

NEC	
Prospeed 286-20MB	\$2399
Prospeed 286-40MB	\$2699
Prospeed 386-40MB	\$3499
Prospeed 386-100MB	\$4159
SHARP	
PC 6220	SAVE
PC 8641	CALL
2400 Baud Modem	CALL
PANASONIC	
CB-150	\$699

COMPUTERS

PANASONIC	
FX1650	
XT. 640K	\$399
FX1750	\$499
286, 640K	
FX1850	\$599
286-12, 640K	
FX1950	\$999
386	
Call for Monitors, Hard Drives	

COPIERS

PANASONIC 820	
\$699	
Reduce/Enlarge, Auto Cassette	
Best Value on the Market!!	
CANON	
PC 1	\$419
PC 2	\$519
PC 6RE	\$899
PC 7	\$949
NP 1010	\$1149
SHARP	
Z 55	CALL
Z 75	FOR
SF 7350	BEST
SF 7750	PRICE

MISC.

SMARTMAX	
Auto Voice/Fax Switch	\$149
FAXMAX	
Surge Protector	\$75
1 Year Extended Warranty \$99	

PRINTERS

PANASONIC	
KXP 1180	\$155
KXP 1124	\$269
KXP 1191	\$219
KXP 1624	\$349
KXP 1695	SAVE
KXP 4420	\$899
EPSON	
LQ 510	\$279
LQ 850	\$469
LQ 950	\$479
LQ 1010	\$409
LQ 1050	\$595
LQ 2550	\$849
FX 850	\$299
FX 1050	\$419
DSX 5000	\$1299
LX 810	\$179
OKIDATA	
182 Turbo	\$219
183	\$229
320/321	\$319/459
380	\$295
390+	\$459
391+	\$629
393+	\$965
NEC	
2200XE	\$295
P5200	\$479
P5300	\$619
P6200	\$439
P6300	\$599

EDUCATION/GOVERNMENT/CORPORATE/UNIVERSITY P.O.'s WELCOME!
 VISA/MASTERCARD/DISCOVER/AMERICAN EXPRESS/C.O.D. ACCEPTED!
 ALL ITEMS IN STOCK AND SHIPPED WITHIN 24 HRS.

WE'LL MATCH ANYBODY!!

BUSINESS COMPUTER SYSTEMS

1349 Kempsville Road - Virginia Beach, VA 23464
 Info: (804) 420-2710 - Dealers: (804) 420-3128 Tech. Support: (804) 420-8668 - FAX: (804) 420-8788

1-800-33-FAX-55

Attention U.S. BYTE Subscribers

Watch for the next **BYTE DECK** mailing that will be arriving in your mailbox soon!

Use this as a fast, convenient tool to purchase computer products and services. It's loaded with essential hardware and software products that you should be aware of when making your buying decisions...and it's absolutely FREE!

If you have a computer product or service, and would like to reach 275,000 influential **BYTE** magazine subscribers, please give Ed Ware a call today at (603) 924-2596.



Here's what a **BYTE Deck** advertiser has to say:

"Galacticomm does a lot of card-deck advertising, and the **BYTE Deck** has consistently out-pulled every other deck we have ever used."

Timothy Stryker, Galacticomm, Inc., Fort Lauderdale, FL

UNIX EXPO

Where Business Wins!

The UNIX system will help you react faster, play smarter, and sharpen your competitive edge. Whatever your game.

To win, you need information or action. And you'll find more of it at UNIX EXPO than anywhere else. More this year than ever before.

Spend three days with the winners.

Attend the world's largest gathering of UNIX business solutions vendors... more than 200 industry leaders.

Then, choose from an entirely new conference: 28 workshops led by people who are in the trenches, solving today's business and technical problems.

Thinking about open systems? At the first-ever Open Systems Symposium, we'll get down to cases. What's real, what's fantasy, and how open system solutions will fit into *your business*. What specific actions you



October 31-November 2, 1990
Jacob K. Javits Convention Center
New York City

can take today. *At UNIX EXPO. Nowhere else.*

Volley with the leaders... then judge for yourself.

Hear where the industry's headed from the people taking it there:

Francis Dramis, who's made UNIX the heart of Salomon Brothers' 21st century computing strategy and *Jim Cannavino*, IBM's man-in-charge of Personal Systems.

And come hear an important keynote address by *Jim Manzi*, President and CEO of Lotus Development Corporation.

These are just three of UNIX EXPO's blockbuster special events. *At UNIX EXPO.*

Nowhere else.

UNIX EXPO in New York. For seven years, the indispensable event of the business season. Because we help you win!

UNIX EXPO
THE UNIX™ OPERATING SYSTEM EXPOSITION & CONFERENCE

For more information about attending UNIX EXPO, just return this coupon to:

 National Expositions Company, Inc.
 15 West 39th Street, New York, NY 10018
 (212) 391-9111

Name _____

Company _____

Address _____

City _____ State _____ Zip _____

UNIX is a trademark of AT&T. UNIX EXPO is not affiliated with AT&T.

TECH CITY

6 A.M. TO 6 P.M. PST
 (714) 385-1219, FAX (714) 937-5414
 TECHNICAL SUPPORT (714) 956-9593
 1300 E. Katella Ave., Anaheim, CA 92805

Circle 1356 on Reader Service Card (RESELLERS: 1357)

World Radio History

charges for
 Credit Card
 ■ No Credit Card
 charge until
 shipment

**DEALER
 DISTRIBUTOR
 WELCOME**

Special Offer!
\$840**

Plotting

REGIONAL
WHAT'S NEW

METRO NEW YORK • NEW ENGLAND

CompuAdd Debuts First Laptop

CompuAdd's first laptop computer, based on the 16-MHz 386SX processor, comes with Windows 3.0, DOS 4.01, the DOS Help utility, and the LapLink communication program. The 316SL also has 2 MB of memory (expandable to 6 MB), a 40-MB hard disk drive, a 3½-inch floppy disk drive, and a VGA screen.

The system can display 16 shades of gray on the 8- by 6-inch VGA screen. If that's not good enough, you can connect an external monitor via a VGA video port. The 316SL weighs 11½ pounds.

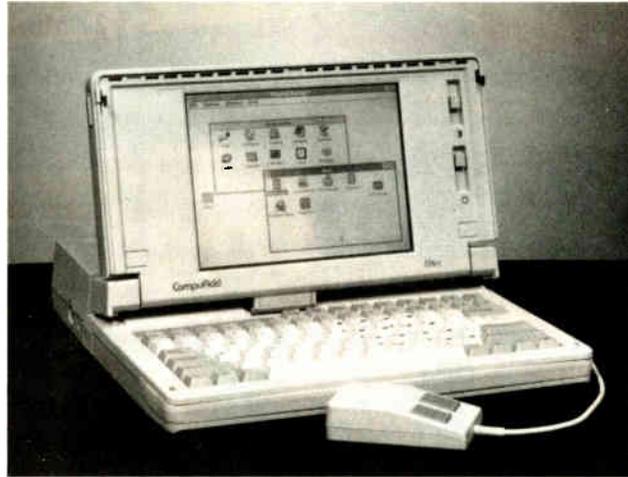
Price: \$2895.

Contact: CompuAdd Corp., 12303 Technology Blvd., Austin, TX 78727, (512) 250-1489.
Inquiry 1010.

Point of Sale for Smaller Retail Companies

The Electric Merchant point-of-sale program for the IBM PC lets retail clerks easily record sales, print receipts, and look up stock information while providing management with security, customizable reporting, and inventory control, Software Creations says.

With the Electric Merchant, clerks can save any sale before ringing it out, for making and printing sales quotes without having to later re-ring the entire sale. You can set up the program so that, when entering transactions, clerks have to enter only a product identification code, not an additional vendor code. Clerks can access information on more than 20,000 separate items from anywhere in the system to provide cus-



The CompuAdd 316SL uses 12-V and nickel-cadmium batteries and ships with power-management software. The 316SL weighs 11½ pounds.

tomers with the most up-to-date product information.

You can set up the system to tell you when a store has reached a minimum number of products. Business reviews include store sales history on any day, sales tax reporting, error checking, and cost of goods sold. The program tracks each sale by category, salesperson, and payment type.

Price: \$995.

Contact: Software Creations, Inc., 10035 Adamo Dr., Tampa, FL 33619, (800) 767-3279 or (813) 684-8291.

Inquiry 1011.

Transfer DXF Files Without Losing Information

AutoSight DXF Handler II modifies complex parts of a CAD drawing, such as blocks, text layers, and hatch patterns, to preserve that information when you transfer files in the DXF format. The program converts complex segments of a drawing to simpler elements, eliminating the time and labor required to edit and move DXF files among versions of AutoCAD and other CAD systems.

Database Finds Quotes by Any Subject or Keyword

With the PennComp Quotemaster Plus, writers, speakers, and editors can quickly find an appropriate quotation for a speech or article by subject, time period, keyword, or author.

The program contains more than 3000 quotations, which you can search by any text string, eliminating the need to poke around in the back of a quotation book's index, the company says.

In addition to the Primary

Literary base of 3000 quotations, four other quote bases, each with 500 quotations, are available for humor, success, contemporary, and motivational quotations.

Quotemaster Plus runs on the IBM PC with 512K bytes of RAM.

Price: \$89; additional quote bases, \$25 each.

Contact: PennComp, 4031 Villanova St., Houston, TX 77005, (800) 326-6145 or (713) 669-0965.

Inquiry 1012.

The utility works with different versions of AutoCAD ranging from release 2 up to release 10, according to AutoSight.

Price: \$195.

Contact: AutoSight, Inc., P.O. Box 362086, Melbourne, FL 32934, (407) 242-5865.
Inquiry 1013.

Pop-up Mail for LANs Requires 7K Bytes

Nouveau is a pop-up mail system designed for the rapid entry and retrieval of messages on any DOS-based network. A TSR program, it lets you send and receive messages of up to 900 characters. When you activate the program, Nouveau displays a window with a list of messages that you haven't read.

Price: \$25 per workstation.

Contact: Integra, P.O. Box 72063, Marietta, GA 30007, (404) 973-3586.
Inquiry 1014.

Pop-up Calculator Solves Time-Based Problems

With QS-Timecalc, you can carry out a variety of time-based calculations on employee time cards, client billing charges, computer usage logging, and totaling time-based processes. You can make the program RAM-resident and use it with your current IBM PC payroll or billing application, Quingen says.

Price: \$39.

Contact: Quingen Systems, Inc., 530 Causeway Dr., Wrightsville Beach, NC 28480, (919) 256-9119.
Inquiry 1015.

Laptops!

Laptops!

Laptops!

V20, BATTERY

LX-2002



\$895

- V20 Microprocessor, 4.77/12 MHz
- 640K RAM
- Dual Floppy Drives, 1.44 MB
- Supertwist, LCD, 640 x 200 CGA/MDA display
- 81 Key Keyboard

80286, BATTERY

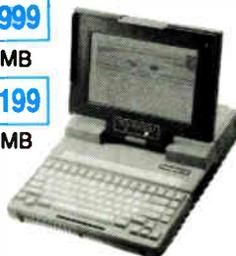
LA-30A

\$1999

20 MB

\$2199

40 MB



- 80286-12 Microprocessor, 12/6 MHz; 80287-8 Co-Processor socket is optional
- 2 - 2/3 Exp. Slots (one 16-bit bus and one 8-bit bus)
- 1.44 MB Floppy Disk Drive, 20 MB 28ms Hard Drive
- 1 MB RAM standard on board (optional 2 MB/5MB) extendable to 16 MB, 64 KB ROM with setup utility
- 1 parallel port, 2 serial ports

LT-V12

\$2295

40 MB



- 80286 Microprocessor, 12 MHz; 80287 CoProcessor
- 1 MB RAM expandable to 4MB
- 1.44 MB Floppy Disk Drive, 40 MB 25 ms Hard Drive
- Backlit DST, LCD 640 x 480 VGA / EGA / CGA / MDA Display
- 83 Key Keyboard

LP-286C

\$2795

20 MB

\$2995

40 MB



- 80C286 Microprocessor, 16/8 MHz; 80C287 CoProcessor
- 1 MB RAM expandable to 8MB
- 1.44 MB Floppy Disk Drive, 20/40 MB Hard Drive
- 32 Gray, LCD, 640 x 480 VGA Display
- 86 Key Detachable Keyboard

80386SX, BATTERY

LT-386SX

\$2995

40 MB



- 80386SX Microprocessor, 16 MHz; 80387SX CoProcessor
- 1 MB RAM expandable to 4 MB
- 1.44 MB Floppy Disk Drive, 40 MB 25 ms Hard Drive
- One parallel port, two serial ports
- Backlit DST, LCD 640 x 480 VGA/EGA/CGA Hercules Display
- 83 Key Keyboard



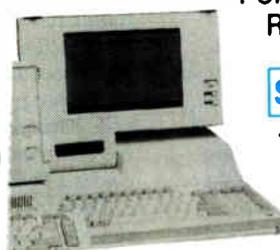
80286, AC ONLY

LP-286B

PORTABLE DESKTOP REPLACEMENTS

\$2695

40 MB



- 80286 Microprocessor, 16/8 MHz; 80287 CoProcessor
- 1 MB RAM expandable to 5 MB
- 1.44 MB Floppy Disk Drive, 40 MB 28 ms Hard Drive
- One parallel port, two serial ports
- Gas Plasma, 640 x 400 EGA/CGA/MDA Display
- 85 Key Keyboard

80386SX, AC ONLY

LP-386SX

\$2995

40 MB



- 80386SX Microprocessor, 16/8 MHz; 80386SX-16 CoProcessor
- 1 MB RAM expandable to 5 MB
- 1.44 MB Floppy Disk Drive, 40 MB 28 ms Hard Drive
- One parallel port, two serial ports
- Gas Plasma, 640 x 480 EGA/CGA/MDA Display
- 85 Key Keyboard

Bonus Buys

With Purchase of Any Laptop



AUTHORIZED SERVICE CENTER:
AST, Chaplet, Epson, Hyundai, Toshiba



CANON BJ-10E

Bubble Jet Printer

\$399

With purchase of any laptop

- Compact and portable - only 4.6 lbs. with battery
- 64 nozzle Bubble Jet head
- High Quality mode resolution of 360 x 360 dpi
- Approximately 700,000 characters per cartridge (HQ mode)
- Optional automatic paper feeder, NiCad bat. pack, replaceable printer cartridge

PROXIMA DATA DISPLAY 400

From Computer Accessories Corp.

\$699

With purchase of any laptop



- Allows any conventional overhead projector to project the CGA/EGA image from your computer display to a screen or wall
- Color Group Select enables you to choose from 15 different combinations of 16 shades each
- Lightweight & portable - weighs just 3 lbs.
- 1 year warranty on parts & labor



The #1 Source!

THE CORPORATE SOURCE

BOFFIN

L I M I T E D

612-894-0595

FAX: 612-894-6175

2500 W. COUNTY RD. 42 • #5 • BURNSVILLE, MN 55337

SEPTEMBER 1990 • B Y T E 64NE-21

Circle 1333 on Reader Service Card

Image-In's Graphics Toolkit for Windows

Image-In says that its new five-module graphics toolkit for Windows 3.0 provides the functions of PC Paintbrush, Omnipage, Picture Publisher, and Streamline in an integrated package.

The program includes modules for scan and paint functions, optical character recognition, converting raster and bit-map images to vector images, gray-scale processing, and an image database manager.

You can buy the modules separately or as a complete package. To run just one or two of the modules, you will need to get the scan and paint module.

The program runs on the IBM AT with Windows 3.0.

Price: All five modules, \$795; individual modules, from \$99 to \$349.

Contact: Image-In, Inc., 406 East 79th St., Minneapolis, MN 55420, (800) 345-3540 or (612) 888-3633.
Inquiry 1017.



The Image-In Vect module can convert bit-mapped images to vector images of any size. You can then export files to AutoCAD in DXF format.

Database for Handling Huge Sets of Data

StatSoft has developed the Megafile Manager for maintaining large databases, downloading long records of data from acquisition equipment, integrating spreadsheet and database files, and otherwise analyzing huge data sets. The program supports records as large as 8 MB, or 32,000 fields with up to 255

characters each.

Not just a database, Megafile Manager can act as a spreadsheet. You can review, edit, and transform data using traditional spreadsheet operations such as copy, move, transpose, and delete blocks.

The program lets you re-code data and perform numerous statistical analyses. It includes a Pascal-like language.

The program currently runs on the IBM PC with 512K bytes of RAM. Versions for the Mac, Unix, and OS/2 will ship later this year.

Price: \$295.
Contact: StatSoft, Inc., 2325 East 13th St., Tulsa, OK 74104, (918) 583-4149.
Inquiry 1018.

PSW Bundles Accounting with DBMS

QuikData 4.0, a transaction-based DBMS for solitary or network systems, includes a programmable accounting system with source

code that provides examples of about 20 application design structures using data dictionaries.

Because it is a data-dictionary-controlled system, the program lets you add fields to its record structure more easily than is possible in a relational DBMS, PSW says. The data dictionary lets you modify a system by adding fields as your processing needs change.

QuikData's DBMS engine uses Novell's Btrieve networked file manager for LAN compatibility and data-file integrity, and the program is compatible with Microsoft BASIC.

Price: \$295.
Contact: PSW, Inc., 14 Middleton St., Nashville, TN 37210, (615) 244-4319.
Inquiry 1020.

Fast Access for Applications in Windows 3.0

First Genesis developed StraightLine for Windows 3.0 users who want a way to bypass the Program Manager and File Manager when switching among or launching applications. The program lets you launch an application by selecting it from a menu, and you can switch instantly between active applications, the company says.

With StraightLine, you need not search through work sets and document groups or rummage through directories and file lists. The program can also launch the Program Manager itself.

Price: \$99.
Contact: First Genesis Software, Inc., 1000 Shelard Pkwy., Suite 270, Minneapolis, MN 55426, (612) 544-4445.
Inquiry 1019.

1-2-3 Enhancement Gives You Back Your Solid Lines

Royall Enterprises' spreadsheet display and printing enhancement for Lotus 1-2-3, Symphony, or Quattro lets you print tables and charts with solid and double lines, special characters like a smiley face, and European characters.

An alternative to Allways and Impress, TACTECS (Tables and Charts Through Extended Character Set) lets you print on any available printer without having to change a spreadsheet file or use a special print enhancement file. Royall says that this feature makes it suitable

for corporate use, where the same file is often printed on several different printers.

A macro drawing environment provides for the rapid drawing of boxes, lines, organization charts, and Gantt charts. And perhaps the best feature of the program is that it doesn't require any extra memory; TACTECS runs entirely inside 1-2-3 code.

Price: \$49.95 for each version.
Contact: Royall Enterprises, P.O. Box 1134, Bloomfield Hills, MI 48303, (313) 641-8245.
Inquiry 1021.

VGA PORTABLE

5 YEARS PORTABLE EXPERIENCE

Color

LIGHTEST &
SMALLEST
CRT PORTABLE



Nobody does Portables better than BSI

BSI specializes in COLOR VGA CRT Portables, Gas Plasmas, LCDs, and Laptops. Now for the first time you can have the power, speed and memory of a desktop in the portable format without having to sacrifice COLOR VGA graphics when changing locations. Our lightest and smallest "take it anywhere" portable is your best choice for both a compact work station and dynamic portable on the road.

We can custom configure your portable to 486, 386, 286 and 8088 systems in VGA, EGA, CGA or monochrome portable, to meet your specific needs.

If you prefer to build your own portable computer and/or put your own brandname, we can provide barebone units, parts and assembly information to help you. Please call us today to get the best dealer pricing.

LAPTOP LT5400 386SX VGA PLASMA

- VGA Plasma Screen, 640x480 Res.
- External VGA Monitor Adaptor
- 80386SX System Board
- 1MB RAM on Board. (Up to 4MB)
- 3.5" 1.44MB Floppy Drive.
- (5.25" External FDD Optional)
- 40MB, 25ms Conner IDE Hard Drive
- 100MB, 19ms Hard Drive + \$400
- 1 Parallel and 2 Serial Ports.
- 87-Key Keyboard, Carrying Bag.
- One 16-Bit Exp. Slot Available.

\$2,450
(On Sale)

LAPTOP LT3600 286-16 VGA LCD

- VGA LCD Backlit Screen, 640x480 Res.
- External VGA Monitor Adaptor
- 286-16 MHz System Board
- 1MB RAM on Board.
- (Expandable to 2 or 5MB Optional)
- 3.5" 1.44MB Floppy Drive.
- (5.25" External FDD Optional)
- 40MB, 25ms Conner IDE Hard Drive
- 100MB, 19ms Hard Drive + \$400
- 1 Parallel and 2 Serial Ports.
- 84-Key Keyboard, Carrying Bag.
- 2-3 Hours Rechargeable Battery.
- One 16-Bit Exp. Slot Available.

\$2,450
(On Sale)



Prices subject to change without notice. Call for return policy.

9440 Teistar Ave., #4, El Monte, CA 91731

For Order Only Call Toll Free

1-800-872-4547

1-818-442-0020 Calif.

Customer Support: (818) 442-7038

All order will be shipped by UPS CDD cashier's check. Company check on approval. IBM PC XT/AT are registered trade marks of IBM Inc.

386-33 100MB COLOR VGA PORTABLE

- Built-in SONY 8.5" Color VGA Monitor
- 0.26mm Dot Pitch, 800x600 Resolution
- Speed Digital Display, 3 Drive Bays
- 220W P/S 110/220V, 4 Exp. Slots
- 86-Key Detachable Keyboard
- 386-33 MHz CPU, w/32K Cache Memory
- 1MB Memory on Board (To 8MB)
- VGA Graphic Card (256K, 800x600 Res.)
- (512K, 1024x768 Res. + \$50)
- External Monitor Adaptor
- 1.2MB or 1.44MB FDD
- 100MB 25ms HDD (To 500MB)
- Serial/Parallel/Game Ports
- Carrying Bag, Weight 27 Lbs.
- Dimensions: 17.5(W) x 14.1(D) x 6.8(H)
- 7 expansion Slots Model Optional

\$3,659
(Special)

HDD	286-12	386SX	386/25	386/33	486/25
40MB	2209	2469	2839	3239	4859
100MB	2629	2889	3259	3659	5279
150MB	2909	3169	3539	3939	5559
200MB	3019	3279	3649	4049	5669
345MB	3809	4069	4439	4839	6459

VGA AMBER CRT PORTABLE 65MB AT

- Built-in 9" Amber VGA Monitor
- Speed Digital Display, 3 Drive Bays
- 205W P/S 110/220V, 4 Exp. Slots
- 86 Keyboard, Detachable Keyboard + \$30
- AT 12 MHz System, 1MB Memory (To 4MB)
- VGA Graphic Card (256K, 800x600 Res.)
- Run 48 Grey Scales VGA Internally
- Run Color VGA Externally
- 1.2MB or 1.44MB FDD
- 65MB 25ms HDD (To 500MB)
- Serial/Parallel/Game Ports
- Carrying Bag, Weight 26 Lbs
- Dimensions: 17.5 (W) x 14.1 (D) x 6.8 (H)

\$1,639

HDD	286-12	386SX	386/25	386/33	486/25
40MB	1479	1739	2109	2509	4129
65MB	1639	1899	2269	2669	4289
100MB	1899	2159	2529	2929	4549
150MB	2179	2439	2809	3209	4829
200MB	2289	2549	2919	3319	4939
345MB	3079	3339	3709	4109	5729

AMBER CRT PORTABLE 65MB AT

- Built-in 9" Amber Monitor
- Speed Digital Display, 3 Drive Bays
- 205W P/S 110/220V, 4 Exp. Slots
- 86 Keyboard, Detachable Keyboard + \$30
- AT 12 MHz System, 1MB Memory (To 4MB)
- Mono or Color Graphic Card
- Amber EGA Display (option) + \$100
- 1.2 MB or 1.44 MB Floppy Drive
- 65MB 26ms Toshiba Drive
- Carrying Bag Weight 26 lbs.
- Dimensions 17.5(W) x 14.1(D) x 6.8(H)

\$1,369

HDD	286-12	386SX	386/25	386/33	486/25
40MB	1209	1469	1839	2239	3859
65MB	1369	1629	1999	2399	4019
100MB	1629	1889	2259	2659	4279
150MB	1909	2169	2539	2939	4559
200MB	2019	2279	2649	3049	4669
345MB	2809	3069	3439	3839	5459

COLOR EGA CRT Portable Available

386-33 100MB VGA PLASMA PORTABLE

- 640x480 VGA Plasma Display
- Detachable 101-key Keyboard
- 200W P/S, 110/220V, 3 Drive Bays
- 386-33 MHz CPU, w/32K Cache Memory
- 1MB Memory on Board (To 8MB)
- 1.2MB or 1.44MB FDD
- 100MB 25ms HDD (To 500MB)
- Serial and Parallel Ports
- External Monitor Adaptor
- Carrying Bag, Weight: 26 Lbs.
- Dimensions: 16"(W) x 9.75"(H) x 8.5"(D)

\$3,429

HDD	286-12	386SX	386/25	386/33	486/25
40MB	2019	2279	2649	3049	4669
65MB	2169	2429	2799	3199	4819
100MB	2399	2659	3029	3429	5049
150MB	2659	2919	3289	3689	5309
200MB	2759	3019	3389	3789	5409
345MB	3529	3789	4159	4559	6179

CGA PLASMA PORTABLE 65MB AT

- 640x400 CGA Plasma Display
- Detachable 86-Key Keyboard
- External RGB Monitor Adaptor

\$1,619

HDD	286-12	386SX	386/25	386/33	486/25
40MB	1469	1729	2099	2499	4119
65MB	1619	1879	2249	2649	4269
100MB	1849	2109	2479	2879	4499
150MB	2109	2369	2739	3139	4759
200MB	2209	2469	2839	3239	4859
345MB	2979	3239	3609	4009	5629

CGA LCD PORTABLE 65MB AT

- 640x200 Res. Backlit LCD CGA Display
- 640x400 Res. CGA Display + \$120
- 200W 110/220V P/S, 6 Exp. Slots
- Detachable 86-Key Keyboard
- AT 12MHz System, 1MB Memory (To 4MB)
- 1.2MB or 1.44MB FDD
- 65MB 25ms HDD (To 500MB)
- Serial/Parallel/Game Ports
- External Monitor Adaptor
- 16"(W) x 9.5"(H) x 7.5"(D), 23Lbs

\$1,349

HDD	286-12	386SX	386/25	386/33	486/25
40MB	1209	1469	1839	2239	3859
65MB	1349	1609	1979	2379	3999
100MB	1579	1839	2209	2609	4229
150MB	1829	2089	2459	2859	4479
200MB	1929	2189	2559	2959	4579
345MB	2679	2939	3309	3709	5329

EGA LCD PORTABLE GENOA Model + \$340

(Run 386 Window and Unix)

EGA LCD PORTABLE YAMAHHA Model + \$210

VGA LCD PORTABLE AVAILABLE CALL

See us at
COMDEX/Fall '90
November 12-16, 1990
Sahara Hotel
Las Vegas, Nevada
Booth S9106

MANCHESTER & NEC EQUIPMENT COMPANY

WHY NOT THE BEST ?



WHY MANCHESTER

- High quality industry standard products at unbeatable prices.
- Multi-million dollar inventory assuring you prompt delivery.
- 17 years of quality and dependability in the computer business.
- Knowledgeable sales reps who help you plan, design, implement and manage your computing environment.
- 15 step burn-in and test procedure on all equipment.
- A service department that maintains your equipment in first rate condition.
- Support specialists in sophisticated applications such as Networking, CAD/CAM, Desktop Publishing and Connectivity.
- Risk free corporate evaluations, both in house and on location; demonstrations on the newest and most innovative products.

WHY NEC

- Recognized as the standard in providing quality products, high performance rates and user reliability.
- An industry leader in the research and development of computer products for the past three decades.
- Outstanding desktop engineering systems designed for high user performance and growth potential.
- Industry Standard Architecture (I.S.A) and Extended Industry Standard Architecture (E.I.S.A)
- 24 Billion dollar a year company with an on-going multi-million dollar commitment to research and development.
- State of the art design with an extensive family of feature rich products.
- All systems designed with the end-user in mind.

DOUBLE YOUR COMPUTING POWER

with the only two names you need to remember, MANCHESTER and NEC. Give us a call today and find out more about the NEC POWERMATES. Why not work with the best! Let MANCHESTER satisfy all your system needs and lead your company through today's computer world and beyond.

Authorized NEC Computer and Printer Dealer

MANCHESTER EQUIPMENT CO., INC.

"The Computer Supply and Equipment Experts"

SYSTEMS INTEGRATION ■ NETWORKING ■ CONNECTIVITY ■ CAD/CAM ■ DESKTOP PUBLISHING

50 MARCUS BOULEVARD ■ HAUPPAUGE, NEW YORK 11788

(516) 435-1199 ■ (516) 434-8700 ■ FAX (516) 435-2113

New York City
(212) 629-6969

Ft. Lauderdale
(305) 491-7560

Tampa
(813) 962-8083

Boston
(617) 739-1555

For additional information, ask for Dan Kalata



FIFTEEN YEARS AND COUNTING

A black-tie affair lets Jerry reminisce

We're at Spring Comdex, and I've just attended BYTE's 15th anniversary party. It was a very elegant black-tie affair held at The Mansion, one of Atlanta's spiffier restaurants. There was caviar, and an ice sculpture that spelled out BYTE, and all manner of expensive food and drinks; but I couldn't help remembering the old days, when you'd see more beards than suits at a BYTE affair, and the party would be an informal gathering in a local pizza place.

All things change, of course. When BYTE first started, the president/CEO of a start-up company was likely to be a young technoweenie who understood computer chips and programming, but not much else. Then came the era of the financial people, who put up the money and wanted to run the show personally, often with disastrous results. Now the CEO will be in a suit, clean shaven, with a background in marketing, and the technoweenie who thought up the project will be carefully kept in the background, if allowed to come to Comdex at all.

Or worse: I went through one expensive booth today in which the PR lady knew nothing technical about her product. She referred me to the product manager. He didn't know how much memory his device drivers took up (and didn't know what a device driver was). He referred me to their "technical person"—who didn't know it either. So it goes.

Still, there are start-up companies who compete with pure technological excellence rather than slick marketing; for example, Sota and USVideo. Many were at the BYTE party. Others showed up at the Silicon Northwest party. (This is a consortium of Northwest-based companies who show their products while

guests scarf up northwestern salmon, clams, wines, and suchlike.) Others were at Tech Southeast, now the best party at Comdex.

Dan Bricklin and Bob Frankston, the original "beards who made good," were there. They haven't much changed, and are still BYTE readers. Ironically, their VisiCalc program was the beginning of the end for the computer industry that BYTE originally served.

VisiCalc, the first spreadsheet, was the first program that every business not only needed, but instantly *knew* that it needed. I recall businesspeople in computer stores saying, "I want a VisiCalc." The clerks explained that VisiCalc was a program, and you needed an Apple to run it on. (Bricklin and Frankston wrote VisiCalc on an Apple because that's what they happened to have.) "Yeah, yeah, fine, whatever it takes, but I gotta have a VisiCalc."

Prior to VisiCalc, most people who owned computers understood them or wanted to. They wanted to learn more about programming and how to upgrade their system and which chips were best. They read BYTE, and complained if the articles weren't technical enough. Many built computers from kits.

Those were the times of incredibly rapid change. Memory boards doubled in size from one issue to the next. Every month, there were amazing new programs that could do things we had confidently predicted wouldn't happen for years. Bill Godbout's CompuPro would have a new marvel at every show. Marketing consisted largely of bragging about technical specifications. You can read all about those days in my two books, *The User's Guide to Small Computers* and *Adventures in Microland*, both from Baen Books.

After VisiCalc, there was a shift. The computer community never lost any of the enthusiasts—indeed, their numbers continued to grow—but they were first outnumbered and then swamped by the

influx of the suits, and the users who didn't care what was in the computer or how it worked, as long as it got the job done. I can hardly complain, of course, since I'm one of them; but I do remain curious about how the machines work.

As the senior writer on the editorial staff—the only editor who's been with BYTE longer than me is my copy editor Warren Williamson—I've watched all these changes happen, but it was particularly brought home tonight by the elegance of BYTE's 15th anniversary party. I enjoyed that party very much, and I collected a ton of business cards and listened to glowing descriptions of products that are shipping, and others that will be out Real Soon Now.

But I also enjoyed getting away from it and out to a smaller gathering of the hackers who love this technology for its own sake and whose enthusiasm makes it happen. I can drink champagne with the new market-oriented CEO, and that's fine; but I'm glad I can still get out to a pizza parlor with the beards. BYTE still talks to beards and hackers as well as to suits and users; and I like that a lot.

Pournelle's Laws

Over 10 years ago, my BYTE columns proclaimed "Pournelle's Laws." I confess that the number of those laws has varied over the years, but the first two have been here from the beginning: "One user, one CPU"; and "Silicon is cheaper than iron."

I have modified the First Law. It now reads, "One user, at least one CPU." This is not a change in principle, since from the beginning the point was to advocate decentralized computing. That's a battle that has largely been won; but some of today's readers may not realize just how bitter that fight was. In the early days, computing, especially in corporate centers, was highly centralized. There would be a great HULKING GIANT of a machine enthroned on platforms in an

continued

air-conditioned room, attended and approachable only by priests in white coats. Ordinary users seldom even *saw* the machine, and none were allowed to touch it.

Moreover, departments weren't allowed to have small computers. The usual trick was that the central computing department would buy what was then a machine of great capacity, because that was thought to be needed for some primary problem. That task wouldn't use anything like all the central computer's capacity, so other departments would then be required to use its services and pay for them.

If a department head wanted a particular kind of report, the director of computing would have special programs written to provide it—and would charge the department an outrageous fee for the service. There were few commercially available programs; nearly every program was custom-written for a particular company. Often the programming was done by IBM or another mainframe vendor, and the customized programs were not sold but leased for tens of thousands of dollars a year.

From early on this was silly, but after

the development of VisiCalc and dBASE II, the absurdity became obvious: even in 8080/Z80 days, microcomputers could provide more information, faster and better tailored to a department's needs, than ever could the Hurling Giant in the basement. Pournelle's Law, One user, one CPU, was a declaration of independence from Central Computing.

After that battle was won, there was still the war against multiuser microcomputers, which I consider a compound absurdity. The corollary to Pournelle's First Law is "Networks, not multiuser." It was one reason I remained opposed to Unix, which has always been a multiuser scheme and has been used to justify enormous central systems.

I have no objections to large central systems, provided that there's something real for them to do and, more important, that they are networked to independent workstations. The central system can provide central databases, networked automatic backup capabilities, and such-like; but the heart of the computer revolution is to provide each employee with tools not lock-stepped to everything else; to liberate individual creative energies;

to let people do things their own way. That battle is not yet won. Diskless workstations are the latest ploy in the eternal war of the centralists against the rest of us. It's important to remain vigilant.

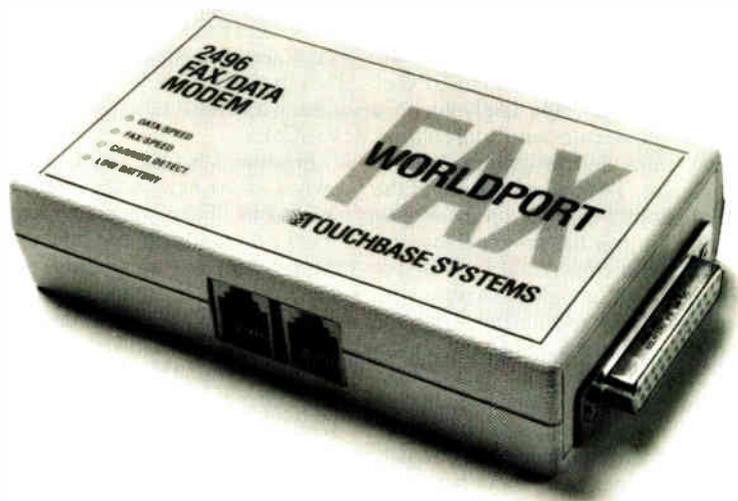
The Second Law—"Silicon is cheaper than iron"—originally referred to bus systems. When first formulated, the Law referred to the S-100 bus versus "all-up" or turnkey machines like the Exidy Sorcerer. In modern times, it's the difference between machines with slots for third-party hardware and those without.

What I meant, then and now, was that it is a lot cheaper to upgrade your system by changing or adding boards than to throw it away and start over. A large part of my original opposition to the Apple Macintosh was because the original Mac was an all-up machine with a proprietary bus and operating system, designed to cut out third-party hardware developers. That tends to be forgotten now that the Mac II has slots.

I see no reason to apologize for the Second Law, but it did lead to the least successful of my predictions. I thought that mass storage systems based on high-

continued

Compact Desk.



This pocket-sized box instantly turns a portable computer into a laptop office. Introducing the WorldPort 2496™ portable fax and data modem.

If your business is like most, fax is a way of life. The WorldPort 2496 is the fax of life on the road.

Weighing less than 8 ounces, with battery, it also runs on AC power and connects to RJ11s or optional acoustic couplers for public phone

use anywhere. Via Bell or CCITT standards. It even sends and receives fax and data messages unattended or while you run other applications.

Suddenly, a laptop in the field is a full communications center. With up-to-the-minute incoming from your host. Overnight outgoing to the branches. And on-the-run faxes to any client. Over pay phones, hotel phones and PBXs worldwide.

Get the WorldPort 2496. It adds the power of your office to the portability of your laptop. And the advantages of a fax to the convenience of your desktop.

Call us today at 800-541-0345 (in New York, 516-261-0423) for more on the WorldPort line and the dealer nearest you.



Touchbase Systems, Inc.
160 Laurel Avenue
Northport, NY 11768
(516) 261-0423
Fax (516) 754-3491

WorldPort 2496 is a trademark of Touchbase Systems, Inc. © 1989 Touchbase Systems, Inc.

POWER DEBUGGING

BOUNDS-CHECKER

*Finds out-of-bounds memory accesses —
AUTOMATICALLY.*

Flush out those Nasty pointer problems and other out-of-bounds memory accesses — AUTOMATICALLY.

Each time you make a change to a program, run BOUNDS-CHECKER while testing the new code. If you accidentally access out-of-bounds memory, BOUNDS-CHECKER will pop up displaying the offending SOURCE LINE. And your program runs at full speed.

Ship Bug-Free Products

You can run BOUNDS-CHECKER while testing your program. There are no additional steps to your testing cycle, but you can feel secure when the program has passed through BOUNDS-CHECKER with no reported problems.

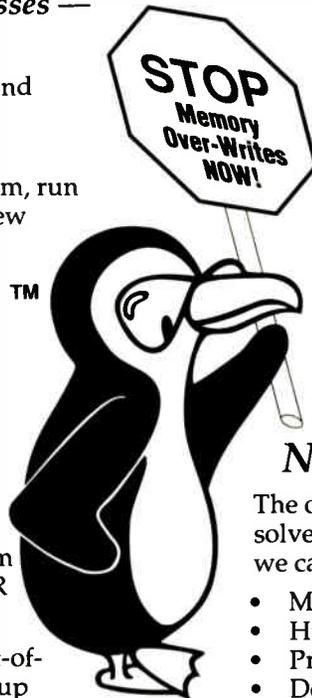
Many over-write problems and other out-of-bounds memory accesses do NOT show up during normal testing. An out-of-bounds memory location may be modified, but that particular location doesn't happen to be important at the time. Once the program is in the field and a certain network is loaded or a certain T&SR or device driver is loaded, that memory location suddenly becomes very important... AND THE SYSTEM CRASHES.

You can prevent these problems by making BOUNDS-CHECKER a standard part of your testing procedure.

Gives you the protection of a protected operating system under MS-DOS.

BOUNDS-CHECKER uses the 80386 virtual machine technology to provide real-time memory protection. In addition BOUNDS-CHECKER uses the symbolic information output by your compiler to differentiate CODE and DATA. When your program is running, BOUNDS-CHECKER protects the program's CODE and all memory outside your program.

Requires 80386 PC.
MS-DOS is a trademark of
Microsoft Corporation.



"BOUNDS-CHECKER and Soft-ICE make sophisticated use of the most powerful versions of Intel's processor family to track down some of DOS programming's most insidious bugs. If you're developing programs for DOS, these are essential tools."

PC Magazine
July, 1990 pg. 48

Soft-ICE 2.5 New Version, New Features

The only debugger specifically designed to solve those problems unique to MS-DOS that we call the DOS Nasties.

- Memory over-writes
- Hung programs
- Program too big to debug
- Debugging T&SRs and Loadable Drivers
- Multiple Symbol Tables
- Supports Microsoft C 6.0 & Turbo C++

MagicCV 3.0 New for C6.0

A set of tools designed to ease the memory crunch with Microsoft C 6.0.

- Run Code View in *Less Than 8k*
- Run CodeView with EMM & VCPI
- Increase heap space when compiling
- Increase memory with make
- Load high T&SR's and device drivers
- VCPI support

BOUNDS-CHECKER \$249
Soft-ICE 2.5 \$386
MagicCV 3.0 \$199

Special Offer...

Buy BC & S-ICE Save \$100
Buy S-ICE & MCV Save \$86
Buy all three Save \$186

30 Day Money-Back Guarantee



CALL TODAY (603) 888-2386 or FAX (603) 888-2465
P.O. BOX 7607 ■ NASHUA, NH ■ 03060-7607 ■ U.S.A.

Circle 211 on Reader Service Card

World Radio History

precision spinning metal would soon go away, to be replaced by some kind of chip-based device: bubble memory, holographic memory, nonvolatile memory chips; I wasn't sure what would do the job, but I was certain something would come up to replace the hard disk.

That's likely to be true sometime in the future; but I thought it would happen well within the decade of the 1980s, and clearly it has not. In my defense, when I said this in 1978, even 10-megabyte hard

disk packs were as large as—and sounded like—washing machines. What I failed to do was to factor in the success of the microcomputer revolution: decentralized small computers not only allowed the design of better hard disk drives, but by controlling robots, greatly lowered the cost of their production.

The Information Revolution

In one of my first BYTE columns, I said that by the end of the millennium, any

member of Western Civilization would be able to get the answer to any question that has an answer—and this at reasonable cost. I see no reason to revise that.

At the time, my only model of electronic networking was the ARPANET, but that proved to be a good harbinger. Now we have a dozen other information utilities, with more coming all the time. We have the beginnings of electronic publishing, with companies like Softserv offering "paperless books." There are commercial information networks like Dialog. There is also BIX, which continues to amaze me: there are few questions I have seen (or asked myself) in my BIX conference that have not been answered, usually within hours. The information revolution continues at an ever more rapid pace.

I am not sure that we have given enough thought to the consequences of that revolution.

The Soviets Are Here

My most bizarre prediction was made in 1980, when I said that the small computer would, by the end of the millennium, bring down totalitarian Communism. The argument was simple enough: armies without sophisticated computing power would be unable to compete. All aspects of modern military power, from outer space to smart bombs to battle management to logistics to tank interception, depend on sophisticated technology, which itself depends on small computers for both its development and its deployment.

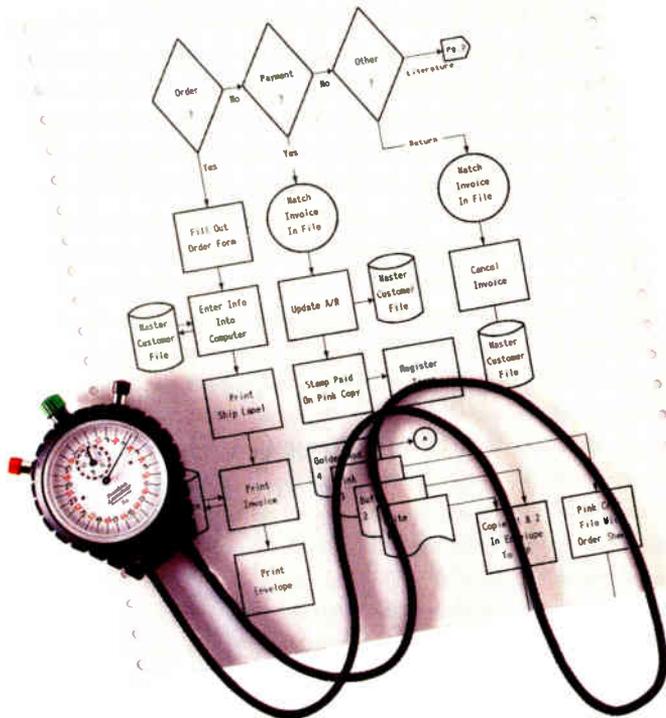
So long as the U.S. had even a marginally rational strategy of technology, the U.S.S.R. was faced with an intolerable dilemma: import or develop computing power, or give up all pretense of being a modern military power. Moreover, such computing power must be *distributed*; keeping a few great Hulking Giants under careful control isn't going to do the job.

As early as 1946, Arthur Koestler said that the sufficient condition for the destruction of totalitarian Communism would be the free exchange of ideas in the Soviet Empire. Distributed computing power automatically brings the free exchange of ideas. The small computer is the ultimate in *samizdat* (self-publishing) capability. It is literally impossible to prevent people with small computers from communicating with each other, nor is it possible to censor what kinds of information they exchange.

The result was glasnost; and that has come so far that ParaGraph, the joint

continued

BY HAND. OR BY NOON.

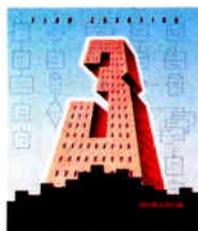


Announcing Flow Charting™ 3

Now, even complex flowcharts that once took days to perfect can be presentation-perfect—in no time!

Quick to master and a snap to use, Patton & Patton's flowcharting software is the standard of both large and small businesses around the world—and is available through all major software dealers.

See your dealer today! Or, for a "live," interactive demo disk, call: **800-525-0082, ext. BY35.** International: 408-778-6557, ext. BY35.



PATTON & PATTON
Software Corporation

Excellence in charting the flow of ideas!

Works on IBM & 100% compatible PC's, supports CGA/EGA/VGA and over 150 dot matrix and laser printers, with multiple print densities and 10 font sizes. **Creates multi-page charts, portrait or landscape, on most standard paper sizes.** Mouse or keyboard controlled.

IBM is a registered trademark of International Business Machines Corporation.

PERISCOPE® IV

New
Version
5

THE *Real* REAL-TIME SOURCE-LEVEL DEBUGGER

With Periscope Model IV, you can debug your software while it runs at full speed, something *no* software-only debugger can do.

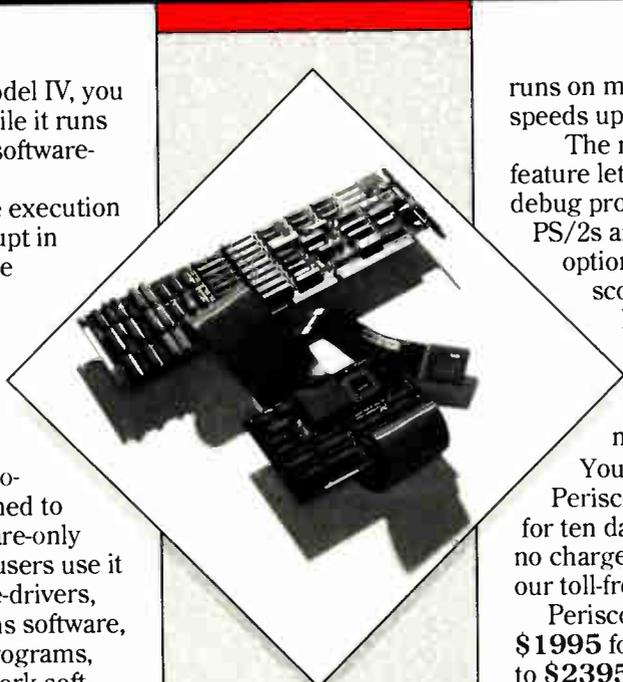
You can also examine the execution history of a hardware interrupt in Periscope IV's real-time trace buffer, something *else* no software-only debugger can do.

When The Going Gets Tough... Periscope IV helps you debug most any program, but is specially designed to debug programs that software-only debuggers can't. Model IV users use it to debug TSRs, ISRs, device-drivers, DOS, BIOS, communications software, real-time data acquisition programs, multitasking software, network software, keyboard drivers, disk caching software, systems software, spread sheets, EMM products, and so forth.

"Periscope is my #1 favorite program... I would rather change my editor than my debugger," writes Phil Mayes, who used Periscope IV to track down some very elusive bugs causing intermittent corruption.

Periscope IV provides source-level support for popular PC compilers and linkers, such as those produced by Microsoft, Borland, and others, and it

The Periscope manual, software, break-out switch and quick-reference card are included with Model IV.



"The Model IV hardware really makes Periscope shine, especially when you've got timing-related problems. I can now track down changing pointers and altered buffers on my 386. I've been using it to debug Crosstalk® Mk. 4 and there's just no better way to do it."

JEFF GARBERS
Director of Software
Development
Crosstalk Communications

runs on most any 80286 or 80386 at speeds up to 25MHz.

The new Remote Debugging feature lets you use Periscope IV to debug programs running on IBM PS/2s and compatibles. The optional Plus board keeps Periscope from using any of the lower 640K, so Periscope can't be overwritten and doesn't use the memory your program needs.

You can try Periscope IV for ten days at no charge before you buy it. Call our toll-free number for details.

Periscope IV prices range from \$1995 for a 16 MHz 80286 system to \$2395 for a 25MHz 80386 system. The optional 512K Periscope PLUS board is \$400.

Given the value of your time, can you afford *not* to try it?

**Call Toll-Free Today for
More Information or to
Order Your Periscope:
800-722-7006**

In the UK call Roundhill Computer Systems at 0672 84 535. In Germany call H+B EDV at 07542 6353 or ComFood at 02534 7093. In Sweden call LinSoft at 013 124780.

The
Periscope
Company, Inc.

1197 Peachtree St., Plaza Level
Atlanta, GA 30361
404/875-8080 • FAX 404/872-1973

Circle 295 on Reader Service Card (RESELLERS: 296)

venture of the U.S.S.R. and the U.S. that I described in the August issue, had a booth at Spring Comdex, the first attendance of a Soviet firm at a U.S. computer trade show. Two years ago, Soviet citizens coming to the U.S. had to stay in groups, and they were usually shepherded by large men in ill-fitting brown suits. No more.

ParaGraph was demonstrating their Cyrillization programs, which will automatically install Cyrillic characters and fonts into a number of word processing programs; if you write or publish in Cyrillic, call ParaGraph at (800) 872-8777 to get the details.

Incidentally, ParaGraph is not the only company with Cyrillic capability: Bob Wallace's successful shareware PC-Write Lite now has a Cyrillic module.

The Next Revolution

In the 15 years since BYTE was founded, we have seen incredible changes in the hardware available to us. The 486 I now have on my desk (under it, actually; it's in a tower configuration) has far more power than did the Hurling Giants of 1975. This trend hasn't stopped. Micro-

computers will become increasingly powerful for lower and lower costs.

The microcomputer revolution has irretrievably changed the way we do business. It has brought glasnost, if not perestroika, to the U.S.S.R. (see my August column). The development of information networks and utilities continues apace. What remains?

I think the next great impact will be on the schools. Earlier this decade, a Presidential Commission on Education reported that "if a foreign government had imposed this system of education on the U.S., we would rightly consider it an act of war." Another report noted the similarity—in both organization and results—of the U.S. school system to the Soviet system of collectivized agriculture. Little to nothing has changed since those reports—indeed, in some places things are worse, not better.

On the other hand, the computer has had almost zero impact on American education. This is in part because there is no decent educational software, in part because we've yet to have really widespread distribution of small computers into the educational system, and in very

large part due to the resistance of the educationist establishment, which fears these machines as the Soviet *nomenklatura* rightly feared the introduction of microcomputers into the U.S.S.R.

All this will change in the next decade. As I write this, IBM is announcing new emphasis on computers intended for the home and the schools, with introduction of new machines designed to compete in those markets. Commodore has come out with a new machine for home and school. The makers of Nintendo game systems have plans. Philips/Polygram continues development of Compact Disk Interactive drives. CDI will certainly have a major impact on the information revolution. And the installed base of the CD-ROM doubles each year as the price of CD-ROM drives falls.

As the installed base of really powerful home computers grows without limit, the schools will be unable to resist bringing these machines into the classrooms. With such large market potentials, capital will be available to write and promote exciting new educational software.

Even more impact will come from the *continued*

THE FIRST NAME IN TRUE OEM COMPATIBILITY

NATIONWIDE
1-800-292-6272

FAX MARYLAND LOCAL
1-301-561-4659 1-301-561-0200

Hours: Monday - Friday
8:00 a.m. - 6:00 p.m. EST



WE ACCEPT PURCHASE ORDERS & CHECKS

Use of Equipment manufacturer's names is for identification only. NCRC is in no way affiliated with the OEMs listed.

NATIONAL COMPUTER RIBBONS®

9566 Deereco Road • Timonium, Maryland 21093

90 DAY NCRC GUARANTEE

We have always believed that no sale is complete until the customer has received total satisfaction from our products. We will never, knowingly, disappoint you. If for any reason your purchase does not give you complete satisfaction, the full purchase price will be cheerfully refunded upon return of the merchandise.

Philip E. Boringner, President

By buying from the manufacturer you are guaranteed the freshest ribbons, highest quality and fastest service.

We manufacture our products with the blackest matrix inks, premium high density nylon, precision engineered plastics and "Aem" air refrigerated loading equipment.

Minimum Order 6 Ribbons

COLORS
BLUE - GREEN - PURPLE - RED
Nylon Only

CARTRIDGE RIBBONS (NYLON)

No.	Description	Price Ea. (Black)
180	Apple Imagewriter II 4/C	9.75
114	Apple Imagewriter	3.75
127	Brother M 1509/1709	6.65
104	Canan A-1200	5.65
109	Centronics 350/351/352/353	10.75
118	Citizen LSP 1200/1800	5.65
169	Citizen MSP 10/20	3.15
170	Citizen MSP 15/25	4.45
123	Comrex 420	8.65
131D	Data Products B-300/600	6.25
140	Epson DXF 5000	22.85
280	Epson EX 800/1000	5.35
165	Epson FX/MX/RX 70/80/85	3.15
167	Epson FX/MX/RX 100/185/186	4.45
288	Epson Lq500/Lq800/Lq850 H.D.	4.45
289	Epson Lq 1000 H.D./Lq 1050	5.65
163	Epson Lq 1500	3.75
281	Epson Lq 2500 H.D.	5.65
283	Epson Lq 2550	5.65
283C	Epson Lq 2550 4 color	23.00
287	Epson Lq 950	5.25

No.	Description	Price Ea. (Black)
175	Epson LX 80/90	3.15
145	Hewlett Packard 2631A	13.85
181	IBM 3287/3615 SD Loop	2.25
195	IBM 3287/3619 SD Cart	3.15
188	IBM 4201 ProPrinter II	4.75
176	IBM 4202 ProPrinter XL	5.65
177	IBM 4207 ProPrinter X24	5.65
211	IBM 4208 ProPrinter XL24	7.35
184	IBM 4224	12.95
875	IBM 4234	26.35
286	Mannesmann Tally 85	5.05
285	Mannesmann Tally 86	5.65
204	Mannesmann Tally 120/160	3.85
205	Mannesmann Tally 140/80	4.45
660	NEC Pinwriter P1/P2/P6	4.55
661	NEC Pinwriter P3/P7	5.05
662	NEC Pinwriter P5/P9	5.05
663	NEC P2200 H.D.	6.95
210	NEC 5200/5300 Nylon	6.85
210M	NEC 5200/5300 M/S	11.75
210C	NEC 5200/5300 4 color	23.00
209	Okidata 182/183/192/193/320/321	4.55

No.	Description	Price Ea. (Black)
206	Okidata 292	6.15
208	Okidata 293/294	7.05
212	Okidata 393	14.95
215	Panasonic KXP 1124	5.65
217	Panasonic KXP 1080/1091	4.55
216	Panasonic KXP 1190	7.95
220	Panasonic KXP 1524	9.15
221	Panasonic KXP 1624	10.25
226	Radio Shack DMP 400/LPV1	3.75
282	Radio Shack/DMP 130	4.75
282	Seikosha SP800/1000	4.75
261	Star Micronics NB/NL/NP/NX 10	4.55
264	Star Micronics NL/NP/NX 15	6.65
286	Star Micronics NX 1000	4.25
266C	Star NX 1000 4 color	9.85
267	Star Micronics NX 2400	5.45
262	Star Micronics Radix 10/SR10	4.55
263	Star Micronics Radix 15/SR15	5.25
245	Toshiba P321/P351	3.95
245	Toshiba P1340/P1350/P1351	3.95
246	Toshiba P321SL/P341SL	5.85
247	Toshiba P351SX	6.55

No.	Description	Price Ea. (Black)
135	Tritel	3.25

CARTRIDGE RIBBONS (FILM)

(correctable / multi-strike)

307	Brother EM200 HR15/M/S	4.75
158	Diablo Hytype II M/S	3.75
202	NEC 3500/8800 M/S Flip	6.05
320	IBM Selectric II H.Y. Corr	2.75
171	IBM Actionwriter Corr	4.50
334B	Olivetti ET 121/351 M/S	5.55
227	Ricoh 1300/1600 M/S	3.75

TWIN SPOOL (NYLON)

454	Decision Data 6807/6711/6814	9.15
456	Dec writer LA 30/36	3.35
462	IBM 3262/5262	6.55
465	IBM 3525 T/S	4.05
464	IBM 5225/5250/5280	19.15
470	Okidata 80, 82, 92, 93	1.65
467	Printronix 150/300/600	6.55
470	Star Micronics Gemini 10/10X	1.65

"CALL US FOR VOLUME DISCOUNT PRICING"

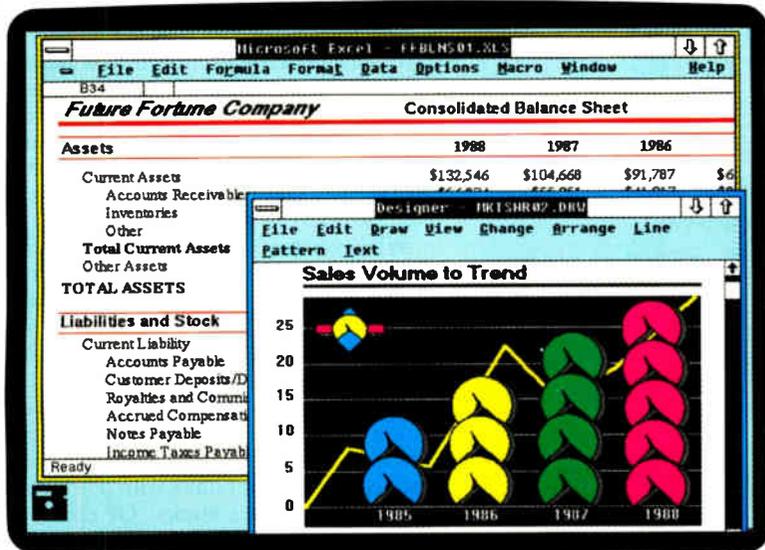
*This is only a partial list of our products. *Prices subject to change without notice. *\$5.00 shipping and handling charge on all orders under \$50.00 Over \$50.00 actual freight is charged.

Try our products and see why 100,000+ customers are now using National Computer RIBBONS brand products.

WE ALSO SELL ALL OEM ORIGINAL BRAND RIBBONS

Look familiar?

Then this \$50 upgrade will look great.



If this looks like your current version of Windows, you can upgrade for just \$50.



You may have received Microsoft Windows with your hardware. If you did, you can save \$99 with this upgrade offer.



Check out your software because if it works within a Windows environment, you're in luck.

If you are using Microsoft® Windows™, the best thing about this offer, besides the special upgrade price, is that you'll now have access to all the memory in your PC. Not to mention that you can keep using your existing MS-DOS® applications, multitask with other Windows applications, and network more easily.

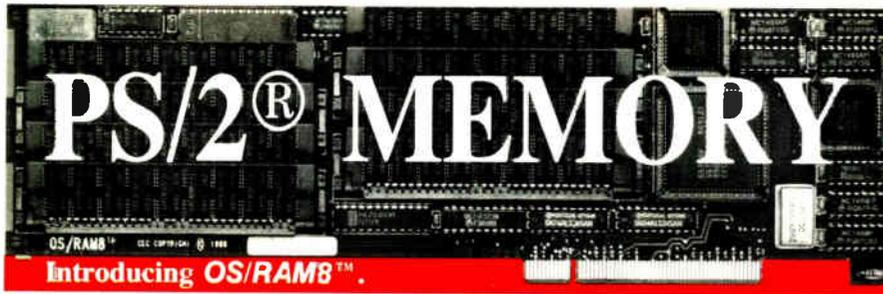
All the popular Windows applications have already been updated to utilize Windows 3.0's powerful capabilities. And most are offering low-cost or free updates. So if you have any version of Windows—including runtime Windows—give us a call. We'll upgrade your copy of Windows, help you update your applications, and answer any questions you may have.

But make sure and call for your \$50* Windows upgrade before September 15, 1990. You'll save \$99 off the suggested retail price of \$149. And you'll be using Windows 3.0. Which will make you look great.

To get your Windows upgrade for just \$50, call (800) 323-3577, Dept. L53.

Microsoft
Making it all make sense™

© 1990 Microsoft Corporation. All rights reserved. Microsoft, the Microsoft logo and MS-DOS are registered trademarks and Making it all make sense and Windows are trademarks of Microsoft Corporation. *Offer good only in the 50 United States. Payment in U.S. funds (plus a \$5.50 shipping/handling fee and applicable sales tax). Please allow two to four weeks for delivery.



- 8 Mbytes of memory + 2 serial ports.
 - Extended and expanded memory. LIM 4.0.
 - Works with all of your programs.
 - Run DOS or OS/2 effortlessly.
 - Fast and simple switchless installation.
 - Auto-configuration for all operating systems.
 - Works in all Micro Channel™ computers.
 - Expanded memory 10 times faster than Intel.
 - Risk free guarantee. Two year warranty.
 - IBM approved ID. Best price. Fast delivery.
- Call today 1-800-234-4232 or 617-273-1818



Capital Equipment Corp.
Burlington, MA. 01803

PS/2 and Micro Channel are trademarks of IBM

development of new authoring tools. Owl International's Guide, Apple's HyperCard, Microsoft QuickBASIC, and other such programs will let the ordinary user develop sophisticated educational programs.

We'll have a lot of false starts. The centralists will try to dictate the form and content of educational software, and for a while they will succeed, as they have generally succeeded in controlling textbooks. But they will not be successful enough. Large U.S. corporations are already concerned that the schools aren't producing graduates with enough education to be put to work without extensive reeducation and training. Most companies remain snowed by educationist hype, but business by its very nature demands results; and there will come a time when business itself will, in self-defense, begin educating not only its employees, but their children.

I have earlier proposed that large corporations provide their employees not only day care, but on-site schools for their children; and that they demand that the teachers in these schools *get results*, not offer excuses for why the kids didn't learn anything. I think this will happen; and that these and other private schools will be a sufficient market for educational software that actually accomplishes something.

Meanwhile, many classroom teachers will despair of changing the system and will begin to make use of educational software that works. After all, most teachers don't want kids to fail. Many have been taught so many "diagnostics," which is to say excuses for failure, that they no longer expect the children to succeed; but most teachers hate that, and if they can be shown that there are methods that work, they'll adopt them.

It will be a long and difficult battle, as difficult as anything that has happened yet; but in my judgment, the small computer will bring decentralization—perestroika—to the American school system as surely as it has brought glasnost to the U.S.S.R.

The Real Hit of the Show

Normally, it's a bit hard to pick the most impressive item at Comdex: not only is there a lot to choose from, but there's no way to be sure that what they're demonstrating is real.

This time it was easy: a week before I came to Comdex, Larry Aldridge of Sterling Microsystems (3164 East La Palma, Suite K, Anaheim, CA 92806, (714) 632-7429) brought over the new Cheetah Gold 486. Larry puts together systems based on the Cheetah motherboard. The Gold 486 is itself one fantastic bit of hardware; and in it was the Per-

ceptive Solutions, Inc. (PSI) hard disk drive controller.

The PSI Hyperstore 1600 card uses configuration modules to run as an MFM, RLL, ESDI, or SCSI controller; in the SCSI version, it will let you chain CD-ROM drives to the controller. Whatever configuration, this system is *fast*, blindingly fast, so fast I'd have suspected a trick if I hadn't been running this myself. Now understand, to get the kind of performance I'm getting, you need a superfast computer like the Cheetah Gold 486; hanging the PSI controller on your old AT will improve performance, of course, but you need a really hot machine to take full advantage of it.

When you have both, the result is little short of amazing. As an example, normally to run DataDesk Animator, you want to load the images into a RAM disk or into extended memory. With the PSI controller, you don't have to: this will run those images directly off the hard disk at any speed you'd ever want. It does it smoothly, with no jerks or glitches; indeed, the disk light blinks with perceptible pauses between blinks. Of course, the light isn't supposed to stay on; the PSI system uses all kinds of tricks with cache memory to anticipate what the program will need and be ready to provide it. As PSI Vice President Eric Lenington put it, "If that light stays on, we haven't done the job right."

I haven't had the PSI controller long, but I'd say the company has done the job heroically.

DPT

My Cheetah 386 has a Distributed Processing Technology (DPT) hard disk drive controller, which was the fastest controller we knew about back when Big Cheetah was put together. That controller has been in continuous use, 16 hours a day of hard usage and left turned on the other 8 hours about 90 percent of the time, and has performed extremely well.

Bill Godbout used to say that if the error rate is large enough to measure, it's too large; I feel the same way. In the past year plus that I've used the DPT controller with Big Cheetah, I've had precisely two incidents in which I got retry errors in reading or writing to the hard disk. In both cases I tried to get them to repeat, couldn't, and finally saved all my work and hit the Reset button just in case. My guess is that the problem had nothing to do with hardware at all, but was some clash resulting from multitasking under Desqview; and neither incident lost me any data.

In other words, the DPT controller has

CHAOS MANOR

been both very fast and very reliable for over a year, and I can unhesitatingly recommend the product.

I told the DPT people about the PSI controller's performance. They were aware of the company. DPT has not been standing still and has improved their controller since they sent me the one I use. The upshot is they'll send their newest, the PM3011/70, which I'll install in the Cheetah Gold 486; meanwhile, I'll put the Hyperstore 1600 into Big Cheetah. Then I'll run speed tests, so we can see just what performance is due to the computer and what's due to the controller. I should have that information next month.

Meanwhile, I love it when two really competent outfits compete to give us better performance; the whole industry benefits, especially when it's something as fundamental as a hard disk drive controller. Stay tuned.

New Speed Tests

Everyone has system and disk speed tests. The BYTE Lab has one you can get copies of. So do most other magazines. I even devised one myself: filling two matrices, multiplying them together, and summing the elements of the result. Mine had the advantage of doing a lot of both floating-point and integral arithmetic.

For disk speed tests, I tend to use the Coretest utility; this gives you a lot of information and compares your machine with a number of "standard" machines. The Coretest index is based on both data transfer rate and seek times, and people I trust say it's the best speed index there is (see table 1).

For general speed testing, I've tended to use my matrix test, but in fact I got away from doing that during the past year or so.

At Comdex, Robert Hurt handed me yet one more system test. I've known Hurt for some time, and I tend to respect his judgment. Anyway, it's called the Landmark System Speed Test and is distributed by Hurt's Landmark Research International. They needed it: they were demonstrating what they called "the fastest computer in the world," to wit, a 486 jacked up to 44 MHz. The chip was cooled by a gadget known as Icecap, which stands about 4 inches tall—they had to saw away part of the disk bay to get it into the machine—and has some kind of active refrigeration.

The Landmark test's great merit is that you can't peg the meter: it will measure computer speeds beyond anything we're likely to have in this century. Incidentally, Landmark has some other neat

stuff, including a kit for cleaning, testing, and aligning floppy disk drives; write for their flier. Core International makes disk systems as well as the test program.

It's hard to tell just how accurate the Landmark test is, but I've just tried it on nearly every machine in the house, and it seems to work just fine; certainly the results are about what you'd expect (see table 2).

It also shows the very respectable performance of the Premier 9000, and the truly awesome speed of the Cheetah Gold 486 with the Hyperstore 1600 controller.

DR DOS

I'm often credited with making CP/M the standard back in S-100 days. True or not, I've always had a soft spot in my heart for Digital Research; the full story of why the company didn't make a deal with IBM—and how Seattle Engineering got its first DOS, which it sold to Microsoft—hasn't yet been told in print. Perhaps one day I will.

I've been experimenting with a beta version of DR DOS 5.0; this version works with Microsoft Windows 3.0, although I understand that Microsoft tried a number of tricks to prevent that. What it *doesn't* work with is the new Cheetah Gold 486. "Timing problems," I'm told,

that will be fixed Real Soon Now.

In fact I rather hope so, because there are good features in DR DOS. DR DOS's main claim to fame is *enormous* temporary program areas; we were getting as much as 639K bytes of free memory with VGA! (It would be 1K byte larger—yes, 640K bytes of free RAM—but the Hyperstore 1600 uses 1K byte out of main memory.) It's said to work with Desqview.

It has a number of features MS-DOS doesn't have or doesn't do well. It also comes with a quite competent 386 memory management program, standard, that claims "VCPi compatibility"—meaning that programs that use extended memory, such as Lotus 1-2-3, AutoCAD, and Mathematica, can run directly.

I'd sure like for DR DOS to be a success, if only to give Microsoft some competition: look how much better QuickBASIC got when Borland came out with Turbo Basic.

Alas, we've run into problems. We can't make their 386 memory manager work with AutoCAD; nor will QEMM-386 5.0 behave properly with DR DOS. Desqview runs only with no memory manager installed at all.

I want DR DOS to work, but it's not quite there yet. However, when I sent a draft of this column to Digital Research,

continued

PS/2® MEMORY

Introducing OS/RAM32™

- ✓ 8 Mbytes of fast 32 bit memory.
- ✓ Works in all Micro Channel™ computers.
- ✓ Fast LIM 4.0 driver included.
- ✓ Provides extended and expanded memory.
- ✓ Easy switchless installation.
- ✓ Automatic configuration for DOS, OS/2 or UNIX.
- ✓ Risk free guarantee. Two year warranty.
- ✓ IBM approved ID. Fast delivery.
- ✓ From \$299 to \$1249 with 8 Megabytes.
- ✓ PC Magazine "Hot Prospect" 1/16/90.

Call today 617-273-1818 or 1-800-234-4CEC

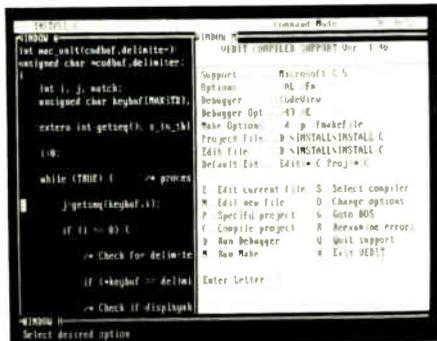
cec Capital Equipment Corp.
Burlington, MA. 01803

PS/2 and Micro Channel are trademarks of IBM

Finally, a fast, powerful text editor that integrates your favorite

VEDIT PLUS

programming tools and uses no memory!



- Mouse support
- Pull-down menus
- Columnar blocks
- 1000 Level Undo
- Regular Expressions
- Small 70K, super fast
- DOS, UNIX/XENIX, FlexOS
- Also VEDIT \$69, VEDIT Jr. \$29



**FREE Evaluation Copy
Call 1-800-45-VEDIT**

The new VEDIT PLUS is the productivity breakthrough programmers have been looking for. Run not only popular compilers, but all of your favorite tools from within the editor. When shelling to DOS, VEDIT swaps itself and any desired TSRs out of memory to give you more memory than when you entered VEDIT.

Only VEDIT gives you the advantages of a powerful and flexible editor without giving up the convenience of an integrated environment.

VEDIT offers stunning performance, versatility and ease of use. Completely written in assembly language, it's small and lightning fast. Edit text and binary files of any size, even 100+ megabytes. Installation is trivial; VEDIT.EXE and an optional help file are all you need - no overlays, no configuration files.

Other features include multiple file editing, windows, unlimited keystroke macros, "hot keys", context sensitive help, word processing, automatic indenting and total configurability. VEDIT has been the choice of 100,000 programmers, writers and engineers since 1980.

VEDIT PLUS adds a powerful "off the cuff" macro programming language, complete with source level debugging.

VEDIT PLUS - \$185 for DOS, \$285 for UNIX/XENIX. Call for a free demo today.

Greenview

P.O. Box 1586, Ann Arbor, MI 48106
(313) 996-1299 * Fax (313) 996-1308

CORETEST RESULTS

Table 1: The Coretest measures the performance of a computer based on the data throughput of its hard disk drive system.

Machine/controller	Data transfer (KB/sec)	Average seek (ms)	Track-to-track seek (ms)	Performance index
Cheetah 486/PSI	1519.5	0.3	0.7	223.7
Cheetah 386/DPT	620.2	1.4	1.1	42.0
Premier 9000	788.8	15.1	2.8	8.3
IBM PS/2 80 (70-MB)	800.0	36.0	15.0	6.3
Compaq 386/20	375.0	26.0	4.0	4.3
Kaypro 386/Perstor	159.8	25.2	3.9	3.1
Zenith Z-248	241.7	31.8	6.7	3.2
IBM XT (10-MB)	85.0	79.0	31.0	1.2

LANDMARK SYSTEM SPEED TEST RESULTS

Table 2: The Landmark System Speed Test rates the computers in megahertz relative to an IBM AT running at 6 MHz with an 80287 math coprocessor.

Machine	CPU (MHz)	FPU (MHz)	Video (characters/ms)
Cheetah 486	82	196.0	1321 ¹
Premier 9000 (386)	49	N/A	1321 ¹
Cheetah 386	22	44.0	892 ²
Goldstar 386	19	N/A	1962 ³
Kaypro 386	15	15.7	774 ⁴
Zenith Z-248 (286)	10	5.3	473 ⁴

¹ Tseng Laboratories video chip.
² Video Seven.
³ Paradise Systems Super VGA.
⁴ EGA.

it sparked a flurry of activity; we now have a DR DOS that appears to work with 386 machines; and they're working on the 486 version. More next month, but it looks as if they are moving on this.

Ad Lib Visual Composer

I am not musical. I can't sing, I don't play any instruments, and I can't read music. However, Mrs. Roberta Pournelle was a music major in college and has sung professionally; the result is that I'm a founder member of the Los Angeles Opera Association, and we go to all the opening nights.

Despite not being musical, I've always liked what's usually called "classical music," and since what I grew up to regard as "popular music" no longer exists except as "golden oldies," I tend to keep my radio fixed on KUSC, the local good-music station. I have, therefore, developed some store of knowledge about classical opera. I've also learned to hate most modern opera. As for minimalism, as

KUSC's Jim Sveda says, common sense tells you there isn't much there, even if politeness makes us pretend there is.

It was with some trepidation, therefore, that I went to the world premiere of two "fantastic" modern operas based on the children's books by Maurice Sendak: *Higglety Pigglety Pop!* and *Where the Wild Things Are*. In fact, they were quite interesting: the staging was excellent, the actors were good, the costuming was superb.

The only problem was the music by Oliver Knussen: there wasn't much, and certainly there were no arias; in fact, there wasn't a bar of it that couldn't have been something else.

I'd be willing to bet that with the possible exception of the conductor, no one hearing the same opera again with similar but different music would know the difference—with the possible exception of a very irritating repetitive atonal line always ending in the word *hot* sung in a

continued

Everything You Ever Wanted In UNIX. And Less. \$99.95*

OK. We know it's hard to believe. So just consider this. Coherent™ is a virtual clone of UNIX. But it was developed independently by Mark Williams Company. Which means we don't pay hundreds of dollars per copy in licensing fees.

What's more, Coherent embodies the original tenet of UNIX: small is beautiful. This simple fact leads to a whole host of both cost and performance advantages for Coherent. So read on, because there's a lot more to Coherent than its price.

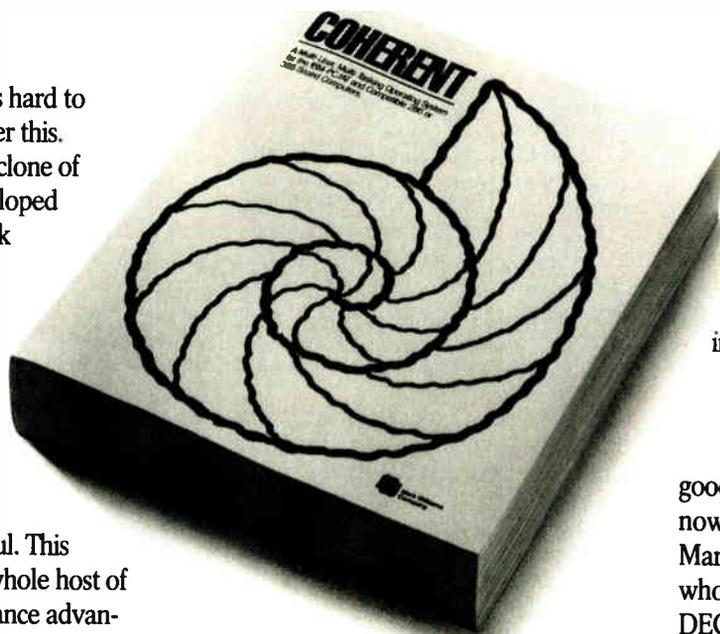
SMALLER, FASTER... BETTER.

Everybody appreciates a good deal. But what is it that makes small so great?

For one thing, Coherent gives you UNIX capabilities on a machine you can actually afford. Requiring only 10 megabytes of disk space,

LESS IS MORE!	Coherent For the IBM-PC/AT and compatible 286 or 386 based machines.	Santa Cruz Operation's XENIX 286, Version 2.3.2
No. of Manuals	1	8
No. of Disks	4	21
Kernel Size	64K	198K
Install Time	20-30 min.	3-4 hours
Suggested Disk Space	10 meg	30 meg
Min. Memory Required	640K	1-2 meg
Performance*	38.7 sec	100.3 sec
Price	\$99.95	\$1495.00

*Byte Exec benchmark, 1000 iterations on 20 MHz 386. Hardware requirements: 1.2 meg 5¼" or 1.4 meg 3½" floppy, and hard disk. SCSI device driver available soon. Does not run on Microchannel machines.



Coherent can reside with DOS. So you can keep all your DOS applications and move up to Coherent. You can also have it running faster, learn it faster and get faster overall performance. All because Coherent is small. Sounds beautiful, doesn't it?

But small wouldn't be so great if it didn't do the job it was meant to do.

EVERYTHING UNIX WAS MEANT TO DO.

Like the original UNIX, Coherent is a powerful multi-user, multi-tasking development system. With a complete UNIX-compatible kernel which makes a vast world of UNIX software available including over a gigabyte of public domain software.

Coherent also comes with Lex and Yacc, a complete C compiler and a full set of nearly 200 UNIX commands including text processing, program development, administrative and maintenance commands.

And with UUCP, the UNIX to

UNIX Communication Program that connects you to a world-wide network of free software, news and millions of users. All for the cost of a phone call.

We could go on, but stop we must to get in a few more very important points.

EXPERIENCE, SUPPORT AND GUARANTEES.

Wondering how something as good as Coherent could come from nowhere? Well it didn't. It came from Mark Williams Company, people who've developed C compilers for DEC, Intel, Wang and thousands of professional programmers.

We make all this experience available to users through complete technical support via telephone. And from the original system developers, too!

Yes, we know \$99.95 may still be hard to believe. But we've made it fool-proof to find out for yourself. With a 60-day money-back no-hassles guarantee.

You have to be more than just a little curious about Coherent by now. So why not just do it? Pick up that phone and order today.

You'll be on your way to having everything you ever wanted in UNIX. And for a lot less than you ever expected.

1-800-MARK WMS
(1-800-627-5967 or 1-708-291-6700)
60-DAY MONEY BACK GUARANTEE!



Mark Williams Company
60 Revere Drive
Northbrook, IL 60062

*Plus shipping and handling. Coherent is a trademark of Mark Williams Company. UNIX is a trademark of AT&T. XENIX is a trademark of Microsoft.

CD-ROM



NEW!

Guaranteed
Lowest Prices!

Microsoft CD-ROM Special

CD-ROM drive kit with Bookshelf	\$849
CD-ROM drive kit with Bookshelf and Programmers Library (LAN)	1169
Bookshelf essential writing reference	Call
Programmers Library on-line reference	Call
Stat Pack business research statistics	145
Small Business Consultant management tool	120

NEC CD-ROM Special

CDR-72 CD-ROM Drive ext. PC & Mac	\$Call
CDR-82 CD-ROM Drive int. PC	Call
CDR-35 CD-ROM Drive ext. smallest, lightest	Call
Clip Art 3D 2,500 3-D images, PC & Mac	Call
Image Folio 4,000 photos, VGA format, PC	Call
Type Gallery Adobe or Laserjet typefaces	Call
Image Gallery Clip art library, PC & Mac	Call
Photo Gallery Tiff format photos, PC & Mac	Call

PC Sig Library



The definitive software and public domain software collection. The newest version containing the equivalent of over 1400 floppy disks on one CD-ROM disc, including:

- word processors, spreadsheets, databases
- teaching and educational software
- business and financial software
- communications software
- language and utilities programs
- graphics and games
- entertainment and home software
- and more...

\$465

Knowledge Access

KAware CD-ROM Development System

KAware Disc Publisher full featured development system - prepare, index, access & distribute info on CD-ROM. For publishers & info managers with technical documentation, images, catalogs, lists, reference databases & more. Retrieval features: keyword/hypertext/Boolean searching, menus, pull down windows, user added notes & export other programs.

KAware Disk Publisher/Full Text	\$795
KAware Disk Publisher/Fielded	\$795
KAware Disk Publisher/Image	\$795

Bureau Best Sellers

Between Heaven & Hell	Oxford English Dictionary
CD Guide on CD-ROM	Oxford Textbook of Medicine
CIA World Fact Book	McGraw Hill Encyclopedia
Computer Library	Whole Earth Catalog
Grolier Encyclopedia	Guinness Disc of World Records
Movie Database	US Patent Database

NEW! U.S. History on CD-ROM

Essential reference over 30,000 pages covering the full spectrum of U.S. History from 1600 to 1990 \$395

Pioneer 6 disc Minichanger

DRM-600 CD-ROM Drive gives you up to 6 CD-ROM discs on-line for over 3 Gigabytes \$1395

MORE! Over 200 different titles and drives in-stock for the PC and Mac

Free subscription to CD-ROM End User with every order!

Money back guarantee Free tech support

Call - special drive/little combo's

Call - FREE on-line CD-ROM access!



Overnite
Delivery

Bureau of Electronic Publishing, Inc.

Dept. Q, 141 New Road, Parsippany, NJ 07054
Fax # 201-808-2676

Call: 1-800-828-4766 orders only

(201) 808-2700 information

falsetto rising tone. So it goes.

But it got me to thinking. I recently installed the Ad Lib Synthesizer Card in the Cheetah Gold 486. I confess I did that largely for games: many games now use the Ad Lib sound system. The Railroad Tycoon game sounds great with the Ad Lib system. The card doesn't require any software overhead, so except for using up a slot, it's no problem to have it there; and adding it gives your PC about the same sound capability as the Mac.

The Ad Lib card came with the Visual Composer program. This, it turns out, is extremely easy to use: when you invoke it, the program comes up with a display of a piano keyboard over on the left. Click on a key, and it plays. You can also click in the grid-lined space out to the right of the keys, and any notes put there will play when you tell the program to play your "tune."

You can put in notes in the "first voice," adjust them until you like them, and then add the "second voice." Notes put in that voice will play simultaneously with those in first, but nothing you do in second voice mode will affect first voice. When you have those two right, you can add a third—up to 11 voices, each independently editable. You can play any single voice, or all at once. There is also a whole bunch of preset instrument sounds you can add.

When we got back from the opera, I put up Visual Composer and began noodling around. The results are a bit weird, but I like it better than what I heard at the Music Center. I've heard that the opera *Holy Blood and Crescent Moon* was written on a computer by a man who doesn't read music. Maybe I'll be able to do something of the sort. As a writer, I should be able to do my own libretto. I suppose if I do attempt an opera, I'll need the MIDI Supplement, which lets you attach a MIDI device, play on that, and record the result. I'll also need Instrument Maker, which lets you create new instrumental sounds.

The program will copy, cut, paste, and transpose. The notation is *not* standard music notation, and if there's a way to get it to print in standard notation, I haven't found it. This is a severe limit to using it for professional work.

There are better programs for the Atari ST and the Amiga that really do print out in standard music notation, but the Ad Lib card and program are a start. I know you can do some pretty good music for it, because many games now have tunes as well as sound effects. I would be willing to bet that in five years there won't be many PCs without really good

sound capability.

Incidentally, I play the Ad Lib music through a \$25 set of battery-powered amplified speakers I got at Radio Shack; I can also input it into my stereo system. Either works fine.

LANtastic

Artisoft started off as a tiny little outfit at Comdex with a display out in the periphery; now their booth is right near the BYTE booth, which shows there's some justice in the world, because Artisoft's LANtastic is one neat product (see "Networks of Peers," June BYTE).

My friend Greg Bear, retiring president of Science Fiction Writers of America (I can say from experience that retiring from *that* job is one heck of a relief), uses LANtastic in an unusual way. He has a 286 machine set up as a server: it has a backup hard disk drive, an Amdek Laserdek CD-ROM drive, and some other stuff. This links with LANtastic to his 386 system running Windows/386. In one window of that, he has the CD-ROM with Microsoft Bookshelf running underneath WordPerfect 5.1. The window has to be 544K bytes in size; anything smaller would crash. Fortunately, LANtastic takes up only about 16K bytes of regular RAM; the rest is stuffed up into extended memory. With Windows/386, you can just manage.

I intend to set up my system that way, with two Denon CD-ROM drives, the Maximum Storage WORM (write once, read many times) drive, and a Bernoulli Box on a 386 clone server; the whole mess will link with the Cheetah Gold 486 through LANtastic. While I'm at it, I'll set up Mrs. Pournelle and John Carr with LANtastic networking capability as well. The only reason I haven't done it yet is that I'm still experimenting with DR DOS; pretty soon I'll decide whether to keep that or dump it, and I can get to work. Whether I'll use Windows or Desqview isn't yet decided.

LANtastic is available either as coaxial connected Ethernet or in the older 2-megabit-per-second twisted-pair configuration. It's a true peer-to-peer network—no net server required, so my designation of the "service machine" as a "server" isn't really correct. They've recently greatly improved the installation procedure so that it's understandable for ordinary people. They have also added speech-synthesizer capabilities: you can now telephone over LANtastic and leave a message in your own voice. They're working on a program that will let you program speech synthesis as well, but

continued

THE NEW STANDARD FOR HIGH PERFORMANCE STATISTICAL SOFTWARE

CSS

COMPLETE STATISTICAL SYSTEM

WITH DATA BASE MANAGEMENT

AND GRAPHICS

A powerful, comprehensive, elegant, and super-fast statistical package for IBM (PC, AT, PS/2) and compatible computers. ■ The CSS optimized user interface with fast hierarchical menus incorporates elements of artificial intelligence; even complex analyses require only a few keystrokes (batch processing is also supported). ■ CSS features comprehensive, state of the art implementations of: *Basic statistics, Multi-way frequency tables, Nonparametric statistics, Exploratory data analysis with analytic graphs, Multiple regression methods, Time series analysis with modeling and forecasting (incl. full ARIMA), General ANOVA/ANCOVA/MANOVA, Contrast analysis, Discriminant function analysis, Factor analysis, Principal components, Multidimensional scaling, Item analysis/Reliability, Log-linear analysis, Cluster analysis, Non-linear estimation, Logit Probit analysis, Canonical analysis, Survival and Failure Time analysis (Censored data), Quality Control analysis, and much more.* ■ All statistical procedures are integrated with fast data base management and instant, presentation quality graphics (over 100 types); full support for all mono and color graphics boards (incl. VGA) and over 100 plotters and printers (incl. the HP and Postscript standards). ■ All CSS screen output is displayed via customized Scrollsheets™ (i.e., dynamic, user controlled, multi-layered tables with cells expandable into pop-up windows); all numbers in a Scrollsheet™ can be instantly converted into a variety of presentation quality graphs; contents of different Scrollsheets™ can be instantly aggregated, combined, compared, plotted, printed, or saved. ■ The flexibility of the CSS input/output is practically unlimited: CSS offers an intelligent interface (read/write) to all common file formats (Lotus, Symphony, dBase, dBase III+, dBase IV, SYLK, ...) and special utilities to easily access data from incompatible programs; graphics can be saved in files compatible with desktop publishing programs (Aldus, Ventura). ■ CSS data files can be as large as your operating system (DOS) allows; OS/2 version coming soon. ■ CSS precision exceeds the standards of all common precision benchmarks. ■ *Technical note: The CSS user interface and all I/O were written in Assembler and bypass DOS; graphics and data management were written in Assembler and C; the computational algorithms were written in Assembler and optimized Fortran.* ■ \$495 (plus \$5 sh/h); 14-day money back guarantee.

Circle 274 on Reader Service Card



StatSoft

2325 East 13th Street ■ Tulsa, OK 74104 ■ (918) 583-4149

Fax: (918) 583-4376

Overseas Offices: StatSoft of Europe (Hamburg, FRG), ph: 040/4200347, fax: 040/4911310, StatSoft UK (London, UK), ph: 0462/482822, fax: 0462/482855, StatSoft Pacific (Melbourne, Australia) ph: 613-497-4755, fax: 613-499-7410, StatSoft Canada-CCO (Ontario), ph: 416-849-0737, fax: 416-849-0918 Available From: CORPORATE SOFTWARE and other Authorized Representatives Worldwide
Holland: Lemax BV 02968-94210; France: Conceptel (t) 45669700; Sweden: AkademiData 018-240035; Korea: Geul Bang (02) 272-1973



ITEMS DISCUSSED

AlignIt Floppy Drive Maintenance\$199	Genlock Overlay Module\$399	LANtastic 2.57
Landmark System Speed Test 2.0\$59	TVGA Video Card\$799	2-Mbps starter kit.....\$525
Landmark Research International 703 Grand Central St. Clearwater, FL 34616 (800) 683-6696 Inquiry 986.	USVideo 62 Southfield Ave. One Stamford Landing Stamford, CT 06902 (203) 964-9000 Inquiry 991.	additional adapter cards\$249 Artisoft, Inc. 575 East River Rd. Artisoft Plaza Tucson, AZ 85704 (602) 293-6363 Inquiry 995.
Cheetah Gold 486\$4995	HyperMap (price not available) Cognivision Research Valencia, 93, Pral 1, 08029 Barcelona, Spain 34 (3) 323 63 22 Inquiry 992.	PC-Write Lite 1.02\$79 Quicksoft, Inc. 219 First Ave. N, Suite 224 Seattle, WA 98109 (800) 888-8088 (206) 282-0452 Inquiry 996.
Cheetah International, Inc. 1003 West Cotton Longview, TX 75604 (214) 757-3001 Inquiry 987.	Hyperstore 1600\$899	PM3011/70\$1150
Computer Books	configuration modules:	Distributed Processing Technology 132 Candace Dr. P.O. Box 1864 Maitland, FL 32751 (407) 830-5522 Inquiry 997.
Baen Books	MFM\$310	Railroad Tycoon\$59.95
260 Fifth Ave. New York, NY 10001 (212) 532-4111 Inquiry 988.	RLL\$340	Microprose Software 180 Lakefront Dr. Hunt Valley, MD 21030 (301) 771-1151 Inquiry 998.
Coretest\$20	ESDI.....\$430	
Core International 7171 North Federal Hwy. Boca Raton, FL 33487 (407) 997-6055 Inquiry 989.	SCSI\$400	
DR DOS 5.0\$199.95	Perceptive Solutions, Inc. 2700 Flora St. Dallas, TX 75201 (800) 486-3278 (214) 954-1774 Inquiry 993.	
Digital Research, Inc. Box DRI 70 Garden Court Monterey, CA 93942 (800) 443-4200 (408) 649-3896 Inquiry 990.	Instrument Maker\$49.95	
	Personal Computer Music System\$219.95	
	Synthesizer Card\$149.95	
	Visual Composer\$99.95	
	Visual Composer/MIDI Supplement\$39.95	
	Ad Lib, Inc. 50 Stanford St., Suite 800 Boston, MA 02114 (800) 463-2686 Inquiry 994.	

that's not out yet.

One reason, perhaps, that LANtastic hasn't received more notice is that *it just works*. Unlike Novell networking, which literally requires thousands of dollars of schooling to sell, LANtastic is simple and easy to use. True, Novell has many sophisticated features, like security and internetworking, but most people don't need them.

If you need an inexpensive peer-to-peer network, LANtastic is the clear choice. It gets a well-deserved Chaos Manor User's Award. Recommended.

Winding Down

I'm out of space, and I haven't had a chance to talk about the USVideo TVGA Video Card, which allows us to run Mrs.

Pournelle's Reading Program, mix in a camcorder video of her explaining it all, and put the whole thing on videocassette. This is one of the most exciting things that we've done recently.

The game of the month is Microprose Software's Railroad Tycoon; I'd hate to tell you how much time I've wasted with that. If you ever liked to play with trains, you will love this.

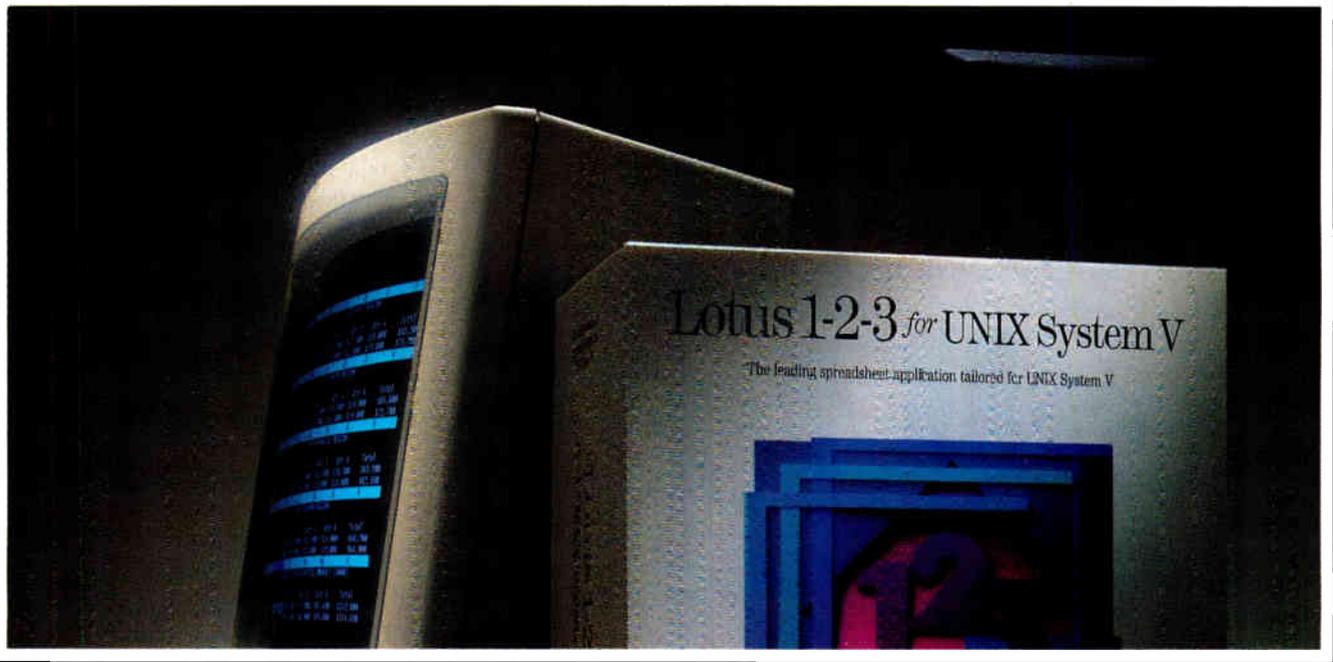
One of the most interesting programs this month is HyperMap from Cognivision Research. This makes visual databases on an EGA or VGA system.

The book of the month is by Geoffrey Hosking, *The Awakening of the Soviet Union* (Harvard University Press). The computer book of the month is by Douglas W. Nance, *Fundamentals of Pascal*

(West Publishing); mirabile dictu, a readable introductory textbook that's both systematic and thorough.

Next month, a whole bunch of stuff on Windows 3.0 and Desqview. ■

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. Jerry welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on BIX as "jerry."



A system with this much power doesn't deserve anything less.

UNIX* System V/386 PC users no longer have to settle for a spreadsheet that's anything less than the industry standard.

Because now, Lotus® 1-2-3® for UNIX System V gives you all the power and performance of 1-2-3. Along with new features that let you make the most of your UNIX or XENIX® System V/386 PC.

So you can work with true 3D worksheets. Take advantage of file linking. Create high-impact business graphics. Access databases quickly and easily. In fact, do everything you can do with Lotus 1-2-3 Release 3.0.

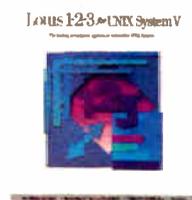
And macros, keystrokes, and files are compatible with other 1-2-3 releases. So you can not only use any work you've done with 1-2-3 up to

now, you can also share information with other 1-2-3 users, regardless of their platform or environment.

At the same time, you get full advantage of your UNIX system's capabilities. Like multi-tasking, so you can work on one job while your computer is completing work on others. Background processing, that lets you run 1-2-3 applications at preset times. And with the Multi-user Edition, you can even save money by having a group of users share a single spreadsheet package.

Call 1-800-343-5414, extension CDK-0112, for more information about 1-2-3 for UNIX System V.

And start using the best spreadsheet you can get. Instead of settling for just any spreadsheet you can get.



Introducing Lotus 1-2-3 for UNIX System V

© 1990 Lotus Development Corporation. Lotus and 1-2-3 are registered trademarks of Lotus Development Corporation.
*UNIX is a registered trademark of AT&T. XENIX is a registered trademark of Microsoft Corporation.

They all talk about us.

"...a technological breakthrough that reduces the rigid blocky digitizer tablet to a flexible mat..."

PC Network - Dec., 1989

"...thin enough to roll up like a poster with a narrow border that maximizes the active footprint."

Architectural Record - Jan., 1990

"The twelve ounce GridMaster is flexible, only 1/32 in.-thick and...gives you a resolution of 1,000 lines per inch with accuracy to 0.01."

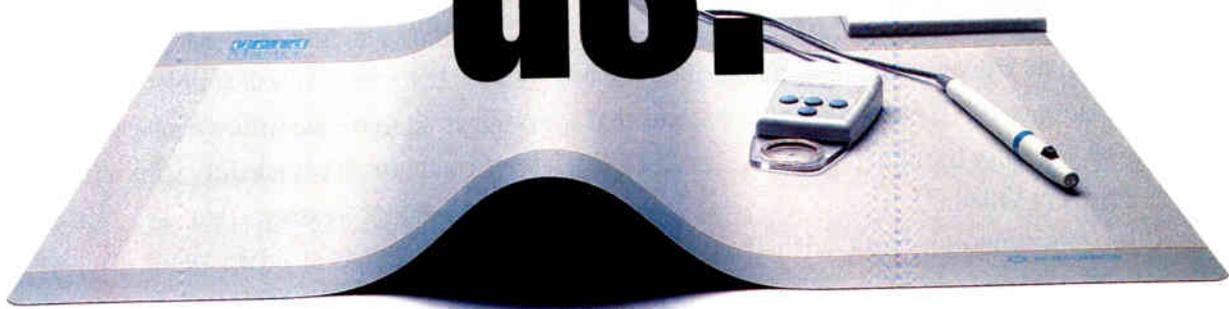
BYTE - What's New - March, 1990

"A dramatic innovation..."

Architectural and Engineering Systems - Feb., 1990

"Can be used with all graphic applications."

MacWorld - April, 1990



Now, take advantage of the unique, full function electromagnetic digitizing tablet of the future. GridMaster. It's the incredibly convenient new digitizer that's just 1/32" thin, weighs just 12 oz., and is so unobtrusive you won't know it's there till you need it. GridMaster's a full professional specifications digitizer ready to meet your needs for CAD, publishing/presentation, video/animation or virtually any graphics application. Its easy to use and delivers resolution of 1000 LPI, with pen tilt correction resulting in accuracy of 0.01". An absolute positioning digitizer, it maintains user-set configurations implemented by cursor, on-tablet menu or host download commands. It comes fully equipped with comprehensive utilities & drivers, built-in diagnostics, & pen or four-button cursor, with 16-button cursor available. 12" x 12" & 12" x 18" sizes.

Grid Master™ from **NUMONICS**

101 COMMERCE DRIVE, MONTGOMERYVILLE, PA 18936 TOLL-FREE: 1-800-247-4517

Circle 210 on Reader Service Card

World Radio History



FUTURE HISTORY

Who says there is no Unix business software?

There are many great myths in the computer industry, like "With just a minor modification to this software, our computer will run your entire business." One I hear a lot is, "There aren't any good business applications available yet on Unix." And yet there are almost 400 *pages* of application programs listed in UniForum's 1990 Unix Products Directory.

I'm not going to reveal a secret conspiracy involving evil DOS software vendors bribing computer tabloid writers. There aren't any. Neither will I recite the litany of reasons why this unfortunate state of affairs *did* occur. And, in spite of the growing popularity of this column, I'm under no illusions: Misconceptions and prejudices of this magnitude don't go away after being exposed to logic.

Without getting on any soapboxes, though, I'd like to make sure the facts are clear. There are at least a dozen Unix spreadsheets and even more word processors. Accounting packages and DBMS platforms abound. There are many personnel, sales, project management, and office-automation programs.

And then there are vertical market packages. If your company is involved in farming, construction, medicine, retail sales, law, finance, real estate, manufacturing, insurance, or a host of other industries and professions, there are many packages to choose from. Do you run a bank? Perhaps a blood bank? A speakers' bureau? A funeral home? Are you a yacht broker? An importer? Do you sell off-road accessories? Lumber? There are packages for all these and more.

Enough already. The point is that Unix applications do exist, and the main reason they do is, clearly, that companies



are using Unix in the real world. After all, how much difference is there between typing "123" under DOS and typing "123" under Unix?

And if that's not good enough, there are over 70 windowing and menu packages available that you can use for friendly front ends.

Let's See What Develops

Even with all the applications available now, there's plenty of room for more, especially better ones. I know there are many developers reading this column, so here's some free advice, guaranteed to be worth at least what you paid for it.

Look at the rapid growth in several technology areas: high-performance CPUs (both RISC and more traditional designs, such as the i486), high-resolution graphics (Super VGA and 8514/A on the IBM PC end, and low-cost workstations on the other end), digital signal processors, and homogeneous networks.

The end result is surely going to be high-performance interconnected workstations with video and audio I/O. The key here is that things will have to be standardized at some level so that they will all work together.

From the software end, you want to be developing on one of two main fronts. Users will demand applications that are not only intuitive (from a *real* user's point of view), but work intelligently and invisibly with whatever resources are available. In other words, the application should automatically find and use things like color graphics, a mouse, voice I/O, network connections, and printers. It shouldn't require a guru to install or a supervisor to type `chmod` commands.

The other way to succeed is to make the glue that holds all this together. Develop a program that can locate resources across a network, for instance. Write a universal driver for a pop-up window.

continued

Figure out a way to wrap applications software in a self-installing package so you don't need that guru. Develop software that makes network administration easier. Invent an expert system that will generate optimally intuitive software. Then sell all this stuff to the developer in the previous paragraph.

Daze of Future Past

It's certainly hard to believe that 15 years have passed since I saw my first issue of

BYTE. Fifteen years is an appreciable period of time in anyone's life, and it is several generations in the computer industry, of which even Unix is but one small part.

In 1975, Unix was already six years old, but it had still been ported only to Digital Equipment architecture, and it had just been rewritten in C (from assembly language) two years before. Computer scientists outside Bell Labs had learned of the existence of Unix a little

over a year before that, with the publication of the paper *The Unix Time-Sharing System* by Dennis Ritchie and Ken Thompson in the *Communications of the ACM*. And the first "modern" revision of Unix, called version 6, was still about a year away.

Without gazing nostalgically at the past too long, I think it's important to realize how far Unix has come before I talk about where it is going. Those who have been involved almost exclusively with Unix have seen it grow into a major force in the industry. Yet, until quite recently, Unix has not had much impact on the public, compared to, say, hardware products such as the IBM PC and the Apple Macintosh.

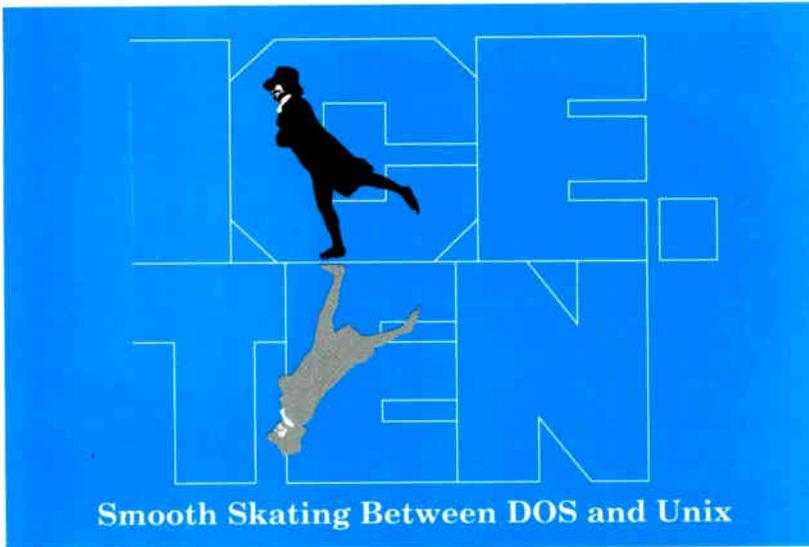
On the other hand, how many software products are still around, let alone growing as fast as Unix, 20 years after their introduction? This in spite of the confusion created by the relatively large number of revisions and semicompatible versions of Unix that have existed at just about every moment of its life span.

A Patch of Blue Sky

The next 15 years is almost too far ahead to predict, at least in terms of the computer industry. It seems clear, however, that Unix itself will cease to be a major issue, just as "to C or not to C" is no longer the question for many software developers. After all, how many other technical issues do manufacturers as diverse as Apple, AT&T, Compaq, Cray, Data General, DEC, IBM, and Sun agree on? Even now, people are starting to use the term "open systems" to avoid being associated with Unix exclusively; yet "open systems" is little more than a euphemism for "Unix and Ethernet."

In the years to come, Unix—or whatever name the megaconsortia of the future give it—will be the core of a company's information resource network (except for those companies too small to have more than one computer). Whether the users deal with Unix directly (which I think is unlikely) or with a front end, such as a graphical user interface (GUI), is a moot point; Unix will someday be as ubiquitous as microprocessors are today. The reason has nothing to do with its many benefits to developers. It is simply that there's no other nonproprietary system that supports multiple hardware platforms, not to mention networking and other standards. Users and developers have agreed that it's the training and support costs that make or break software, and a common standard for all types of computers—not just Intel-based ones—is

continued



Smooth Skating Between DOS and Unix

Staying Cool

For smooth integration of DOS and UNIX, **ICE.TEN** is still the industry standard. It provides memory resident **Wyse 60** or **SCO Color Console ANSI** emulation (*deja vu*), easy file transfer (*ucopy*), and a DOS command shell (*dshell*) for UNIX or Xenix.

Introducing Host Print™

Now with Host Print, **ICE.TEN.PLUS** allows a DOS application to print transparently to any UNIX or Xenix printer.

Perfect with Word

Perfect with WordPerfect
With either version you'll get clean performance software, fine-tuned for the best UNIX and Xenix applications. Mature software that works perfectly the first time.

A Nice Price

ICE.TEN is \$295 per 386 UNIX (or Xenix) host, including **both DOS and UNIX** software for the UNIX host and up to eight DOS machines.

ICE.TEN.PLUS is \$395 per 386 UNIX (or Xenix) host. It allows an unlimited number of DOS PC's. It has features of the standard version, **plus Host Print, VT220** emulation, and speeds up to **115K** baud.

Wired for ethernet? **ICE.TCP** is **DOS TCP/IP** with **ICE.TEN** emulation.

For more hard, cool facts, just give us a call.

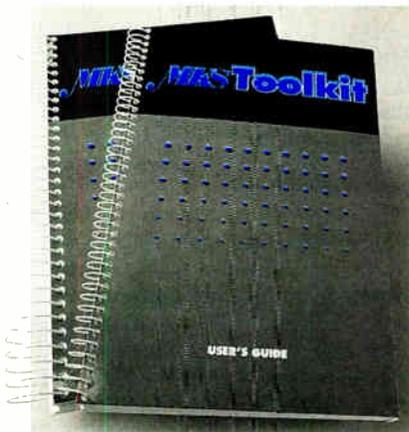
James River Group Inc
125 N First St Minneapolis MN
55401 USA
612-339-2521

James River Group

I N C O R P O R A T E D



"The MKS Toolkit is an amazingly faithful replication of a System V UNIX™ environment." - UNIX Review



"The entire MKS documentation package proved excellent in every respect"

Daniel McAuliffe, IEEE Computer, Jan. 1990

Powerful UNIX™ Tools for DOS and OS/2.

We can tell you that MKS Toolkit offers both experts and novices the purest form of UNIX utilities in a DOS or OS/2 environment. Fortunately, we don't have to. Software reviewers, universities, and major corporations all over the world are discovering MKS Software and how it can help their programmers and software developers make the most of their creative talents.

Reduce Keyboard Shock

With our proprietary code, the MKS Toolkit offers you more than 150 UNIX System V.5-compatible tools for DOS or OS/2. With MKS Toolkit, your computer or clone becomes a comfortable environment for shells, string matching, editing, file manipulation, and more. Productivity increases because all the familiar commands are at your fingertips.

"MKS software is absolutely the best in its class. Don't mix environments without it."

Grover Righter Director Hybrid Systems,
Novell Netware Product Division

Site Licences

MKS Toolkit reflects its users' needs. Organizations such as AT&T, H-P, ITT, and NCR - all heavily committed to the UNIX system - use MKS Toolkit to create a standard operating environment. Universities, from Harvard to UCLA, use MKS Toolkit to enrich personal research computing environments and double the bandwidth of their PC teaching labs. The National Institute of Standards and Technology uses MKS Toolkit as a standard operating environment for experts and as a POSIX training tool for neophytes.

Interconnectivity

MKS Toolkit interacts well on standard PC and PS/2 networks. Combined with Novell Netware™, the most popular LAN for PCs, MKS Toolkit creates a UNIX time sharing system in DOS or OS/2 organizations. UNIX shops can now hook up all their PC's using PC-NFST™) and MKS Toolkit, enabling you to use a PC as a Unix workstation and off-load your mini or main machine.

POSIX Tools

MKS is an active participant on the POSIX 1003 standards committee. This involvement reflects MKS's commitment to tracking the shells and utilities standard to the fullest extent possible under DOS or OS/2. Apart from multi-tasking and constraints on file names under DOS or OS/2, MKS Toolkit follows the POSIX standard. MKS achieves this by building the underlying POSIX system on DOS or OS/2 before moving utilities.

POSIX Training

Government departments and organizations choose MKS Toolkit as a cost-effective means of familiarizing personnel with the POSIX environment - now a Federal government standard for computing.

Cost-effective Learning Tool

If your organization is committed to moving into the UNIX environment, then MKS Toolkit is the perfect learning path. DOS or OS/2 users retain the familiar world of the PC keyboard and programs and move effortlessly to a UNIX environment on their desktop. Exposure to new commands and functionality now becomes an integral part of the novice's working day.

"With this package, you can become familiar with the UNIX environment on your microcomputer, with DOS only a keystroke away."

Byte Magazine, May 1989

MKS Programming Platform

MKS Toolkit is the heart of the MKS Programming Platform. MKS Platform helps smooth out the details of programming and software development by adding time-saving utilities such as: MKS RCS (Revision Control System), MKS Make™ (automated program builder), MKS LEX & YACC™ (compiler learning and construction tools). Also available is MKS SQPS™ an enhanced version of the Documentator's Workbench™ with complete troff typesetting capabilities.

In all, you simply cannot find a more complete set of commands and utilities to get you from DOS or OS/2 to UNIX or POSIX. With MKS Toolkit or Platform, you get there fast, stress-free, and with no extra investment in hardware.

 Full 30 day money back guarantee.

For more information, or to order, call: 1-800-265-2797 (continental U.S. only)
1-519-884-2251 (outside continental U.S.) 1-519-884-8861 (FAX)

35 King Street North, Waterloo, Ontario, Canada N2J 2W9

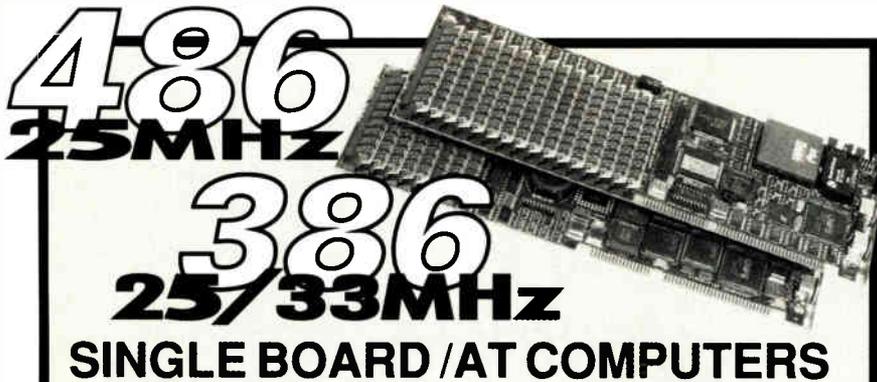
MKS, MKS Make, MKS Toolkit, MKS RCS, MKS LEX & YACC are trademarks of Morlice Kern Systems Inc. UNIX is a trademark of AT&T.



Put The Power Of UNIX In Your PC.

Circle 189 on Reader Service Card

World Radio History



486 25MHz

386 25/33MHz

SINGLE BOARD /AT COMPUTERS

80486-25MHz Now

80386-25MHz Now

- 25MHz 80486 CPU w/Internal CACHE & Co-Processor
- Up to 16Mb of SIMM Memory
- 8Kbytes of Internal CACHE
- 128Kb or 512Kb Secondary CACHE Daughter Cards Available
- 2/4 Way page Interleave Memory
- BIOS Shadowing
- Reset/Speaker/Keylock Connector
- ROM Based Utilities
- On-Board Lithium Battery

- Up to 25MHz CPU w/CACHE
- Up to 8Mb of RAM Memory Supports up to 20Mb with DTI's Memory Daughter Card
- Optional 80387 Math Co-Processor
- Multi-Function I/O Cards Available

80386-33MHz 3rd Qtr

- 33MHz 80386 CPU
- 32.64 or 128Kb of CACHE
- 6 or 8MHz Bus Speed
- Up to 32Mb RAM
- COM 1 & COM2 (Up to 115Kb)
- LPT1 w/Bidirectional Mode
- Up to 2 Floppy Drives
- Future Domain Compatible SCSI Port
- PS/2 Mouse Port
- IDE Disk Drive Port

"19 Years of Quality Service"



An Ergon Co.

1-800-443-2667

112 E State St. • Ridgeland, MS 39157

/AT is a trademark of the IBM Corp.

the only way to go.

What you think of now as DOS will be no more than a front end for Unix. That's happening now, with interface products from companies such as Locus and Visionware. There's no reason to kick people out of a familiar operating environment, but there's equally no reason to keep your firm in the dark ages of data processing by not sharing data and resources.

A Real Product

Of more concern to users will be what I call the Graphical Operating System Hack (GOSH) or Multimedia User Environment (MUSE)—two terms that I will be glad to donate to the public domain. These are what today are known as GUIs but will evolve into intelligent multitasking environments that will themselves be available across multiple software and hardware platforms.

IXI Software's current X.desktop product is an early example of this type of thinking. While it was originally written for Unix, there are ports under way for both DEC's VMS and IBM's MVS. X.desktop is a complete graphical front end that lets a user deal with files, directories, and applications without knowing anything about the underlying operating system. It's a perfect analogy to Unix, which was designed to let a user or programmer deal with files, directories, and applications without knowing anything about the underlying hardware. When was the last time you, as a user, cared about hexadecimal load points? Yet many computer users routinely deal with such problems not very long ago.

Of course, the technical developments occurring even now make it obvious that your GOSH- or MUSE-based workstation of the future will have audio and video extensions that will greatly increase the complexity, if not the usefulness, of current hardware and software. After the dust of new standard-making settles, though, you'll finally have computers that will do more of what people really need them for. Just wait till you see MegaRogue Turbo Plus, with live dragons! ■

David Fiedler is executive producer of Unix Video Quarterly and coauthor of the book Unix System Administration. He has helped start several Unix-related publications. You can reach him on BIX as "fiedler."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

HP HEWLETT PACKARD

COMPUTERS

APPLE
Mac Port 40 HD 2799 99
Mac II ci 40 HD 4099 99
Mac SE 30 40 HD 2899 99
Mac II CX 40 MB 3549 99
Mac II CX 40 MB 699 99
Mac Color Mon. 429 99

Image Writer
Compaq 286/12 MHz 1699 99
Compaq 386 SX 16 MHz 2649 99
w/40 MB HD
NEC PW 386 SX 2 MB 1099 99
w/40 MB HD
Packard Bell 286 SX 1.1 2 FDD 1 MB 849 99
40 HD VGA MTR
386/25 Tower 1 MB 2399 00
100 HD VGA Mon.

FACSIMILE (FAX)
Canon Fax 23 799 99
Canon Fax 35 849 99
Murata M-1100 699 99
Panasonic KX-120 949 99
Panasonic KX-220 929 99
Panasonic KX-230 1249 99
Panasonic UF-250 634 99
Panasonic UF-290 739 99
Sharp FO-215 839 99
Sharp FO-333 824 99
Sharp UX-170 999 99
Sharp UX-190 849 99
Toshiba 3750 749 99

MONITORS
486 On Screen 485 00
NEC G5 2 A 229 99
NEC MultiSync 2 A 424 99
NEC MultiSync 3 D 584 99
NEC MultiSync 4 D 1099 99
Pricision Ultrasync 14 499 99
Pricision Ultrasync 16 799 99

FAX/MODEM
Supersport 286e 40 2949 99
Supersport 386 SX 100 449 00
Worldport 7895 499 99
Worldport 7896 499 99
Toshiba Laptop 499 99

PRINTERS
Citizen 200 GX 184 99
Citizen 650 L10 294 99
Diconix 150 F/Mac 314 99
Epson FX 850 384 99
Epson FX 1050 289 99
Epson LX 1050 474 99
Epson LX 1050 414 99
Epson LX 1050 504 99
Epson LX 1050 889 99
Epson LX 1050 124 99
Epson LX 1050 294 99
Epson LX 810 439 99
FujiFuji DL 3400 584 99
NEC P-2700e 319 99
NEC 5300 449 99
NEC 6300 294 99
NEC 6300 454 99
NEC 6300 599 99
NEC 6300 949 99
NEC 6300 164 99
Ok-393
Ok-320
Ok-321
Ok-390
Ok-390
Ok-391
Ok-393
Panasonic KXP 1180 53 49
Panasonic KXP 1124 78 99
KXT 1470 41 99
KXT 1470 50 99
KXT 2355 54 99
KXT 2355 63 99
KXT 2355 73 99
KXT 3145 93 99
KXT 3155 93 99
KXT 3170 116 99
KXT 2469
KXT 2634
KXT 2740
KXT 3610
KXT 3710
KXT 3910
KXT 3980
KXT 4000

LASER PRINTERS
Hewlett Packard 649 99
Desk Jet Plus 774 99
Desk Writer F/Mac 1099 99
HP Laser II 949 99
HP Laser HP 1549 99
Okidata 699 99
Ok Laser 800 1199 99
Ok Laser 820 2399 99
Ok Laser 840
Philips 884 99
KIP 4420
KXP 4450
New User Reliable Toner Cartridge F/HP Laser. Lasts 5 Times Longer. CALL

LASER ACCESSORIES
2 MB F/HP II 154 99
1 MB F/HP II 111 99
2 MB F/HP II 214 99
Post Script F/HP II 319 99
Post Script F/HP III
25 in. F/HP
25 in. F/HP
Novelty ELS II 2 15 1672 00
Novelty Netw Adv 2 150 4299 00
Novelty SFT 2 15 2488 00
3 COM 3C2600 2075 00

NETWORK OPER. SYS.
Novelty ELS II 2 15 1672 00
Novelty Netw Adv 2 150 4299 00
Novelty SFT 2 15 2488 00
3 COM 3C2600 2075 00

Hardware
Lantronic Ether Start 494 99
Lantronic Ether Adapt 249 99
Lantronic 2 MB Starter 384 99
Lantronic 2 MB Adapt 179 99
Lantronic 2 MB Adapt 144 99
Lantronic 2 Two 94 99
Lantronic Voice Adapt

MODEMS
U.S. ROBOTICS
Courier HST 9600 574 99
Courier HST 9600 Dual 999 99

IN N.Y. STATE 1-800-223-6779
IN CANADA TOLL FREE 1-800-666-1668
S & W COMPUTERS & ELECTRONICS
31 West 21 Street, New York, N.Y. 10010
N.Y.C. (212) 463-8330

FAX # 212-463-8335
TOLL FREE 1-800-874-1235

ORDERS ACCEPTED VIA FAX
COURTESY HST 9600 Dual 999 99

HOURS Sun 10-5
Mon-Thurs 9-6
Fri 10-2
Sat Closed

PRICES HARD TO MEET — SERVICE HARD TO BEAT! World Wide Inquiries Promptly Filled

THE TOOLBOX

■ B ■ Y ■ F ■ A ■ I ■ R ■ C ■ O ■ M ■

NOW USE 4GL SPEED & C SOURCE CODE POWER WHEN DESIGNING YOUR DBMS

Whether you need the development speed and convenience of 4GL programming or the low-overhead power capabilities of C source code, The ToolBox by FairCom can meet the requirements of any professional developer!

INDUSTRIAL STRENGTH TOOLS

Develop applications the way you want with The ToolBox's industrial strength tools.

c-tree®

DATA FILE MANAGEMENT

- Portable. Used in over 100 system environments
- Optional client/server architecture
- Variable length records
- Key compression
- Ascending/Descending key segments
- Dynamic space reclamation
- Fixed & variable length key fields
- Advanced, high-speed B+ trees

d-tree™

INTERFACE DEVELOPMENT

- Prototype generation is easy with the RUN utility
- C-tree interface streamlines data base operations
- Dynamic Development -- Interface/Resources mgmt.
- Complete screen handler creates entire windows
- HELP management assists with pop-up menus, etc.
- Menu management -- Pop-up, Pull down, Lotus, etc.

r-tree®

REPORT GENERATION

- Create or change reports without C programming
- Multi-file access with virtual fields & records
- Complete layout control with conditional page breaks, conditional output and headers/footers for each break
- Dynamic format specifications w/horizontal repeats
- Powerful set functions & automatic accumulators
- Arbitrarily complex selection criteria

SOURCE CODE POWER AND 4GL FLEXIBILITY

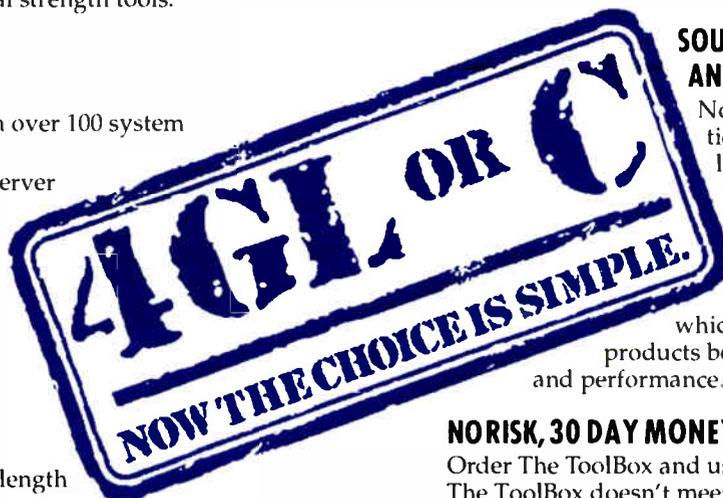
Now you can create applications using the methods you like -- whether it's 4GL convenience (Special Edition) or the C source code power (Professional Edition) of The Toolbox Series from FairCom. No matter

which one you choose, both products boast unparalleled portability and performance.

NORISK, 30 DAY MONEY-BACK GUARANTEE

Order The ToolBox and use it for 30 days. No risk. If The ToolBox doesn't meet your development needs, just return the entire package for a full refund.

CALL (800) 234-8180 TO ORDER YOUR COPY OF THE TOOLBOX TODAY!



FAIRCOM CORPORATION
4006 West Broadway
Columbia, Missouri 65203
(314) 445-6833 ■ FAX (314) 445-9698

THE TOOLBOX PRICE LIST

The ToolBox,
Professional Edition \$1,095
DOS, Unix, Xenix, VMS,
OS2 Full source, single
and multi-user support.

The ToolBox,
Special Edition \$695
Microsoft, Borland, Xenix,
OS2 Object Libraries, single
user only.

Upgrade to
Professional Edition \$400
Includes overnight delivery.

New Version
Performs defect analysis on
"anything that spins."

Hard Disks Die.

Hard disk manufacturers want us to believe that hard disk technology is absolutely reliable ... but experience teaches otherwise. We depend upon data storage to be flawless, but hard disk technology isn't. Surface defects, head alignment drift, and low-level format aging cause hard disks to fail.

A hard disk drive's low-level format fades with use. The drive's read/write heads lose their delicate alignment and move away from the original low-level format information. These new data track locations intersect unseen surface defects that were once harmlessly located between tracks. DOS's chilling "Abort, Retry, or Fail?" message inevitably results. Precious data is soon lost.

If left unchecked, data storage becomes more an act of hope and faith than one of science.

A return to science. The problem is known and understood, and the solution is clear. While a drive's data can still be read, the drive must be given a new, realigned and strong low-level format. Then all current surface defects must be located and managed.

This process prevents hard disk data loss.

An act of prevention. Gibson Research Corporation's SpinRite™ software program reads hard-to-read and impossible-to-read data from a DOS hard disk, nondestructively low-level reformats the drive's surface while optimizing the sector interleave factor, analyzes and scrubs each track of the drive for surface defects, and relocates any endangered data to safety. SpinRite easily restores hard disk drives to better-than-new condition with their data intact. Before any data is lost, SpinRite detects that a drive is "softening"

then determines and eliminates the cause. SpinRite readily recovers data that the system cannot read.

SpinRite won Byte Magazine's prestigious Award of Distinction and continues to win computer industry praise and acclaim. It has proven itself to be effective in preventing hard disk failure. SpinRite will work for you.

SpinRite II features a detailed technical log, as well as support for DOS 4 and large device driver partitions. It is available immediately from local software retailers or directly from Gibson Research with a 30-day satisfaction guarantee.

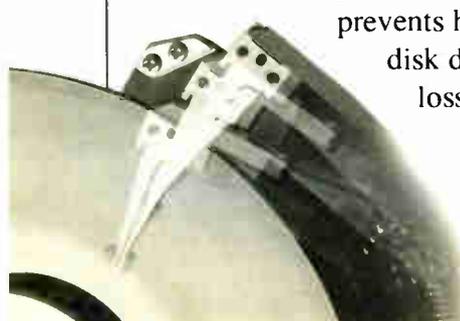
Suggested retail price: \$89.

To receive additional literature or to purchase SpinRite II, call toll-free:

SpinRite II.

A return to science.
An act of prevention.

(800) 736-0637.





THE PLACE TO BE FOR DTP

Is the Mac really the best machine for desktop publishing?

In my line of work, I occasionally use desktop publishing (DTP) software to produce some pretty basic camera-ready items—stationery and business cards for my consulting company, an occasional flier or short brochure for my university department, that sort of thing. But I'm no pro, that's for sure.

Imagine my surprise when I found out that I was supposed to talk about the hottest DTP tips at the recent MacWorld Expo. Well, I'm a member of the Expo's advisory board, so I wanted to give it my best shot. For me, it meant getting to know DTP from the point of view of the pros who live that life every day. Along the way, I found out something very interesting: The Macintosh's reputation as the microcomputer of choice for DTP work is well deserved.

Surprising Facts

First, most of the professional desktop publishers I talked with weren't ardent MacFolk. This surprised me, as I expected just the opposite. But the dozen or so people I worked with in Chicago, Boston, San Francisco, and Cupertino were not in that league. They use the Mac for their DTP work because it suits their work flow the best. They've tried other systems, including high-end 386 and 486 machines running DOS and Windows or OS/2 along with PageMaker or Ventura Publisher; several have also tried a Sun SPARCstation and a NeXT Computer, both running Unix and FrameMaker.

The overall consensus was that the Mac is the best compromise of performance, an easily learned interface, expandability, known value, and reliabil-



ity. These desktop publishers also mentioned the ease with which they can sell or upgrade an older Mac to get a high-powered Mac IIci or IIfx. The Mac is the machine of choice for people in this type of work.

What I next learned startled me. It's the software, not the Mac's WYSIWYG display, that first got their interest. Another surprise: It wasn't page-layout software like PageMaker, but high-resolution drawing software that won them over. Virtually all the desktop publishers I consulted have commercial art backgrounds, so they understand color and graphical elements better than I do.

The raft of good monochrome and color drawing programs for the Mac (e.g., Illustrator, FreeHand, PixelPaint Professional, MacDraw II, ImageStudio, and Cricket Draw) convinced them that the Mac is the place to be for DTP. They all mentioned that DOS, Windows, and OS/2 machines (or Unix workstations)

couldn't come close to the array of specialized drawing software on the Mac.

Less Surprising Facts

Finally, though, I started to validate a few things I expected (whew!). PageMaker is the most popular page-layout program for DTP, but Quark XPress is close behind. PageMaker 4.0 excels at flowing text, and its typographic features (e.g., hyphenation, kerning, and leading) are much improved over version 3.0. It also includes a useful Story Editor that most of these desktop publishers believe is a huge improvement over the largely nonexistent editing tools in 3.0.

According to these experts, Quark XPress provides more features than PageMaker does, but it's also harder to use. However, Quark XPress does four-color separations with aplomb, and its graphical placement capabilities and typographic features are more accurate

continued

NOW!—Non-DOS Formats for 3½ and 5¼ inch disks

COPIES MOST FORMATS FLAWLESSLY.

NEW: The V3000 now supports non-dos formats, i.e., Unix, Xenix, NCR, etc., in addition to all IBM formats.

Attach a Victory V3000 Autoloader to your IBM/PC or Macintosh, enter one or more jobs, and walk away! The system automatically copies 5¼ or 3½ inch disks—up to 180

per hour. Switching the copy drive takes less than a minute. Auto-Dup tests the quality of each copy, sorting the disks into one of two output bins.

Do-It-Yourself Servicing.

The Autoloader's simple component design and diagnostics for checking drive alignment and speed allow you to maintain the system without outside service.

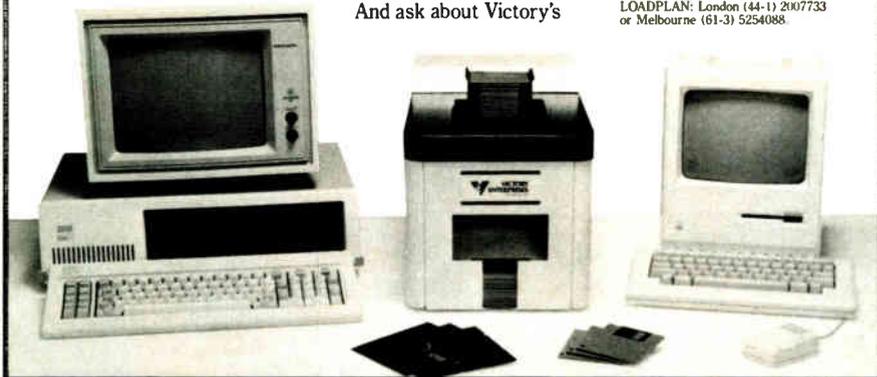
Call (800) 421-0103. And ask about Victory's

family of affordable Autoloaders that support Serialization and Custom Label Printing.



Victory Plaza
1011 E. 53½ Street
Austin, TX 78751-1728
(512) 450-0801

Internationally call BFI: Frankfurt (49-6074) 40980, London (44-622) 882467, Milan (39-2) 33100535, or LOADPLAN: London (44-1) 2107733 or Melbourne (61-3) 5254088.



QuickTrace™

Vector Based Graphics



TIFF Bit Map

The Automatic Tracing Program



QuickTrace is an automatic tracing tool which converts scanned "dot" images into vector based graphics. Instead of drawing by hand, try QuickTrace. It will help you to easily and quickly enter graphics like logos, maps and clip art, which would otherwise be difficult and time-consuming on your PC.

- for DTP (Illustrator, PageMaker, Harvard Graphics) Convert into EPSF, CGM, Micrografx PIC, DRW \$245
- for AutoCAD DXF \$295
- for Lotus Freelance Plus \$245

PLEASE CONTACT:
212-605-2339

Developed by
icl Information & Control Lab. Co.
Nakajima Bldg., 5F, 11-22, Shinjuku 5-chome,
Shinjuku-ku, Tokyo 160, Japan
Phone. 3-352-4746 / Fax: 3-357-7114

Mitsubishi International Corporation
Technology Affairs Dept
520 Madison Avenue, New York, NY 10022
Phone. 212-605-2339 / Fax: 212-605-1847

● QuickTrace is a trademark of Information and Control Laboratory Co., Ltd. ● Micrografx is a registered trademark of Micrografx, Inc. ● AutoCAD is a registered trademark of Autodesk, Inc. ● Lotus and Freelance are registered trademarks of Lotus Development Corporation. ● Illustrator is a registered trademark of Adobe Systems Incorporated. ● PageMaker is a registered trademark of Aldus Corporation. ● Harvard Graphics is a trademark of Software Publishing Corporation.

MACINATIONS

than PageMaker's. That's why they use PageMaker for longer, less critical publications, while Quark XPress is reserved for smaller, snazzier pieces.

I was also reminded of the kinds of damage that page-layout programs can do in the hands of inexperienced users. Each of my DTP friends showed me some "publications"—done by novices—they had been asked to "fix."

Conclusion: Mac page-layout programs can produce high-quality documents in the hands of experienced users. But that's also their biggest collective weakness.

To use one of these systems, you have to already know a lot about how a finished publication is supposed to look and how it gets to that finished stage. You need to know how graphical elements (i.e., photos, charts, tables, and the other visual devices) should be placed, how text should be flowed around your graphical elements, how much white space should appear between characters and lines, and what "feeling" the whole document is trying to give you.

The Mac has made a generation of computer users literate in the basic two-dimensional ways of graphics-based desktop computing. The problem is that publications aren't really 2-D entities. They have a pseudo "third dimension" operating all the time, even if it's just text on a page. A well-designed publication draws you into it, as if it were a 3-D environment that you could wrap around yourself. A poorly designed publication draws you nowhere; it leaves you flat and doesn't immerse you in its alternate universe. If you think I'm overstating this effect, think back to the time you read that *really* good book.

The problem is that the Mac makes all its users think that they can do anything, as long as they have the proper software. You say you need to create a four-color glossy recruiting publication for your company? Punch up Word, PageMaker, and FreeHand, and you're on your way. You've got the Mac behind you. You can do anything. It's the power to be your best.

That's the problem. While the Mac can be a powerful computing engine, it can't make you a subject matter expert—or at least not overnight. The Mac does such a good job of taking us over the start-up learning hump that we forget about that niggling little problem of subject matter expertise.

There are worse problems to have in the realm of personal computing, I think. Like the problem of getting started

continued

Take Our Course In C And The First Lesson You'll Learn Is In Economics.

NTSC
or
PAL
Formats



"I heartily
recommend...
...an excellent
bargain."
GARY RAY
PC WEEK

C's power, and portability make it the language of choice for software developers. Unfortunately, learning C can be a very costly proposition. Classroom instruction is, in a word, expensive. And many C video courses carry hefty price tags.

The top C video course at the lowest possible price

But now, there's The Complete C Video Course from Zortech. It's the ultimate C training tool for home or work. And all it costs is \$295.

You get ten videos with 36 lessons covering all levels of programming skill. A comprehensive, easy-to-follow 365 page workbook. And even a free C compiler.

Free C compiler included

Yes, that's right. The Complete C Video Course includes our famous C compiler (it runs on any MS-DOS machine) with linker, library manager, full graphics library and on-line help. It's the choice of professional programmers everywhere for fast code, fast development and fast debugging.

```
#include <stdio.h>
#define NAMLEN 15
#define NUMMARK 4
struct person
{
    char name[NAMLEN];
    int mark[NUMMARK];
};
```

Learn C in as little as two weeks

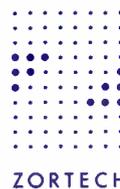
Speaking of speedy, with The Complete C Video Course you can learn C in only two weeks.

Compare that with the up to four months it can take to learn C in class.

Each lesson averages 17 minutes of clear, concise instructions. Used in conjunction with our workbook you'll find they provide everything you need to know to become proficient in programming in C.

Save your company thousands

If you think The Complete C Video Course is a great way for you to save money learning C, think about how much it could save your company. Use it instead of sending programmers to school and you'll save thousands. What's more, The Complete C Video Course is even tax deductible. C is unquestionably the most valuable programming language you can master. And now you can get everything you need to become productive in it from course to compiler to tools for an economical \$295. Mail the coupon or call our hotline to receive it ASAP.



Look at all these C video pluses

- Only \$295 complete.
- Ten videos with 36 lessons.
- Comprehensive 365-page workbook.
- Free C compiler with linker, library manager, full graphics library and on-line help.
- Compiler and hardware independent.
- Designed to help you learn C in as little as two weeks.
- Tax deductible.



Zortech Inc.
4-C Gill Street
Woburn, MA 01801
Voice: 617-937-0696
Fax: 617-937-0793

- ★ Yes, rush me The Complete C Video Course including free C compiler for \$295.00 (VHS only)
- ★ Please include (No.) extra workbooks at \$29.95 each.
- ★ I'd like to order (No.) extra C compilers with this course at the special price of \$49.95.

Name/Company.....
Address.....
.....
Phone.....
City.....
State..... Zip.....
Here's my check for.....
VISA/VC#.....
Exp. Date.....

Prices do not include shipping



The Complete C Video Course \$295

Order Hotline (800)848-8408

JMP™ to a Higher Level of Discovery

With JMP Software for Statistical Visualization

Make a quantum leap in data analysis with JMP software for your Apple Macintosh®. JMP combines traditional statistics with today's most innovative graphics.

Discover more.

▲ Fit regression and Analysis of Variance models, but see them in a new way with leverage plots, showing how each point contributes to each hypothesis test.

▲ Fit means, but see the significance of their differences visually with comparison circles. ▲ Analyze high-dimensional data and extract principal components, but see both the points and variables in the same graph with a biplot, one that spins in 3D. ▲ Examine a correlation matrix, but see more with a matrix of scatterplots with density ellipses. See high-dimensional outlyingness of points with Mahalanobis distance plots. ▲ See your data always displayed in a familiar spreadsheet grid.

Interact more.

▲ Point and Click to view, edit, or manipulate your data...to get an analysis...to identify points...to customize...to get context-sensitive help...to choose colors and marker symbols for your points in every graph. ▲ Point and Click on a calculator panel to make formulas for variables. ▲ Point and Click on your data in one graph, and the corresponding points will be highlighted in all the other graphs instantly. ▲ Click and Drag to change the intervals for histograms instantly...to spin your 3D graph smoothly in real time...to resize any graph. Cut and Paste your data within JMP or to other applications. ▲ Cut and Paste reports to other applications or journal them to a file.

Understand more.

▲ JMP is simple to use, so you can spend your time studying your data, not your software. ▲ JMP presents statistical results visually, so you are always

looking at graphs as well as numbers, finding patterns, and noticing points that don't fit patterns. ▲ JMP organizes its statistical methods in a unified way. You approach your data more directly with fewer frustrations regarding the statistical recipes. You always have a method that takes into account the variable's measurement level: nominal, ordinal, or interval.

MacWEEK says "JMP is powerful and easy to use. The programmers' delight in writing JMP is evident throughout and makes the program intuitive and a pleasure to use."

A Free Video Preview

For a free video preview of JMP, call our JMP Sales Department at (919) 677-8000. In Canada, call (416) 443-9811. Or, write us at the address below.

 **From SAS Institute Inc.,
the number one name in data analysis software.**

SAS Institute Inc. □ JMP Sales Dept.
Box 8000 □ SAS Circle □ Cary, NC 27512-8000
Phone (919) 677-8000 □ Fax (919) 677-8123

To use JMP, you need an Apple Macintosh with 1+ meg, 2 meg recommended.

JMP is a trademark of SAS Institute Inc., Cary, NC, USA.
Apple and Macintosh are registered trademarks of Apple Computer, Inc.
Copyright © 1990 by SAS Institute Inc. Printed in the USA.

Circle 260 on Reader Service Card

MACINATIONS

in the first place. Pretenders to the Mac throne should keep that in mind as they try to duplicate and exceed the machine that put the personal into personal computing and windows on desktop computers everywhere.

Windows 3.0—An 85 Percent Mac?

This, of course, brings me to Microsoft Windows 3.0. I beta-tested this baby and now use the release version. Of all the windowing systems that have tried to beat the Mac at its own game, Windows 3.0 is the first one that could really do it. OS/2, while much improved, still seems bloated for what it does.

Compared to OS/2, Windows 3.0 seems almost lean. It will even run on a 640K-byte XT! Also, it automatically configures to your hardware on start-up—getting the most functionality out of an 8086-, 286-, or 386-based system with 1 megabyte of RAM, and a 386-based system with more than a megabyte of extended RAM. If you want to know more about Windows 3.0, see Jon Udell's excellent First Impression "Three's the One" in the June BYTE. My bottom line is simple. Windows 3.0 gives you about 85 percent of a Mac on almost any kind of PC, and that could be enough to induce Mac software developers to look at IBM platforms lovingly.

Tip of the Month: On Location

Mitch Kapur is one of the really bright guys in the computer business. Founder of Lotus Development, Kapur now heads a small start-up company called On Technology. Its first product, a desk accessory (DA) called On Location, portends good things for the company.

On Location lists for \$129.95, which is much too high for what it does. It provides an active index of files and file contents on your disks that can be searched at high speed. You can get much of what On Location does in other DAs and utilities, including CE Software's excellent DiskTop, but On Location is arguably faster and easier to handle. But it's also buggier.

I have been using version 1.0 since March, and I like it. But I don't like the fact that I've had to recreate the indexes at least a dozen times because of a repeating "This index is damaged" problem. This is especially troublesome, since it takes On Location over an hour to index a big disk. It takes about 2½ hours to do a Jasmine DirectDrive 180 of mine that holds 170 MB in 9200 files, and that's on a processor-cached 8-MB Mac IIci. On slower Macs, the indexing performance is even slower. Once the indexes are

ITEMS DISCUSSED	
DiskTop	\$99.95
CE Software, Inc. 1854 Fuller Rd. P.O. Box 65580 West Des Moines, IA 50265 (515) 224-1995 Inquiry 981.	
On Cue 1.3	\$59.95
Icom Simulations, Inc. 648 South Wheeling Rd. Wheeling, IL 60090 (708) 520-4440 Inquiry 982.	
On Location 1.0	\$129.95
On Technology, Inc. One Cambridge Center Cambridge, MA 02142 (617) 225-2545 Inquiry 983.	
PageMaker 4.0	\$795
upgrade from 3.x	\$150
Aldus Corp. 411 First Ave. S Seattle, WA 98104 (206) 622-5500 Inquiry 984.	
Quark XPress 3.0	\$795
Quark, Inc. 300 South Jackson St., Suite 100 Denver, CO 80209 (303) 934-2211 Inquiry 985.	

created, the searches are done in real time, and blindingly fast, even on less prodigious iron than the IIci.

On Location also has intermittent start-up trouble with some shareware IN-ITs, especially SuperClock, and with Icom Simulations' On Cue menu-bar application launcher. For what On Location costs, and considering that it's the company's only product, On Technology needs to get version 1.1 out quickly, with a large dollop of robustness added. Dropping the list price to \$75 wouldn't hurt, either. ■

Don Crabb is the director of laboratories and a senior lecturer for the computer science department at the University of Chicago. He is also a contributing editor for BYTE. He can be reached on BIX as "decrabb."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Mixing REAL TIME With REAL UNIX[®] Is Not Magic...

It Is Technology.

VenturCom's real time UNIX product family has the only real time kernel for standard hardware platforms which is AT&T's UNIX System V. Not a simple UNIX clone. Not just UNIX on top of a real time executive.

Real UNIX provides designers with SVID and POSIX standards, RFS and NFS, X-windows, Streams, complete development tools, multiple DOS under UNIX tasks. And early access to future technologies.

Real time adds performance and functionality to UNIX with preemptive and biased scheduling, contiguous file system, average interrupt latency of 50 µs, bounded context switches, memory locking, asynchronous I/O, and much more.

Ask us about VENIX™ for 80286/80386 PCs and Single Board Computers; RTIX™ for other UNIX versions, such as Interactive System's 386/ix™ and small, diskless, and ROMable UNIX kernels. Find out why Foxboro, Toshiba, GE, and many others are using VenturCom's real time UNIX products.

 **VenturCom**
Real Time/Real Unix
215 First Street
Cambridge, MA 02142
(617) 661-1230
Nippon VenturCom, Inc.
Tokyo 102 Japan 03-234-9381

UNIX is a registered trademark of AT&T
386/ix is a trademark of Interactive Systems Corp.
VENIX, RTIX are trademarks of VenturCom, Inc.

TOOLS '91

Technology of Object-Oriented Languages and Systems

**INTERNATIONAL CONFERENCE & EXHIBITION
CNIT Paris (La Défense), March 4-8, 1991**

FIRST ANNOUNCEMENT AND CALL FOR PAPERS

Program Chairman: Jean Bézin, Conference Chairman: Bertrand Meyer

TOOLS '91 will continue the tradition of excellence and practicality which have established TOOLS as the major international conference devoted to the practice of object-oriented programming. TOOLS '91 will include tutorials, workshops, invited presentations, submitted papers, and an exhibition of industrial and research object-oriented tools.

The conference format will include:

- Tutorials** (on March 4-5) addressing major topics in the field of object-oriented methods, languages, tools and applications.
- Invited presentations** by international object-oriented experts.
- Submitted papers** on important practical aspects of object-oriented techniques.
- An industrial exhibition** of object-oriented tools, languages, environments, databases and their applications.

The conference will once again be held in the exciting new CNIT center in Paris (La Défense), a business and conference center devoted entirely to technologies of the future.

SUBMITTING A PAPER

TOOLS '91 is now soliciting papers on all

aspects of object-oriented technology. All submitted papers should have a strong practical bent and emphasize applications. A non-exhaustive list of suggested topics includes:

- Reports of actual experiences with object-oriented tools and methods.
- New developments in the technology.
- Development and use of reusable component libraries.
- Management and educational issues.

If you intend to submit a paper, check the appropriate box on the coupon below to receive a copy of the *Guidelines for Authors* and maximize your chances of acceptance.

Submissions may be made in the form of either full papers (8 to 15 single-spaced paged) or extended abstracts (5 or more pages including basic bibliography). Submissions will be evaluated by the International Program Committee, chaired by Professor Jean Bézin of the University of Nantes. Six copies of each submission should be sent to:

TOOLS '91
Attn: Jean Bézin
Laboratoire d'Informatique
Faculté des Sciences et Techniques
Université de Nantes
2, rue de la Houssinière
44072 Nantes Cedex - France

IMPORTANT DATES

All submissions must be received by November 1, 1990 to be considered for inclusion in the conference. Submissions should be in English. Notification of acceptance will be mailed by December 15; final manuscripts will be due January 15.

THE INTERNATIONAL OBJECT-ORIENTED WEEK

One of the most exciting parts of TOOLS is the International Object-Oriented Programming Week, a set of meetings on topics related to the theme of TOOLS. Friday, March 8 has been set aside for independently organized events, such as User Group meetings or standardization committees.

The TOOLS '91 organizers will help coordinate such events if they fall within the scope of object-oriented techniques, and will include the announcements in the final TOOLS program. If you are interested in setting up such a meeting, please contact TOOLS '91 for details at the Paris or Goleta address below.

Electronic Mail:
uunet:geocub.greco-prog.fr/bezin (from the US)
geocub.greco-prog.fr/bezin (from Europe)

NOTE: Tools Pacific. A special edition of the TOOLS conference will be held in Sydney (Australia) during the last week of November 1990, to reflect the growing activity of the object-oriented field in the Pacific Area. For information, please contact Myriam Wever, 8 Jane Street, Balmain, NSW 2041 Australia. FAX +61-2-810-3726 or one of the addresses below.

- Please send me subsequent announcements relative to TOOLS '91.
- I wish to submit a paper. Please send me the Guidelines for "Prospective Tools Authors". This will be a full paper an extended abstract
Title: _____
- My company is interested in exhibiting. Please send me exhibitor information.
- I would like to purchase the proceedings of: TOOLS '89 TOOLS '90
Please send me an order form.

Name and address (please type):

First Name _____ Last Name _____
Company Name _____
Company Address _____
City, State, Zip, Country _____
Phone: _____ Fax _____ E-mail _____

TOOLS '91
SOL
14, rue Jean Rey
75015 Paris - France
Phone: +33-1-40 56 03 58
Fax: +33-1-40 56 05 81

In the US please contact:
TOOLS '91
ISE
270 Storke Road, Suite 7.
Goleta, CA 93117 USA
Phone: (805) 685-1006
Fax: (805) 685-6869

Circle 284 on Reader Service Card



MOVING DOWN TO MICROS

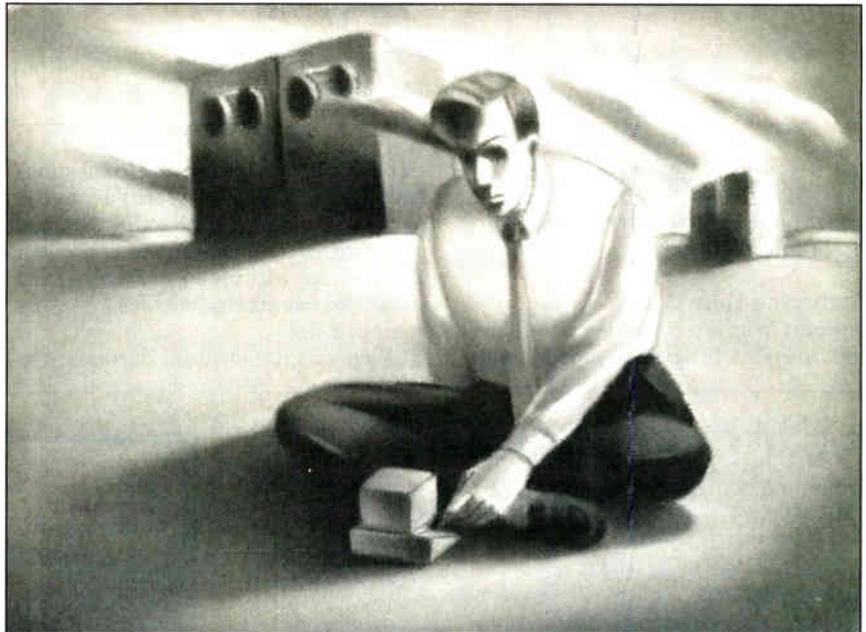
Mainframe-quality decision-support systems are beginning to appear on microcomputers

Throughout the years of growth in the microcomputer industry, a great variety of applications have moved from the world of the mainframe to the world of the microcomputer. A few major areas began with small computers and moved to their larger cousins. There have, however, been some classes of applications that have resisted moving, because of their size and complexity or because of the number of users that they must support. Those areas include large databases and decision-support systems (DSSes); now it appears that they will move to microcomputers as well.

I discussed the role of Structured Query Language database servers last year (see the November 1989 *BYTE*), and that move of the SQL database functions from the mainframe to the microcomputer-based LAN continues. In what may be an even more important move, mainframe-quality DSSes are beginning to appear on microcomputers. While this trend is new, it's also clear that the move will be inexorable. The reason is cost.

What's a DSS?

To explain why cost is such a factor, I'll look at what a DSS really is. While, in the broad sense, a DSS is any software that allows you to see information in a way that helps you make a decision, the term is normally used in a more restrictive sense. In the past, DSSes have been taken to mean large, complex financial or mathematical modeling software that will support a wide variety of queries



with a great deal of flexibility. Now that they are moving to microcomputers, of course, they mean the same thing.

Over the years, DSSes have been so important to large corporations and agencies that companies have been willing to purchase and support mainframe computers dedicated to them. Despite the hundreds of thousands or millions of dollars involved, the ability to perform the complex modeling was profitable.

Many DSSes were custom software, designed specifically for the organizations that they were to support. While some still are custom systems, now there are also commercial DSS packages available in the mainframe and minicomputer worlds, and they are very popular. These packages enable users to link standard modeling functions in such a way that verified functions can take information, pass it from one function to the other, and produce a result or group of results.

You can, for example, project finan-

cial performance for a year for an entire business or division. You can also project or analyze such diverse business characteristics as production-line performance or the effect of foreign currency changes on profitability.

Micro DSS Packages

Two packages have arrived on the market that attempt to bring the power of the mainframe DSS to the desktop. As you might expect given their ancestry, both are massive, complex, and enormously powerful. They are also unlike nearly anything else in the industry. Using them is not a trivial matter—but then, the results they produce and the importance to the businesses that use them are not trivial, either.

Business Wits is the initial product offering from Decisus, a new subsidiary of the Xerox Corp. From its introduction, Business Wits has been billed as a DSS,

continued

ITEMS DISCUSSED

Business Wits\$695	SPSS for OS/2\$995
Advanced Financial Applications\$195	SPSS Advanced Statistics for OS/2\$495
Banking and Investment Applications\$195	SPSS Tables for OS/2\$495
Statistics and Sampling Applications\$195	SPSS Trends for OS/2\$495
Decisus, Inc. 9938 Via Pasar, Suite A San Diego, CA 92126 (800) 433-0307 Inquiry 1101.	SPSS, Inc. 444 North Michigan Ave. Chicago, IL 60611 (312) 329-3500 Inquiry 1102.
	Stats\$475
	KnowWare P.O. Box 17788 Boulder, CO 80308 (800) 759-5669 Inquiry 1103.

and it's a classic example of such systems. SPSS for OS/2, on the other hand, makes no claim to be a DSS, although it does fit the definition.

Gathering Your Wits

Business Wits is a collection of well over 100 functions designed to support analy-

sis of business activities. These functions have been written so that calculations can be taken from an initial set of data and passed through the functions as needed. The package will support graphing, and with it you can create data files for use by other packages.

What's important about Business Wits

is that the standard functions have been chosen specifically for use in a DSS. The specific choice of functions means that the software will perform a wide variety of interest calculations, but it's tough to use it to find the amount of your next car payment. Of course, it's not designed for that. Instead, Business Wits uses calculations to support projections such as the present value of future payments, or to figure such a value in terms of foreign currency fluctuations.

The hundreds of functions that come with Business Wits are designed so that they can't be changed by the end user. Decisus had each function validated for correctness and conformity with generally accepted accounting standards; allowing changes would make the validation meaningless. But if you need a function that Business Wits doesn't support, you can create it.

Number Crunching

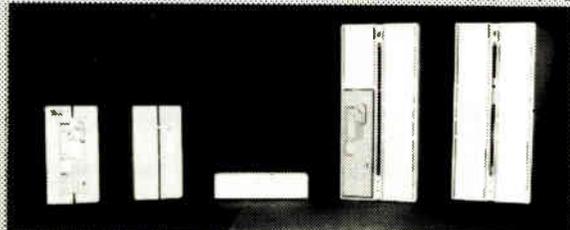
SPSS for OS/2 is the desktop version of a successful DSS already in use on mainframes and minicomputers. The software requires OS/2 1.1 or higher, and it

continued

FAST SCSI STORAGE

Compatible with 286/386, AppleII, Tandy, Atari, Amiga, SunMicrosystem, Macintosh, Silicon Graphics, Next A-Hive - Enclosure for SCSI Drives

- Room for 2-HH or 1-FH drive 40 Watts \$119.
- Incl. all internal cables 65 Watts \$169.



- Half Shell-Compact Hard Drive (1.4"x5.5"x7.5")**
low power 40MB \$599
- Hermit Crab-Portable Hard Drive (2.8"x5.5"x7.5")**
32MB to 200MB 28ms to 12ms \$399
- Hermit Crab Shell** \$69
- SCSI Hard Drive 32MB to 760MB** \$299
- Cartridge Hard Drive 44MB** \$519
- SCSI Tape Drive 50MB to 155MB** \$389
- 2HD/4Floppy 286/386 Controller**
1:1 16MHz MFM/RLL
- XT/AT/286/386 SCSI/ESDI/MCA Controller**
- TULIN CORPORATION** Tel:408-432-9025
2156H O'Toole Ave, San Jose,CA95131 Fax:408-943-0782

Industrial Control Systems
LAN Terminals
Diskless Systems



For the IBM PC, XT,
AT PC DOS* or MS DOS*

SOLID STATE DISKETTE AND DRIVE EMULATORS FOR DISKLESS SYSTEMS

- Diskless systems with local DOS and program storage for client LAN terminals, and embedded and industrial control systems.
- Single or dual disk emulation of 5 1/4" or 3 1/2" diskettes.
- In-board and interchangeable Cassette models using EPROM, Flash EEPROM and SRAM technology.
- On-board EPROM programmer—simply copy a diskette to program the EPROMs or Flash EEPROMs. Flash EEPROMs remotely programmable on LANs.
- Two Autoboot modes, a File (read) and a Programming mode—automatic disk drive designation set-up during booting.
- Flash EEPROM models are electrically erasable. SRAM models are battery backed. EPROM models are ultraviolet erasable.
- Programming utilities included with programmable models; LAN utilities for remote programming of Flash EEPROMs available for Flash models on request.
- List prices with memory ICs from \$195. OEM prices available.



CURTIS, INC.

2837 North Fairview Ave. • St. Paul, MN 55113
612/631-9512 • Fax 612/631-9508



* IBM PC, XT, AT, PS/2 and PC DOS are trademarks of IBM, MS DOS is a trademark of Microsoft



Take the Oops & Downs out of your next presentation.



Tired of fumbling with slides? Fiddling with transparencies? Losing your audience?

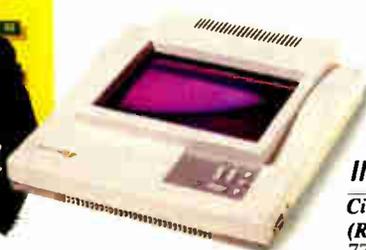
Well, it's time to use an LCD projection panel from In Focus Systems. It lets you project information just as it appears on your computer screen. Even bright, brilliant colors.

So you make stronger presentations. And easily hold any audience.

What's more, the 640x480 display works with IBM[®] compatibles, and the Macintosh[®] family, too. For more information or the name of the dealer nearest you, call 1-800-327-7231, today.

Then take the oops and downs out of your next presentation. And put the audience in the palm of your hand.

1-800-327-7231.



See it. Believe it.

IN FOCUS SYSTEMS, INC.

Circle 143 on Reader Service Card
(RESELLERS: 144)

7770 Southwest Mohawk Street, Tualatin, Oregon 97062.
1-800-327-7231. Oregon, 503-692-4968. FAX, 503-692-4476.

IBM and Macintosh are registered trademarks of their respective companies.

World Radio History

supports Presentation Manager (PM) but will also work without it. SPSS performs various statistical and numerical analysis functions, and it lets the functions start with given information and pass the results through a series of processes to produce a result.

The only way to describe SPSS is that it's truly massive. The base system and the add-on libraries require that you have at least 4 megabytes of memory and 15 MB of available hard disk space. The sys-

tem will run better if you have more memory and a math coprocessor. These machine resources are similar to what you'd find on a minicomputer running the same application.

Despite its mainframe heritage, SPSS takes advantage of PM's graphical user interface, and you can use your mouse to select commands that will build the command file that actually analyzes your data. If you aren't one of those who delight in typing in commands from mem-

ory, the PM support makes SPSS accessible.

Learning Curve

Both of these DSSes are complex systems, and they require that the user have some knowledge of the subject. You will never be able to use Business Wits successfully, for example, if you don't understand at least the basics of business math and finance. You will be able to use the software, but you won't be able to produce meaningful results. The same concept applies to SPSS: Unless you understand mathematical analysis and statistics, you'll get little benefit from this package.

In addition, both packages are sufficiently complex that they require you to have some training to be really useful. The user interfaces are well designed, and even the rank beginner can produce output, but you must have training in the use of the systems to take advantage of their power. In this way, they are like their mainframe cousins. The immense power and flexibility, though, mean that you can do nearly anything you want to do if you know what you are doing.

This power and flexibility are something new in personal computing. In the past, users took decision support to mean packages such as Stats from KnowWare. Stats lets you view and analyze figures and statistics related to your business. While it is a very useful package, and with it you can see trends in your business you might not catch otherwise, it is not in the same league as the other packages discussed here. It's not a DSS, and it makes no claims to be one, but for businesses that don't need or don't want to try a full-blown DSS, software like Stats makes an excellent bridge.

Your organization will get used to using personal computers in decision making and in analyzing business operations. Then, once the time comes when a move to a full DSS makes sense, your organization will be used to the concept, and the infrastructure will be in place to take advantage of the power of a DSS.

Growth Area?

DSSes will be one of the business areas in which microcomputer applications will grow in importance as the millennium draws to a close. Now that personal computers finally have enough power to support and run actual mainframe applications, those applications will begin to migrate to the desktop. The reason for this, as I mentioned earlier, is cost.

As businesses find themselves in a *continued*

"Compiler Ads Are Confusing"

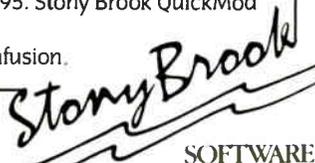
They all claim that their products are the fastest and most powerful. Buzz words like optimized, integrated, and modular are everywhere—never meaning quite the same thing.

We'd like to be more direct. We'll tell you what you can do with our compiler—then you make the comparisons.

- **DUAL PERFORMANCE** You have two compilers in one integrated package—Quick for speed applications development and optimizing for the best code generation—with a simple menu option to move between the two.
- **FLEXIBILITY** You can interface directly with C or any other language. Write only one set of sources for DOS and OS/2, run the most complex applications with no change.
- **COMPATIBILITY** You can generate code compatible with Microsoft Windows, using all window facilities. And develop Presentation Manager applications with no additional software.
- **OPTIMIZATION** You get true global optimization, using data flow analysis and proprietary techniques, not just the standard peephole optimization and automatic assignment of variables to registers.
- **ENVIRONMENT** You have many features you won't find in any other environment—like the ability to organize your code into separate libraries and set compiler options both globally and on a per-module basis. And a make facility that is so well integrated, you don't even know it's there.
- **TOOLS** You get a debugger, profiler, object librarian and overlay linker with unique capabilities. And a runtime library with surprises like interrupt driven serial communications, true multitasking, graphics, and mouse interface modules.

Stony Brook Professional Modula-2 (both the Quick and optimizing compilers for DOS and OS/2) for \$295. Stony Brook QuickMod (for DOS or OS/2) for \$95.

Stony Brook—we eliminate the confusion.



Your Partner
in Software Development

■ The fine print version of this information with all the details, including our benchmark performances, will be mailed to you within 24 hours if you call our 800 number.

800/624-7487 805/496-5837 California and International

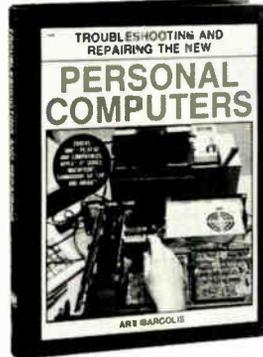
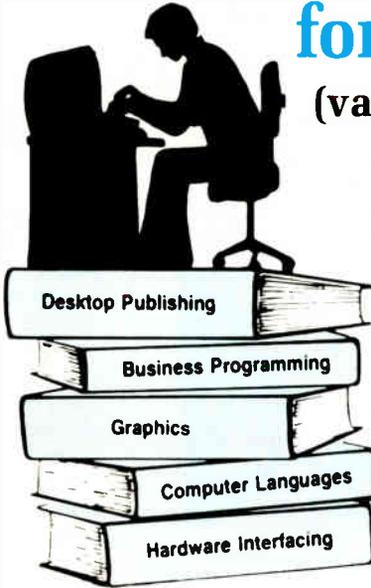
805/496-7429 Fax 187 East Wilbur Road, Suite 9
Thousand Oaks, CA 91360

© 1989 Gogesch Micro Systems, Inc.

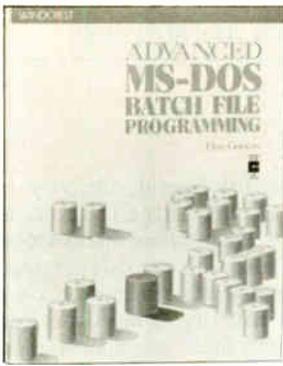
SELECT 5 BOOKS

for only \$4⁹⁵

(values to \$131.75)



2809 \$29.95
Counts as 2



3197 \$34.95
Counts as 2



3382P \$29.95
Counts as 2



3461P \$21.95



15002P \$18.95



15004P \$24.95



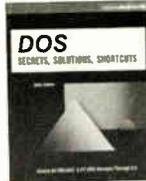
2870P \$16.95



15019P \$21.95



3578P \$16.95



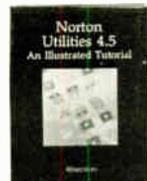
15008P \$24.95



9258P \$29.95



3239 \$29.95
Counts as 2



3359P \$16.95



9808 \$34.95



15013P \$26.95



3440P \$17.95



3283 \$28.95
Counts as 2



3417P \$24.95
Counts as 2



15001P \$22.95



3525P \$21.95



15003P \$22.95



3278 \$34.95
Counts as 2



3237P \$24.95
Counts as 2



15011P \$24.95



3176P \$16.95



2879P \$22.95

When it's new and important in business or personal computing, The Computer Book Club has the information you need . . . at savings of up to 50% off publishers' prices!



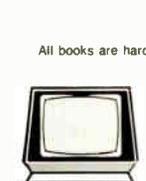
15020P \$24.95



15022P \$22.95



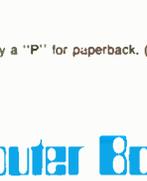
3468 \$26.95
Counts as 2



15013P \$26.95



3440P \$17.95



3283 \$28.95
Counts as 2



3417P \$24.95
Counts as 2



4292 \$49.95
Counts as 3



3422P \$17.95



3247 \$35.95
Counts as 2



3330P \$19.95
Counts as 2



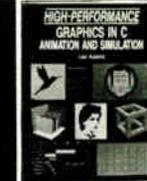
3564P \$19.95



3006P \$29.95
Counts as 2



3318P \$19.95
Counts as 2



3049 \$37.95
Counts as 2



3131 \$26.95
Counts as 2



3279 \$36.95
Counts as 2

All books are hardcover unless number is followed by a "P" for paperback. (Publishers' Prices Shown)



The Computer Book ClubSM

Membership Benefits • Big Savings. In addition to this introductory offer, you keep saving substantially with members' prices of up to 50% off the publishers' prices. • **Bonus Books.** Starting immediately, you will be eligible for our Bonus Book Plan, with savings of up to 80% off publishers' prices. • **Club News Bulletins.** 15 times per year you will receive the Book Club News, describing all the current selections—mains, alternates, extras—plus bonus offers and special sales, with scores of titles to choose from. • **Automatic Order.** If you want the Main Selection, do nothing and it will be sent to you automatically. If you prefer another selection, or no book at all, simply indicate your choice on the reply form provided. You will have at least 10 days to decide. As a member, you agree to purchase at least 3 books within the next 2 years and may resign at any time thereafter. • **Ironclad No-Risk Guarantee.** If not satisfied with your books, return them within 10 days without obligation! • **Exceptional Quality.** All books are quality publishers' editions especially selected by our Editorial Board. BY990

If card is missing, use this address to join: ©1990 THE COMPUTER BOOK CLUB
Blue Ridge Summit, PA 17294-0820

Still
You can't get WYSIWYG from any other word processor.
Introducing Version 1.5 of The Universal Word®

Even graphical based word processors don't give you true WYSIWYG. Not Word for Windows.™ Not Ami Professional.® And WordPerfect® isn't even close.

With **The Universal Word**, the most advanced word processor ever, you get Macintosh® like technology in an IBM® PC and more. You don't have to imagine what will be on the printed page. **What You See is really What You Get.** That's something that isn't possible, even with programs that run under Microsoft Windows.*

True WYSIWYG means great display and printer support, and **The Universal Word** delivers it. Breakthroughs in font and printer driver technologies provide unequalled results on both dot matrix and laser printers. Users can now display and print scalable font sizes from 2 to 100 points (from a rich variety of typefaces that come standard with the program). And **The Universal Word** makes the entire process easier, friendlier, and more productive thanks to an intuitive design, pull down menus, command option keys, and mouse support.

Experiment with multiple font typefaces, sizes, styles, colors, graphics, adjustable character and line spacing, and advanced page layout capabilities, directly on the screen. Also, you can open an unlimited number of windows and perform cut-and-paste operations with ease.

Looking for a foreign language word processor? **The Universal Word's Multi-Lingual version** can support every human language, living or dead, from Arabic to Zulu, making it the richest featured multi-lingual word processor available.

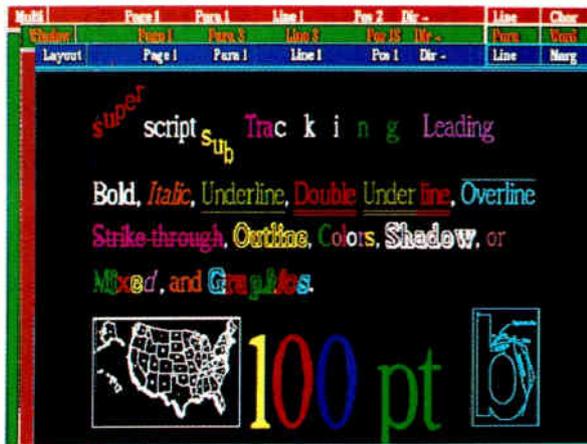
Contact your Local Dealer, or to Order call: In U.S.: **Showcase Distributors 800-776-7674**



Circle 322 on Reader Service Card

213-215-9645 Fax 213-215-9668 300 Corporate Pointe, Suite 410, Culver City, CA, USA

*The price of the Multi-Lingual version may vary subject to its language configuration. The Multi-Lingual Version has copy protection. The English Version is not copy protected. All products and company names are trademarks of their respective owners.



What You See is really What You Get. That's something that isn't possible, even with programs that run under Microsoft Windows.*

True WYSIWYG means great display and printer support, and **The Universal Word** delivers it. Breakthroughs in font and printer driver technologies provide unequalled results on both dot matrix and laser printers. Users can now display and print scalable font sizes from 2 to 100 points (from a rich variety of typefaces that come standard with the program). And **The Universal Word** makes the entire process easier, friendlier, and more productive thanks to an intuitive design, pull down menus, command option keys, and mouse support.

Experiment with multiple font typefaces, sizes, styles, colors, graphics, adjustable character and line spacing, and advanced page layout capabilities, directly on the screen. Also, you can open an unlimited number of windows and perform cut-and-paste operations with ease.

Looking for a foreign language word processor? **The Universal Word's Multi-Lingual version** can support every human language, living or dead, from Arabic to Zulu, making it the richest featured multi-lingual word processor available.

Contact your Local Dealer, or to Order call: In U.S.: **Showcase Distributors 800-776-7674**

Special Introductory Offer (U.S. Prices):
English Version
 \$395.00 \$149.00
Multi-Lingual Version*
 \$495.00 \$247.50
Multi-Lingual Version (Right-to-Left languages, e.g. Arabic)*
 \$595.00 \$297.50

In Middle East (For Product & Pricing Information):
InterSystems:
 Tel: (971-4) 233438
 Fax: (971-4) 227670
Global Systems:
 Tel: (971-84) 56236
 Fax: (971-84) 56839

WYSIWYG®
 CORPORATION



more competitive world, the way in which they take advantage of access to information will determine their success or failure. Those who can manage, analyze, and interpret information on a desktop will have the competitive lead over those who must use mainframes, because they will have used fewer resources to accomplish the same end.

The role of microcomputers is clear. Despite their size, personal computers can offer the individual user more computer resources than he or she can get from the company mainframe, because the mainframe must be shared with dozens or hundreds of other users. Your personal computer, on the other hand, offers performance comparable to some minicomputers, and it is yours alone to use. For this reason, applications (such as DSSes) that once were considered to be useful only in the province of the corporate mainframe environment are now moving to the individual, giving the individual the power once reserved for the corporation.

DSSes are one of the first of these mainframe systems to make the move, because they were often used only by a few users in any corporation regardless of the platform. Now that personal computers are powerful enough, it makes more sense to give the user a powerful microcomputer and save the money spent on using the mainframe.

To date, most of the DSSes have been limited in scope. They have been packages like Stats, which, although useful, lacks the scope and power of a true DSS. Power has a price, of course, and the price is the level of performance required to support these systems. On the other hand, performance requirements will be one factor that will drive the next generation of hardware. SPSS and Business Wits are still packages that have functions that once required a mainframe, and to replace the mainframe, the microcomputer must have similar power. The 1990s will see the power arrive, and the power of the user will grow with it. ■

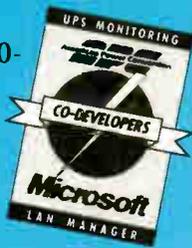
Wayne Rash Jr. is a contributing editor for *BYTE* and technical director of the Network Integration Group of American Management Systems, Inc. (Arlington, VA). He consults with the federal government on microcomputers and communications. You can contact him on BIX as "waynerash," or in the to.wayne conference.

Your questions and comments are welcome. Write to: Editor, *BYTE*, One Phoenix Mill Lane, Peterborough, NH 03458.

State of the art power protection for state of the art power



Your premier file-server deserves premier Uninterruptible Power Source (UPS) protection. The UPS 600LS from American Power Conversion features sine wave output, automatic diagnostics, advanced surge suppression and continuous line filtering. An intelligent micro-processor and a communications interface are built-in, so you can use automatic shutdown with NetWare, VINES, LAN Manager, and SCO UNIX. If you're buying the best, don't settle for less than reliable UPS protection from APC. Call 1-800-541-8896 for your Compaq UPS Sizing and Installation Kit.



Lan's Best Friend™

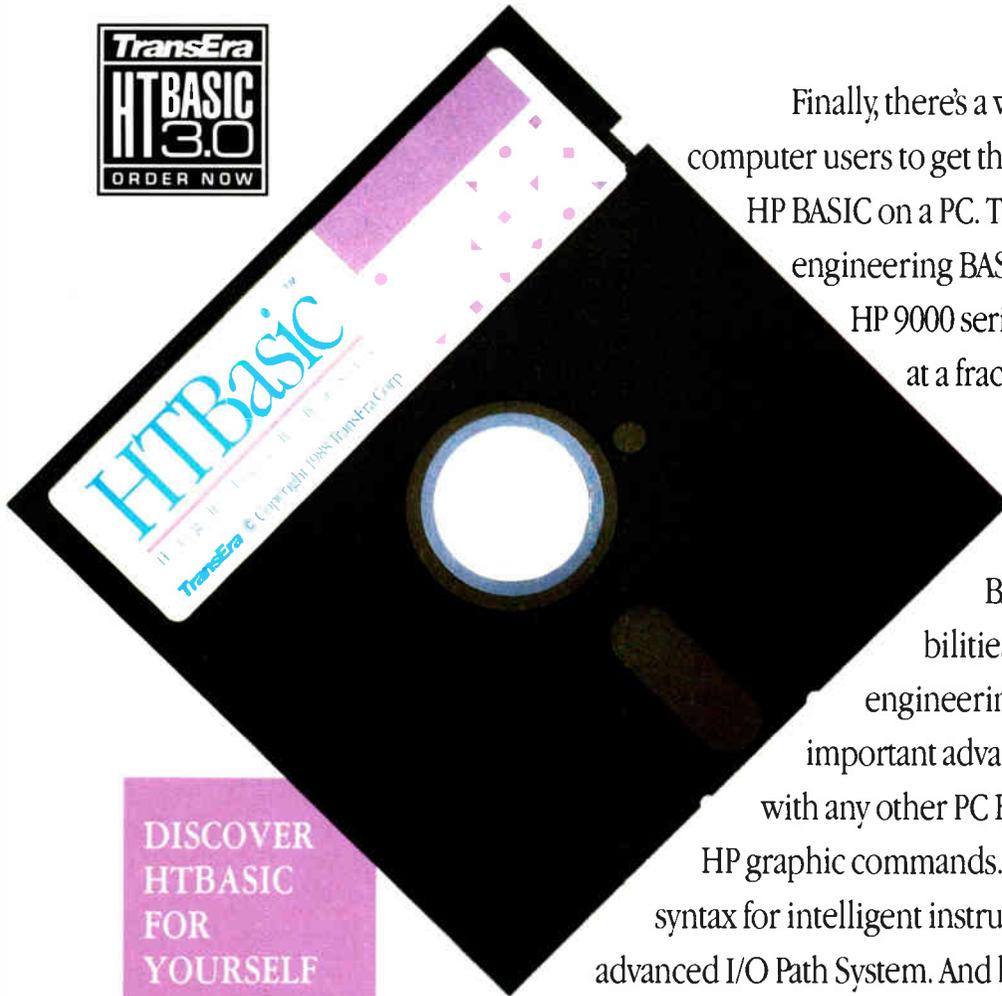
350 Columbia St., Peace Dale, RI 02883
(401) 789-5735 (800) 541-8896

Compaq and System Pro are trademarks of Compaq Computer Corp. Microsoft and the Microsoft logo are trademarks of Microsoft Corporation. Lan's Best Friend and PowerChute are trademarks of American Power Conversion. All other trademarks are the property of their respective owners.

Circle 21 on Reader Service Card (RESELLERS: 22)



Feed this to your PC and it'll think it's an HP BASIC workstation.



Finally, there's a way for serious technical computer users to get the power and features of HP BASIC on a PC. The answer is HTBasic, a real engineering BASIC that turns your PC into an HP 9000 series 200/300 BASIC workstation—at a fraction of the cost.

Like HP's Rocky Mountain BASIC, HTBasic from TransEra is a state-of-the-art BASIC that gives you all the capabilities you need for complex engineering applications. Plus you get important advanced features you won't find with any other PC BASIC. Like the complete set of HP graphic commands. Integrated HPIB (GPIB) syntax for intelligent instrument control. The advanced I/O Path System. And built-in matrix math.

In fact, all the optional HP binaries are built in. There's nothing else to load. You even get the full screen program editing and debugging environment.

Discover the new solution for cost-effective technical workstations. HTBasic from TransEra.

HTBasic
High Tech Basic

DISCOVER
HTBASIC
FOR
YOURSELF

For more
information, write
TransEra Corporation
or call today
(801) 224-6550.

TransEra

3707 North Canyon Road, Provo, Utah 84604 • TEL: 801-224-6550 • FAX: 801-224-0355

Circle 305 on Reader Service Card (RESELLERS: 306)



MASTERING OS/2 THREADS

OS/2's unique style of lightweight multitasking taxes developers and rewards users

Don't make me wait! When I select Print, insert a new value into a spreadsheet, or resize a desktop publishing window, I don't want to be ignored while the application grinds away. None of us likes to wait, and applications designers have heard that message.

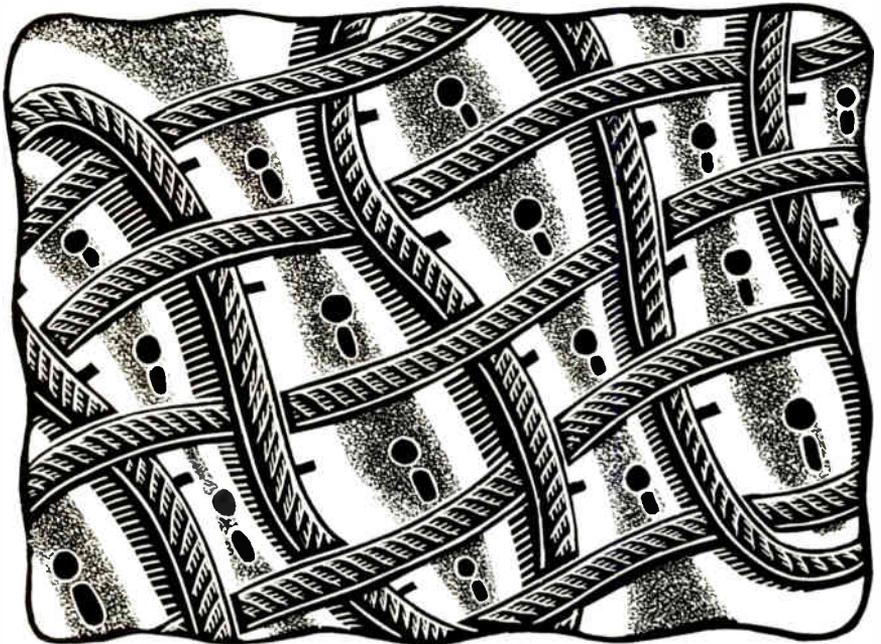
So spreadsheets today come with background recalc features, for example. But these features have taken forever to arrive, and they still aren't universally provided. If everyone knows what the problem is, why don't they just go ahead and fix it?

The answer is that background anything under DOS or Windows has to be custom-made. OS/2 is the first and only widely distributed system to provide a specific mechanism for dealing with problems of this class without building everything from scratch. OS/2 lets a designer cleave off compute- or I/O-bound activities as separately scheduled threads and thereby ensure crisp user interaction at all times.

Modes of Concurrency

When I talk about threads, I'm talking about concurrency: doing more than one thing at a time. The whole idea is to avoid having a processor sit idle when it could be doing something useful, and to be sure that what it is doing is most important.

Key factors that determine the performance of a concurrency mechanism are the time required to create and switch between tasks and the ease with which tasks can share information. Because threads carry less state information than



normal OS/2 or Unix processes, the system can create and switch among them quickly. Because they share memory, tasks enjoy high-bandwidth communication.

The idea isn't completely new. Researchers in the Unix community, particularly at the Carnegie Mellon University Mach project, have talked about lightweight processes for several years. But OS/2 is the first commonly available system to implement this strategy.

A thread is a simple flow of control within a process. Its state consists of an instruction pointer, a stack, a register set, its priority, and certain types of semaphores. Everything else—memory (i.e., instructions and data), file descriptors, even the current disk and directory—is shared with the other threads in the process. Threads, like interrupt routines, require the designer to identify critical sections and implement resource-sharing protocols.

Threads run inside processes, which in turn run inside screens. The progression from threads outward to screens entails more and more "fire-walling" on the part of OS/2.

But the most important distinction is that while processes and screens are normally used for sharing the processor between applications, threads are uniquely a way of sharing the processor inside an application. That means more responsive single-user applications and, just as important, high-performance server applications. Distributed databases that manage transactions using threads, rather than entire processes, can be highly efficient.

Where Are the Applications?

So now I'm back to almost the same question: If everyone knows what the problem is, and if OS/2 provides the means of solving it, why don't you see

continued

People are talking about us.

F77L-EM/32

Port 4GB mainframe programs to 80386s with this 32-bit DOS-Extender compiler. The Winner of *PC Magazine's* 1988 Technical Excellence Award just got better. New Version 3.0 and OS include: Editor, Make Utility, Virtual Memory Support, DESQview Support, New Documentation and Free Unlimited Runtime Licenses. F77L-EM/32 \$895 OS/386 \$395

F77L

The compiler of choice among reviewers and professionals. Includes a Debugger, Editor, Profiler, Linker, Make Utility, Weitek and 386 Real-Mode Support, Graphics. \$595

Lahey Personal Fortran 77

New Version 3.0: Full ANSI 77, Debugger, Editor, Linker, Library Manager, Microsoft and Borland C interfaces, 400 page Manual, Unbeatable Price. \$99



When people talk about FORTRAN
the name mentioned most often is

Lahey
Computer Systems Inc.

Contact us to discuss our products and your needs. (800) 548-4778
Lahey Computer Systems, Inc. P.O. Box 6091, Incline Village, NV 89450
Tel: (702) 831-2500 FAX: (702) 831-8123 Tlx: 9102401256

FORTRAN IS OUR FORTE

FONTS ON-THE-FLY

**NEW
FASE**

NewFase™ for WordPerfect

The instant font generator for WP 5.0/5.1. Create high-quality fonts as you need them. Use 90% less storage than with BitStream. Get camera-ready output on most lasers and dot-matrix printers. Comes with not 1 but 10 scalable fonts. Special symbols, foreign characters, and more. Optional Greek, Cyrillic, APL fonts. From \$149.

Circle 182 on Reader Service Card

Vector™ T_EX

**VECTOR
T_EX**

The most complete scientific typesetting system available today. Scalable fonts, font effects, T_EX standard and powerful new features. Saves more than 80% of storage as compared to other T_EX's. Supports all major printers. Leaves other T_EX's in the dust. Only \$299.

Circle 183 on Reader Service Card

Call today for the latest catalog.
(718) 575-1816

MicroPress, Inc. 67-30 Clyde Street, #2N, Forest Hills, NY 11375

many great multithreaded OS/2 applications?

To start, building a multithreaded application takes a tremendous amount of hard work. Elaborate handshaking is required to ensure that threads don't trample over each other. Everything has to be reentrant, compiled with the right options, and linked with the right libraries. Any shared resources have to be semaphored, and all that semaphoring has to be carefully constructed to avoid race conditions anywhere that could result in "deadly embrace." If the term deadly embrace is a bit fuzzy, trust me, writing your first multithreaded application will give you a good visceral feel for it.

Whenever a thread needs to "own" something, you have to invent a mechanism for the purpose. For example, when building the Hamilton C shell, a highly multithreaded command processor for OS/2, I had to come up with a way for a thread to maintain the notion of a current directory. It would hardly have been acceptable if a script running quietly in the background could suddenly, without warning, change the foreground current directory. Building a high-performance mechanism to re-create a current directory notion for each thread turned out to be a challenging project.

Debugging can be a real treat. Since the kernel's decisions about what thread gets to run next depend on what segments are loaded, setting a breakpoint can (by forcing a segment to be loaded) cause a different execution order. Here's the software analog of the hardware bug that disappears when you put the scope probe on it.

Not for the Faint of Heart

When I began working on the C shell in the summer of 1987, I worried a lot about possible competitors doing the same thing (i.e., building Unix-style tools for OS/2). It seemed like an obvious need, and I knew others were equally capable of writing such things. But mostly, that didn't happen. I wondered why.

One thing that I suspect is that most people who did try to build OS/2 applications came from the DOS world. Swamped by the sea change to multitasking and multithreading, they had difficulty making headway. Time invested with DOS, unless it was spent working on device drivers (which raise acute issues of concurrency), isn't good training for OS/2 threads.

Documentation didn't help. I remember opening my first OS/2 Software Development Kit (SDK) and reading that "a

continued on page 110

MINUTEMAN[®]

UNINTERRUPTIBLE POWER SUPPLIES

TOTAL POWER PROTECTION

- ★ BLACKOUTS
- ★ BROWNOUTS
- ★ OVERVOLTAGE
- ★ UNDERVOLTAGE
- ★ SURGES
- ★ SPIKES
- ★ EMI/RFI

STANDBY UPS MODELS

- 250 VA To 2300 VA
- Sinewave output - 1 millisecond transfer time
- Communications interface and external battery packs available for extended run times

ON-LINE UPS MODELS

- 500 VA To 5,000 VA
- Static By-pass Standard
- True On-Line - Sinewave outputs
- Communications Interface and external battery packs available for extended run time

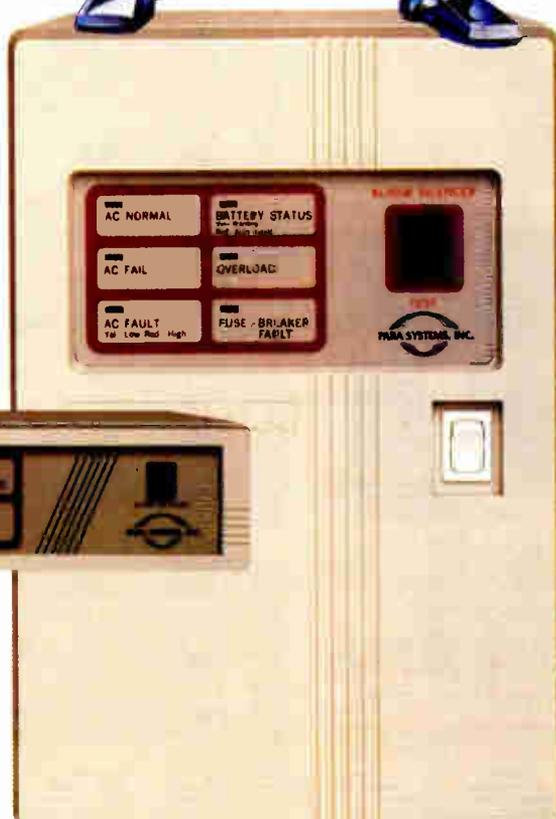


LISTED

NETWORK MANAGER

- Shutdown software for unattended operation
- Only software to communicate with LANs and WANs
- Novell 286 VAP and 386 NLM
- SCO Xenix

SLIMLINE & UPRIGHT MODELS



COMMUNICATIONS INTERFACE

For Unattended System Shutdown

COMPATIBLE WITH:

- Novell
- LAN Manager
- ALTOS
- BANYAN
- VINES
- System V UNIX
- Custom Configuration Any System

NOVELL
Monitor Boards Available



1455 LeMay Drive
Carrollton, TX 75007

Telephone:
(214) 446-7363

FAX: (214) 446-9011 TELEX: 140275 OMEGA

1-800-238-7272

FOR L.A.N.
NOVELL LABS
TESTED AND APPROVED
NetWare Compatible

"Distributed in over eighty countries"

Circle 218 on Reader Service Card

World Radio History

No more foam peanuts

- 3 1/2" format available from us. Specify when ordering.
 - package includes both 5 1/4" and 3 1/2" disks.
 - 3 1/2" format available from manufacturer by request. Call us for details.
- CP—copy-protected; NCP—not copy-protected.

The four-digit number next to each product is the product's ITEM NUMBER. Please refer to this number when ordering. Thank you.

SOFTWARE

We only carry the latest versions of products. Version numbers in our ads are current at press time.

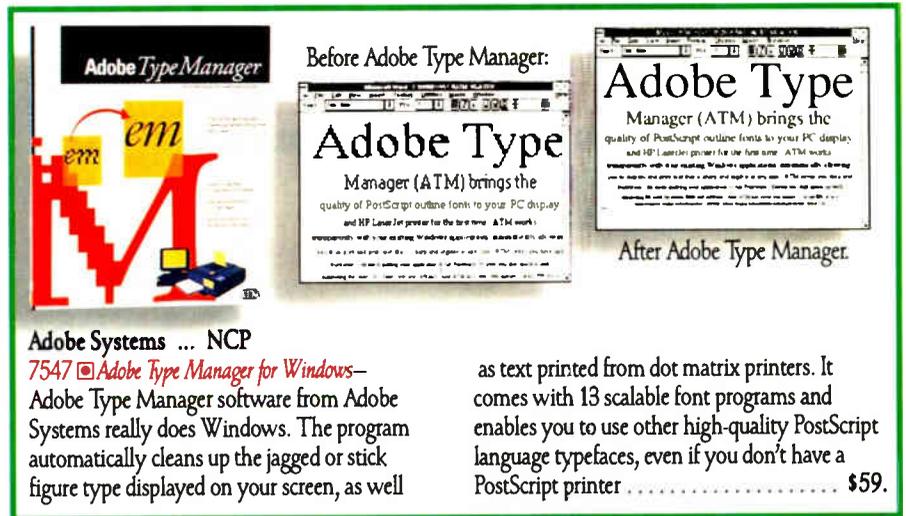
Products listed here in red work under Microsoft Windows.

- Adobe Systems ... NCP**
- 6591 Illustrator Windows 1.0 \$279.
 - 7547 Adobe Type Manager for Windows . . . 59.
 - 6590 Streamline Windows 1.0 229.
 - 7392 Adobe PostScript Cartridge 249.
- (Entire Adobe Type Library, from 1 to 133 is available. Call for more information.)
- Aldus ... NCP**
- 1332 PageMaker 3.01 499.
- Alpha Software ... NCP**
- 5104 Alpha Four 1.1 319.
- Application Techniques ... NCP**
- 1214 Pizazz Plus 2.0 69.
- Ashton-Tate ... NCP**
- 4450 dBASE IV 1.0 499.
- Asymetrix ... NCP**
- 7384 Toolbook 1.0 for Windows 309.
- Autodesk ... NCP**
- 4519 Autosketch 2.0 95.
- Avery ... NCP**
- 6006 Label Pro 1.0 49.
 - 7336 Label Pro 1.0 for Dot Matrix 49.



Alpha Software ... NCP

5104 Alpha Four 1.1—The award-winning, fully relational database management & application development system for business people, not programmers. Offers sophisticated reports and customized applications . . . \$319.



Before Adobe Type Manager:

Adobe Type Manager (ATM) brings the quality of PostScript outline fonts to your PC display and HP LaserJet printer for the first time. ATM works with all the leading Windows applications and all the leading PostScript printers.

After Adobe Type Manager:

Adobe Type Manager (ATM) brings the quality of PostScript outline fonts to your PC display and HP LaserJet printer for the first time. ATM works with all the leading Windows applications and all the leading PostScript printers.

Adobe Systems ... NCP

7547 Adobe Type Manager for Windows—Adobe Type Manager software from Adobe Systems really does Windows. The program automatically cleans up the jagged or stick figure type displayed on your screen, as well as text printed from dot matrix printers. It comes with 13 scalable font programs and enables you to use other high-quality PostScript language typefaces, even if you don't have a PostScript printer \$59.

- Bitstream ... NCP**
- Collections: Newsletters, Flyers, Books & Manuals, Reports and Proposals, Presentations or Spreadsheets each 159.
 - Fontware each 99.
- Borland International ... NCP**
- 7346 Turbo C++ 1.0. introductory price 95.
 - 7356 Turbo Pascal Professional 2nd Ed. . . 179.
 - 6242 Quattro Pro 1.0 325.
 - 1514 Paradox 3.0 469.
- Brightbill-Roberts ... NCP**
- 5408 Hyperpad 2.0 85.
- Broderbund ... CP**
- 1434 New Print Shop (NCP) 39.
- From Access Softek
- 7288 Prompt 1.0 for Windows 79.
 - 7289 Dagnet 1.0 for Windows 89.
- ButtonWare ... NCP**
- 6419 PC-File 5.0 75.
- Caere ... NCP**
- 6004 Omnipage 386 2.1 599.
- Central Point ... NCP**
- 5039 PC Tools Deluxe 6.0 89.
 - 5038 Copy II PC 5.0 27.
- Chronos Software ... NCP**
- 4387 Who•What•When 2.0 179.
- Concentric Data Systems ... NCP**
- 6575 R & R Relational Report Writer 3B 109.
- Corel Systems ... NCP**
- 5506 CorelDRAW! 1.2 329.
- Crosstalk Communications ... NCP**
- 2908 Crosstalk XVI 3.71 119.
 - 5611 Crosstalk for Windows 1.0 129.
- Custom Applications ... NCP**
- 7474 Freedom of Press 2.2 255.
- Data Storm ... NCP**
- 4798 PROCMM PLUS 1.1 65.
- Delrina Technology ... NCP**
- 4325 PerFORM 2.1 (\$30 rebate!) 159.
 - 7351 PerFORMPRO 1.0 for Windows . . . 299.
- Delta Technology ... NCP**
- 5829 Direct Access 5.0 55.
- Digital Composition Systems ... NCP**
- 6799 db Publisher 1.0 for Ventura 149.

- Dow Jones ... NCP**
- 5494 News/Retrieval Membership Pkg. 24.
- 5th Generation ... NCP**
- 5504 Brooklyn Bridge 3.0 79.
 - 2762 Mace Utilities 1990 99.
 - 3950 Fastback Plus 2.1 119.
- FNN Data Broadcasting**
- 7005 NewsReal 1.0 99.
- FormWorx ... NCP**
- 5810 FormWorx with Fill & File 2.5 85.
 - 7311 Form Publisher for Windows 1.2 . . 145.
- Fox Software ... NCP**
- 6188 FoxPro 1.02 489.
- Franklin Software ... NCP**
- 7071 Language Master 2.0 59.
 - 7416 Language Master 3.0 for Windows 59.
- Funk Software ... NCP**
- 2228 Sideways 3.21 42.
 - 7380 PD. Queue 1.0 (print spooler) . . . 55.
- Generic Software ... NCP**
- 2265 Generic CADD Level 3 1.1.3 225.



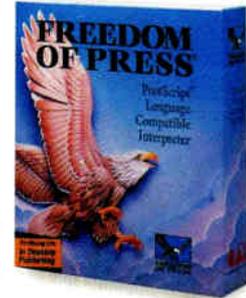
Reality Technologies ... NCP

6572 WealthBuilder by Money Magazine 1.1—Save & invest wisely. Set financial goals & achieve them. Plan for retirement, a child's education, a home. Optimize your portfolio & track all of your investments \$145.

in your orders!

- Great American Software ... NCP**
 4880 One Write Plus Acct. Sys. 2.06 . \$179.
 5825 Money Matters 1.0 55.
Harvard Associates ... NCP
 2324 PC Logo 3.0 59.
hDC Computer Corp. ... NCP
 7389 Windows Express 3.0 55.
 7383 First Apps 1.0 55.
Hilgraeve ... NCP
 2323 HyperACCESS/5 1.1 (DOS & OS/2) 115.
IBM ... NCP
 6599 Current 1.1 239.
Individual Software ... NCP
 6222 Resume Maker 1.1 29.
Inset Systems ... NCP
 7298 Hijaak 1.1 85.
 7300 Inset Plus Hijaak 99.
Intuit ... NCP
 2426 Quicken 3.0 39.
Isogon ... NCP
 7478 FontSpace 1.16 59.
LaserTools ... NCP
 6882 PrintCache 2.3 99.
Lord Publishing ... NCP
 5191 Ronstadt's Financials 1.02 75.
Lotus ... NCP
 5417 1-2-3 3.0 call
 5653 1-2-3 2.2 349.
 5134 Magellan 2.0 119.
MECA ... NCP
 2798 Managing Your Money 6.0 119.
 7002 Home Lawyer 1.0 69.
Microcom ... NCP
 6234 CarbonCopy Plus 5.2 119.
 7024 CarbonCopy Plus+ Host 5.2 199.
Micrografx ... NCP
 6597 Designer 3.01 489.
Micro Logic ... NCP
 6787 Info Select 1.1 55.
Microlytics ... NCP
 2731 GOfar 2.0 45.
Microsoft ... NCP
 7010 Windows 3.0 99.
 7388 Project for Windows 1.0 469.

- 7387 PowerPoint for Windows 1.0 . . . \$329.
 2904 Works 2.0 99.
 2901 Word 5.0 209.
 6195 Word for Windows 1.0 329.
 2856 Excel 2.1 call
 2894 QuickBASIC 4.5 69.
 2895 QuickC 2.0 69.
 2853 C Compiler 6.0 339.
Multisoft ... NCP
 4925 PC-Kwik Power Pak 1.5 79.
Nolo Press ... NCP
 2982 WillMaker 3.0 35.
Norton-Lambert ... NCP
 4928 Close-Up Customer 3.0 135.
 4929 Close-Up Support 3.0 165.
PC Globe ... NCP
 5902 PC Globe 3.0 39.
 5900 PC USA 1.0 39.
Personics ... NCP
 4384 Ultravision 2.0 79.
 7048 Monarch 1.0 (Data Mgmt. Tool) . 319.

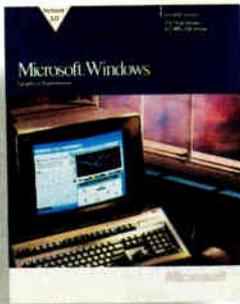


Custom Applications ... NCP
 7474 Freedom of Press 2.2—Print PostScript language files from your PC to over 50 non-PostScript printers. Comes with 35 scalable PostScript fonts and works with any application that can produce PostScript files . \$255.



Microcom ... NCP
 7024 CarbonCopy Plus+ Host 5.2—Control or monitor a remote PC from your PC using standard dial-up modems. Get both controller and client software in one package . \$199.

- Reference Software ... NCP**
 4396 Grammatik IV 1.0 52.
 7483 Grammatik Windows 1.0 52.
Revolution Software ... NCP
 4480 VGA Dimmer 2.01 (screen saver) . 19.
RightSoft ... NCP
 4155 RightWriter 3.1 54.
Samna ... NCP
 5799 Ami Professional 1.2 309.
Softlogic Solutions ... NCP
 3542 Software Carousel 4.0 55.
Software Publishing ... NCP
 3499 PFS:First Publisher 3.0 99.
 3478 PFS:First Choice 3.02 105.
 3496 Professional Write 2.2 165.
 3482 Harvard Graphics 2.3 339.
Symantec ... NCP
 3425 Q&A 3.0 229.
 3431 Timeline 4.0 469.
Systems Compatibility ... NCP
 6564 Software Bridge 4.1 79.

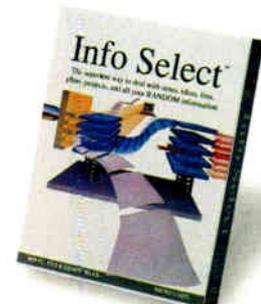


Microsoft ... NCP
 7010 Windows 3.0—It's what the GUI ("gooie") gurus have been waiting for. The latest in Graphical User Interface for MS-DOS machines. Lets each application access much more memory and do it faster . \$99.

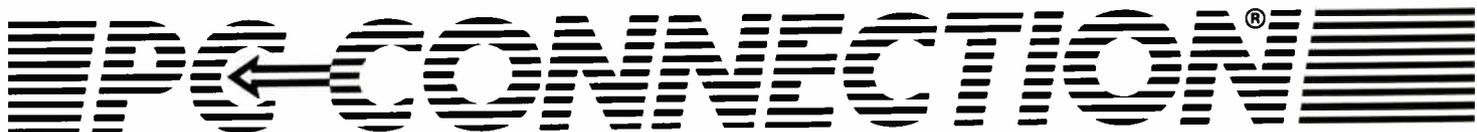
- Peter Norton ... NCP**
 3152 Norton Commander 3.0 99.
 3146 Advanced Utilities 4.5 99.
 6397 The Norton Backup 1.1 99.
Precision Software ... NCP
 6600 Superbase 4 for Windows 1.2 . . 429.
Qualitas ... NCP
 7539 386MAX 5.0 75.
Quarterdeck ... NCP
 6422 QRAM 1.0 49.
 3221 Expanded Memory Mgr. 386 5.1 . 59.
 3220 DESQView 2.26 79.
 4586 DESQView 386 1.1 129.
Reality Technologies ... NCP
 6572 WealthBuilder 1.1 145.

1-800/776-7777

MMC **PC Connection** **760B**
 6 Mill Street
 Marlow, NH 03456
SALES 603/446-7721 FAX 603/446-7791



Micro Logic ... NCP
 6787 Info Select 1.1—The fastest most exciting new way to deal with notes, ideas, plans, contacts, and all your RANDOM information. Easy yet powerful. Endless uses . \$55.



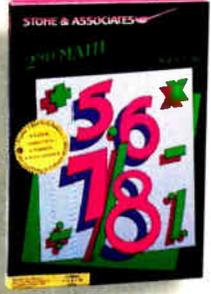
ALL ITEMS SUBJECT TO AVAILABILITY. PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

Newsprint and boxes.



RightSoft ... NCP
4155 Right Writer 3.1—Make your business writing clear, concise and powerful. Award winning Right Writer checks your grammar, style, word usage and punctuation. Works with most popular word processors. . . \$54.

- TIMESLIPS ... NCP**
2987 Timeslips III 3.4 169.
6994 PercentEdge 1.0 69.
- Timeworks ... NCP**
6253 Publish-It! 1.1 115.
- TOPS ... NCP**
6675 TOPS Network Bundle 3.0 159.
3720 Flashcard 2.1 (AppleTalk network card; 1 year warranty) 155.
- Touchstone Software ... NCP**
7420 Check It 2.1 89.
- Traveling Software ... NCP**
4190 Battery Watch 2.0 (3 1/2" only) 35.
5179 LapLink III 3.0 95.
- True BASIC ... NCP**
3561 True BASIC 2.1 52.
- Vericomp ... NCP**
6771 Memory Master 1.0 45.
- WordPerfect Corp. ... NCP**
3804 WordPerfect 5.1 265.
6685 DrawPerfect 1.1 279.

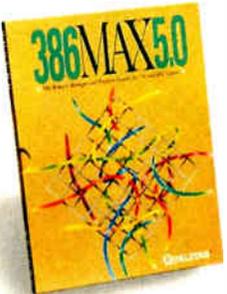


Stone & Associates ... NCP
3439 2nd Math—WILL YOUR CHILD COMPETE...at the college of your choice? Excellent math skills equal academic success! 2nd Math teaches basic math skills, fractions—even pre-algebra. \$27.

- WordStar International ... NCP**
6791 WordStar Prof. 6.0 \$279.
- Xerox ... NCP**
3812 Ventura Publisher Gold 3.0 559.
- XTREE ... NCP**
6161 XTreePro Gold 1.4 75.
- ZSoft ... NCP**
7016 PC Paintbrush IV Plus 1.0. 119.

RECREATIONAL/EDUCATIONAL

- Broderbund ... CP**
5701 Where/Time Carmen Sandiego? 32.
6295 The Playroom 32.
5851 SimCity 33.
- Electronic Arts ... NCP**
5804 Deluxe Paint II (Enhanced) 89.
- Microsoft ... NCP**
2858 Flight Simulator 4.0 39.
- Penton Overseas ... NCP**
 VocabuLearn/ce Levels I & II (French, Italian, German, Spanish, Russian, and Hebrew) each 39.



Qualitas ... NCP
7539 386MAX 5.0—Powerful new MAXIMIZE feature finds and uses all the memory you paid for. Automatic install makes this industry standard memory manager indispensable for all level of 386 users . \$75.

- Sierra On-Line ... CP**
6023 Leisure Suit Larry III 39.
6796 Codename: Iceman 39.
6972 Conquests of Camelot 39.
- Software Toolworks ... NCP**
6436 Hunt for Red October 20.
4659 Chessmaster 2100 (CP) 35.
- Stone & Assoc. ... NCP**
3438 Young Math (ages 5 to 8) 22.
3439 2nd Math (ages 7 to 16) 27.
- True BASIC, Inc. ... NCP**
 Kemeny/Kurtz Math Series:
10 titles each 45.

HARDWARE

Manufacturer's standard limited warranty period for items shown is listed after each company name. Some products in their line may have different warranty periods.



Corel Systems ... NCP
5506 CorelDRAW! 1.2—The world's leading PC illustration software now comes with even more value: CorelTRACE, over 100 typefaces, over 300 clip-art images, a Pantone license—all bundled in for free \$329.

- American Power ... 2 years**
7108 APC Smart-UPS 400 339.
6812 200DL (stand-by power source) . . . 155.
6811 360SX (stand-by power source) . . . 255.
7107 450AT (stand-by power source) . . . 339.
7106 520ES (stand-by power source) . . . 399.
7105 600LS (stand-by power source) . . . 469.
- AST Research ... 2 years**
1299 SixPakPlus 384k C/S/P 179.
6795 SixPak 286 512k 209.
4107 RAMpage Plus 286 512k 419.
6980 VGA Plus (w/512K) (800 x 600 res) 229.
- Boca Research ... 5 years**
7001 BOCARAM/AT PLUS (0-8 Meg) (LIM 4.0 extended) 125.
7061 BOCARAM/XT OK (0-2 Meg, LIM 4.0) 99.
7135 TophAT (16-bit backfill 512K to 640K) 99.
6998 I/O Board for AT 59.
6999 I/O Board for Microchannel S/S/P . 109.
6995 SuperVGA (800 x 600, 16/8 bit) . . . 135.
7026 1024 VGA (16 bit non-interlaced, 512K) 219.
- Bravo Communications**
7400 2 Pos. Laser Compatible Switch Box 109.
- Brother International ... 1 year**
5787 HL-8e Laser Printer 1699.
5788 HL-8Ps PostScript Laser Printer . . 2949.
- CH Products ... 1 year**
7341 Gamecard III Plus (for Microchannel PS/2s) 49.
7340 Flight Stick 49.
7345 RollerMouse (Trackball) serial 85. bus 99.
- Compucable ... 2 years**
1604 2-Position switch box 25.
- Cuesta ... 1 year**
1608 Datasaver 400 Watt (power backup) 429.
- Curtis ... lifetime**
1694 Emerald SP-2 36.
1707 Ruby SPF-2 (6 outlets) 55.
1708 Ruby-Plus SPF-2 Plus 65.
7358 Command Center 93.
Glass Filter Plus (anti-glare screen with radiation protection, specify screen size) each 65.



Nothing obnoxious.

All recyclable.



Intel ... 5 years
4275 Connection CoProcessor—Sends and receives faxes from within many popular applications. Communicate without interrupting your work. Includes Central Point's PC Tools Deluxe 6.0 \$529.

- Datadesk ... 3 years**
6901 Switchboard 175.
- Diconix ... 1 year**
5655 150 Plus Printer (Parallel) 359.
- Epson ... 1 year**
We are an authorized Epson Service Center.
- 1906 FX-850 (80 col., 264 cps, 9 pin) ... call
1904 FX-1050 (136 col., 264 cps, 9 pin) ... call
5183 LQ-510 (80 col., 180 cps, 24 pin) ... call
1930 LQ-850 (80 col., 264 cps, 24 pin) ... call
6765 LQ-1010 (136 col., 180 cps, 24 pin) call
1917 LQ-1050 (136 col., 264 cps, 24 pin) call
5184 LX-810 (80 col., 180 cps, 9 pin) ... call
1052 Printer-to-IBM cable (6 feet) 15.
- 5th Generation ... 1 year**
7157 Logical Connection Plus 512k 599.
- Hayes ... 2 years**
2307 Smartmodem 2400 349.
7391 Ultra 9600 Modem 899.
- Hercules ... 2 years**
2318 Graphics Card Plus 189.
- Hewlett-Packard ... 1 year**
6754 LaserJet III (w/toner) 1699.
6582 LaserJet IIP (w/toner) 1069.
- Intel ... 5 years**
6421 2400B MNP Internal Modem 199.
2352 2400B Internal Modem 2 (for PS/2) 249.
5119 2400 Baud External Modem 179.
6420 2400EX MNP Modem 229.
2346 Inboard 386/PC w/1 Meg (w/free Ami) 519.
4266 Above Board Plus 512k 419.
4267 Above Board Plus I/O 512k 449.
5336 Above Board Plus 8 2 Meg 599.
5342 Above Board Plus 8 I/O 2 Meg 629.
4272 Above Board 2 Plus 512k 469.
5396 Above Board MC 32 0k 359.
4275 Connection CoProcessor 529.
- MATH COPROCESSORS**
7385 80287XL (for 80286 CPU's) 229.
4750 80387SX (for 80386SX CPU's) 309.
2371 80387 (for 16 MHz 80386 CPU's) 349.
2372 80387-20 (for 20 MHz 80386 CPU's) 399.
- Keytronic ... 3 years**
4518 101 Plus Keyboard 99.

- Kraft ... 5 years**
5800 3 button Thunder Joystick \$29.
5802 Trackball 69.
- Logitech ... limited lifetime**
5464 C9 Mouse for PS/2's 69.
5151 HiREZ Mouse (C9) 85.
6029 Trackman (Trackball) serial 85. bus 89.
4297 ScanMan Plus (hand scanner) ... 185.
- Micron Technology ... 2 years**
6669 Intensify 2 Meg Expansion for HP LaserJet II (upgradeable to 4 Meg) . 219.
7012 Beyond Memory Board for PS/2 Model 70 (2 Meg) 265.
- Microsoft ... lifetime**
2897 Mouse with Paintbrush 109.
2898 Mouse with Windows 3.0 149.
- MicroSpeed ... 1 year**
6007 PC-TRAC Trackball serial 75. bus 85.
- Mouse Systems ... lifetime**
5997 Trackball (1 yr. wrnty.) serial 75. bus 85.
4306 PC Mouse II w/PC Paint+ 89.
- NEC ... 2 years**
4799 Multisync 2A (VGA Monitor) 499.
5085 Multisync 3D Monitor 689.



Intel ... 5 years
Above Boards—FREE Quarterdeck QRAM and Manifest with any Above Board or piggyback, now through December 31, 1990! see Intel listing for prices.

- Orchid Technologies ... 4 years**
7512 ProDesigner VGA II (1024 x 768) . 299.
- PC Power & Cooling ... 1 year**
REPLACEMENT POWER SUPPLIES
3202 Turbo Cool 150 (25° - 40° cooler) 129.
3200 Silencer 150 (84% noise reduction) 115.
7053 InnerSource 2210 (internal backup) 399.
- Pacific Data Products ... 1 year**
6779 25 Cartridges in One! (for LJ II, IIP, IID) .275.
7072 25 Cartridges in One! (for LJ III) 349.
Memory upgrade for LaserJet IIP/III
7054 1 Meg 179. 7055 2 Meg 249.

1-800/776-7777

MIMC **PC Connection** **760B**
6 Mill Street
Marlow, NH 03456
SALES 603/446-7721 **FAX** 603/446-7791



Intel ... 5 years
2346 Inboard 386/PC with Free Samna Ami— Gives you 80386 processing power, 1 Mb RAM, and Samna's powerful Windows-based word processor (regularly at \$129). 30 Day Money Back Guarantee. \$519.

- 6839 Memory upgrade for LaserJet II
1 Meg 179. 2 Meg 249.
- 7158 Pacific Page (PostScript Cartridge for LaserJet IIP/III) 379.
- Practical Peripherals ... 5 years**
3101 1200 Baud Internal Modem 65.
3100 1200 Baud External Modem (mini) . 77.
3103 2400 Baud Internal Modem 135.
3102 2400 Baud External Modem 179.
5286 2400 Baud Int. MNP Modem (Lev. 5) 175.
5285 2400 Baud Ext. MNP Modem (Lev. 5) 209.
4542 2400 Baud Internal Modem for PS/2 . 229.
7008 P/NET (peripheral sharing) 1189.
- Reflection Technology ... 1 year**
7127 Private Eye (virtual display) 499.
- SAFE Power Systems ... 2 years**
4562 Safe 425W (standby power bkup) 329.
6747 Safe 400S (new) 399.
- SOTA Technology ... 2 years**
5111 SOTA 286i-12 (12 MHz accelerator) 269.
5402 SOTA 386i-16 (16 MHz accelerator) 389.

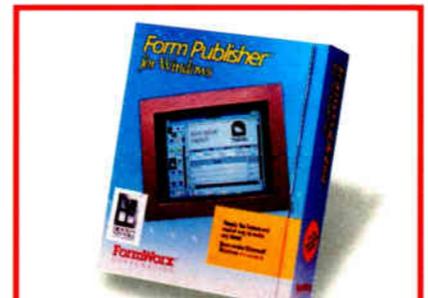


Intel ... 5 years
MNP Modems—Features data compression, error correction, & a built-in buffer providing compatibility with OS/2.
6421 2400B MNP Internal Modem. \$199.
6420 2400EX MNP Modem 229.

- Targus ... lifetime**
7028 Foliopac 1 \$79.
4899 Nylon Laptop carrying case 55.
6037 Premier leather carrying case 199.
- TheComplete PC ... 2 years**
5140 TheComplete Page Scanner 549.
5828 TheComplete Communicator 559.
- Tripp Lite ... 2 years**
6199 Isobar 4-6 (4 outlets, 6 ft. cord) 49.
6200 Isobar 6-6 (6 outlets, 6 ft. cord) 59.
- Video 7 ... 7 years**
5883 1024i VGA (includes 512k) 269.
4931 VRAM VGA 512k 379.

DRIVES

- IOMEGA ... 1 year**
5116 Bernoulli II Single 44 Meg Internal 995.
5117 Bernoulli II Dual 44 Meg External 1969.
5113 44 Meg Cartridge Tripak (5 1/4") . . . 249.
2499 PC2 Controller 169.
7551 Bernoulli II Transportable 44 Meg . 1299.
- Mountain Computer ... 1 year**
2917 40-60 Meg Internal Tape Drive. 379.
5502 83-152M Ext. Tape Drive 799.
5500 83-152M Int. Tape Drive 629.
5190 DC2000 Pre-formatted Cartridges ea. 35.



FormWorx ... NCP
7311 Form Publisher for Windows 1.2—Desktop publishing designed especially for creating professional-quality forms. Use unique object-oriented design techniques & import graphics. Over 600 forms included! . . \$145.

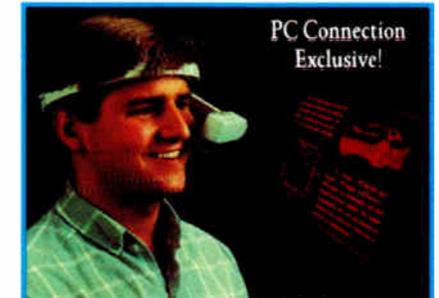
- Pacific Rim ... 1 year**
5010 1.2 Meg External (for PS/2's) 215.
6602 1.44 External (for PC/XT/AT) 239.
- Plus Development ... 2 years**
6425 Hardcard II 40 Meg (19 ms) 599.
6424 Hardcard II 80 Meg (19 ms) 699.
- Seagate ... 1 year**
2285 20 Meg Int. Hard Drive ST225 (w/controller and cables, 65 ms) . . 275.
2286 30 Meg Int. Hard Drive ST238 (w/controller and cables, 65 ms) . . 289.
4554 40 Meg Int. HD ST251-1 (28 ms) . . 359.
- TEAC ... 1 year**
4951 720k Drive (specify XT or AT, 3 1/2") . 75.
4670 1.44 Meg Drive for PC/XT (3 1/2") . . 89.
4326 1.44 Meg Drive for AT (includes Bastech software utilities, 3 1/2" copy prot.) . 109.

MISCELLANEOUS

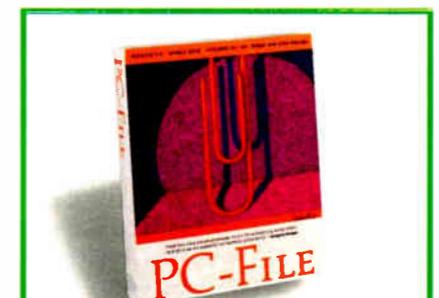
- Checkfree**
6360 CheckFree (electronic checking sv.) \$25.
- CompuServe**
7546 DOS Membership Kit 23.

DISKS

- Maxell ... lifetime**
2789 5 1/4" MD2-D 360k Disks (Qty. 10) . . . 12.



Reflection Technology ... 1 year
7127 Private Eye—A large screen in a small box. A tiny virtual display which offers a full-size, 12" IBM CGA auxiliary screen to PCs & laptops. View privately in planes or meetings. Brighter than LCDs. \$499.



ButtonWare ... NCP
6419 PC-File 5.0—The most friendly, comprehensive database available. It includes letter-writing with mail merge, business graphing, and a powerful report writer. It also works directly on dBase files . . . \$75.

- 2790 5 1/4" MD2-HD 1.2Mb Disks (Qty. 10) . 19.
2792 3 1/2" DS/DD 720k Diskettes (Qty. 10) . 14.
2793 3 1/2" DS/HD 1.44Mb Diskettes (Qty. 10) 27.
- Sony ... lifetime**
3291 5 1/4" DS/DD 360k Disks (Qty. 10) . . . 10.
3292 5 1/4" DS/HD 1.2Mb Disks (Qty. 10) . . 19.
3297 3 1/2" DS/DD 720k Diskettes (Qty. 10) . 13.
3298 3 1/2" DS/HD 1.44Mb Diskettes (Qty. 10) 22.
6659 QD 2000 Tape Cartridge 19.

MEMORY

- 6556 256k DRAMs (100 nanosecond) . . . call
3248 256k DRAMs (120 nanosecond) . . . call
4366 1 Meg x 9 SIMMs (100 nanosecond) call
5510 1 Meg x 9 SIMMs (80 nanosecond) call
5746 1 Meg Chips (80 nanosecond) . . . call

OUR POLICY

- We accept VISA and MASTERCARD only.
- No surcharge added for credit card orders.
- Your card is not charged until we ship.
- If we must ship a partial order, we never charge freight on the shipment(s) that complete the order (in the U.S.).
- No sales tax.
- All U.S. shipments insured; no additional charge.
- APO/FPO orders shipped 1st Class Mail.
- International orders U.S. \$250 minimum.
- Upon receipt and approval, personal and company checks clear the same day for immediate shipment of your order.
- COD max. \$1000. Cash, cashier's check, or money order.
- 120 day limited warranty on all products.*
- To order, call us Monday through Friday 8:00 AM to 1:00 AM, or Saturday 9:00 AM to 5:30 PM. You can call our business offices at 603/446-3383 Monday through Friday 9:00 AM to 5:30 PM.



Omega ... 1 year
7551 Bernoulli II Transportable—The compact version of the Bernoulli Universal family removable media drive, offering users the freedom to easily move his/her Bernoulli drive from one AC outlet to another \$1299.

SHIPPING

- Note:** Accounts on net terms pay actual shipping.
- Continental US:**
● For heavy hardware items such as printers, monitors, Bernoulli Boxes, etc. pay actual charges. Call for UPS 2nd-Day & Next-Day-Air.
● For all other items, add \$3 per order to cover UPS Shipping. For such items, we automatically use UPS 2nd-Day-Air at no extra charge if you are more than 2 days from us by UPS ground.
- Hawaii:**
● For monitors, printers, Bernoulli Boxes, computers, hard drives, and power backups, actual UPS Blue charge will be added. For all other items, add \$3 per order.
- Alaska and outside Continental US:**
● Call 603/446-7721 for information.



*DEFECTIVE SOFTWARE REPLACED IMMEDIATELY. DEFECTIVE HARDWARE REPLACED OR REPAIRED AT OUR DISCRETION.

©COPYRIGHT PC CONNECTION, INC., 1990. PC CONNECTION IS A REGISTERED TRADEMARK OF PC CONNECTION, INC., MARLOW, NH. THE RACCOON CHARACTER(S) ARE TRADEMARKS OF PC CONNECTION, INC.

PC Clout.

Diamonds in the rough.
(Or, why you're always safe with us.)

An early fall afternoon. The sky is bluer than the IBM logo and there's enough electricity in the air to light up Yankee Stadium. You could be at Candlestick, Wrigley, or Fenway, munching a frank, and yelling, "It's outta here!" But the players are suspiciously furry and there's a level of play you rarely see anymore, even in the big leagues. Welcome to the silicon sandlot of Marlow, NH (pop. 563). Where the only game that's played is hardball. And where we don't take American Express. (Just VISA, MC, and Corporate P.O.s.)

Students of the game know that when it comes to PC mail order we

wrote the book: toll-free tech support, latest versions only, and price lists complete with up-to-date stats on warranties, disk size, and copy protection. Give us a call next time you need to know the score on any PC product. We'll never leave you out in left field.

Get into the swing of things.

We have a reputation for always going to bat for our customers. Well now you can go to bat for yourself anytime you like with your very own 32" "R.G. Johnson" bat, custom-made and hand-crafted in New England from solid ash by R.G.'s grandson Bob. This cracker-jack offer is free to everyone who places an order of \$1000 or more between now and November 30.



Go for the fences with the PC Connection Bat featuring our own heavy-hitting mascots. Offer not available to accounts on net terms. One per customer.

REAL-TIME MULTITASKING KERNEL

8086/88, 80x86/88 80386
Z80, 64180, 8080/85 68000/10/20

- Fast, reliable operation
- Compact and ROMable
- PC peripheral support
- DOS file access
- C language support
- Preemptive scheduler
- Time slicing available
- Configuration Builder
- Complete documentation
- Intertask messages
- Message exchanges
- Dynamic operations
 - task create/delete
 - task priorities
 - memory allocation
- Event Manager
- Semaphore Manager
- List Manager
- InSight™ Debugging Tool

THE BEST

Join over 600 developers such as IBM®, Xerox, Hewlett Packard, Hayes, Hughes Aircraft and NASA.

CHOOSE AMX

The best low-cost, high-performance real-time multitasking system available today.

No Royalties
Source Code Included

Demo Disk \$25 US
Manual only \$75 US
AMX 86 \$3000 US
(Shipping/handling extra) *Call for prices for other processors.*

IBM is a registered trademark of IBM Corp.
Z80 is a trademark of Zilog, Inc.
AMX, AMX 86, InSight are trademarks of KADAK Products Ltd.

KADAK Products Ltd.

206-1847 West Broadway
Vancouver, B.C., Canada
V6J 1Y5
Telephone: (604) 734-2796
Fax: (604) 734-8114

thread is a dispatchable element used by MS OS/2 to track execution cycles of the processor." Three years later, that still doesn't tell me anything.

Then came the infamous MTDYNA.DOC. At first, you couldn't use the C library if you wanted to use threads, because the library routines weren't reentrant. In the spring of 1988, a new release of the C compiler brought the multi-threaded library and headers and a 1039-line read-me file, MTDYNA.DOC, buried on one of the disks. For two years, that was the only official documentation for most of us.

Other roadblocks have been the constantly changing "musical header files." I know I've not been alone in just dreading each new SDK or Toolkit release. Each one seemed to bring a new set of seemingly gratuitous changes to all the names defined in the headers. First it was all uppercase, then mixed case; first English, then Hungarian. Each release meant nothing would compile until I'd made all the same gratuitous changes to all my own source code.

Least Common Denominator

The other big reason that there aren't many great multithreaded applications is that once you write one, it's not portable. Conversely, if you're porting something in from another environment, you don't just add threads and stir. To really use threads, you have to weave them pretty tightly into the fabric of your product. And let's face it: It's one thing to be non-portable if you're selling to an installed base of 50 million users, and quite another to a base of only 300,000.

Not surprisingly, most of the first wave of applications for OS/2 have been ports from DOS or Windows. Microsoft's own Word 5.0 and Excel are two very disappointing but typical examples of programs that do absolutely nothing to take advantage of OS/2. Neither Word nor Excel will do background printing; Excel doesn't even let you move its window around while it prints.

The arrival of Windows 3.0 clouds things further. With the upcoming capability of OS/2 2.0 to run Windows binaries unmodified, many developers may think that the right answer is the purely opportunistic one: Write it for Windows, and if it works on OS/2, fine, but don't do anything special. In other words, don't use threads.

What's the Prognosis?

In my view, the prognosis is mixed. On the technical side, things have improved. Documentation is much better. Many

books show how to write a multithreaded program. From discussions I see on BIX and elsewhere, most developers seem to be gaining the familiarity and experience they need.

OS/2 2.0 promises a new, improved semaphore application programming interface that's touted as easier to use, although I'm skeptical. In my experience, it's not the semaphore primitives that are at fault, it's that semaphores are inherently tricky. Race conditions are just plain tough to avoid and even tougher to debug.

I see nothing that changes that. Some version 2.0 changes appear to be more musical headers. For example, the so-called FS (fast, safe) semaphores introduced with great fanfare last year are gone. What possible reason could there have been to introduce these semaphores at all if they were going to be eliminated so quickly?

But the biggest impediments to seeing all those great multithreaded applications now and through the rest of the year will be nontechnical. If sales of OS/2 continue at current levels, don't expect much.

Still, there's hope. Although Windows 3.0 will likely give all of us in the OS/2 community gas pains, it may ultimately be the best thing that could happen to OS/2. If you have the hardware to run Windows 3.0 acceptably, OS/2 should run fine also. OS/2 2.0 will make the migration easier. I have one DOS box right now, and, for me, it's one too many, considering how often I bother with it. But I admit even I was strangely captivated to see multiple DOS applications like good old Lotus 1-2-3 running in Presentation Manager windows under OS/2 2.0.

Ultimately, competitive pressures will grow as more users and developers learn just what can be done with threads. Unlike breakfast cereal, where you can eat the whole box and still have no idea whether it's any good for you, most folks figure out pretty quickly whether new software is any good for them. Take heart: OS/2 threads, used properly, are very good for you—enough so anyone can notice. ■

Douglas A. Hamilton is the founder of Hamilton Laboratories in Wayland, Massachusetts, and the author of the Hamilton C shell, a command processor and utilities package for OS/2. He can be reached on BIX as "hamilton."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Extended-DOS

640K DOS



Go Beyond 640K DOS.

Build multi-megabyte programs with Phar Lap's 386|DOS-Extender.™

If the DOS 640K limit is driving you nuts, get all the memory you want with 386|DOS-Extender from Phar Lap.®

Large-scale benefits. By turning DOS into a true 32-bit operating system, 386|DOS-Extender shatters the 640K barrier. It lets you create protected mode applications that use all the memory in the machine – up to 4 gigabytes. You work within a flat, 32-bit address space. No more suffering with overlays, bank-switched EMS, or segmentation.

With full 32-bit memory and power, you can finally build workstation-class applications for the PC. Your Extended-DOS programs will run considerably faster, have room for more features, and be more responsive than those in 16-bit DOS.

And if that's not enough, add Phar Lap's 386|VMM™ virtual memory manager. With true demand-paging, 386|VMM enables your application to grow bigger than available RAM. Both code and data are automatically swapped to disk as needed.

Total compatibility. Because 386|DOS-Extender is embedded into your program, it is invisible to the end-user. Your program looks exactly like any other DOS application. There's no new operating environment for your end-users to buy or learn.

Every 80386 PC that can run MS-DOS or PC-DOS can run 386|DOS-Extender. It is completely compatible with all DOS-based software, including TSRs and network managers.

386|DOS-Extender is backed by a full complement of 32-bit languages. Choose your favorite from among C, Fortran, Pascal, Ada, Assembler, and others. And with

Phar Lap, you'll be using the finest, most widely used 386 software development tools in the world.

Proven success. AutoCAD 386, IBM Interleaf Publisher, and Paradox 386 are just a few of the hundreds of Extended-DOS applications already being shipped with 386|DOS-Extender. Utilizing this exciting new technology, industry leaders are keeping their competitive edge by delivering the speed and power that 386 users have been waiting for.

So if DOS is looking smaller than ever, call Phar Lap today.

And see what it's like beyond 640K.

Phar Lap 386|DOS-Extender.

We open a world of memory.



Phar Lap Software, Inc.
60 Aberdeen Avenue
Cambridge, MA 02138
617-661-1510
FAX 617-876-2972

Trademark holders: 386|DOS-Extender™ and 386|VMM™ – Phar Lap Software, Inc.; Interleaf Publisher™ – Interleaf, Inc.; Paradox™ – Borland International. Registered trademark holders: Phar Lap® – Phar Lap Software, Inc.; Ada® – U.S. Dept. of Defense; MS-DOS® – Microsoft Corp.; AutoCAD® – Autodesk, Inc.; IBM® – IBM Corporation. © 1989 Phar Lap Software, Inc.

Circle 222 on Reader Service Card

World Radio History

Up to 32 Simultaneous PC-to-Mainframe Connections with *No Impact* on Your DOS or UNIX Applications!

Your applications shouldn't have to compete with 3270 communications for your PC's scarce resources.

That's why we deliver our

Supports NetView, HLLAPI 3.0, and CLEO'S own API.

DataTalker 3270 high-performance PC-to-mainframe connectivity software on powerful

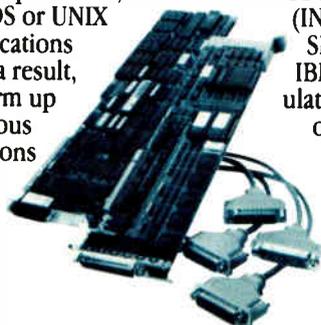
co-processor boards with on-board memory.

With DataTalker 3270, you can offload all communications processing and screen storage to the co-processor, freeing your DOS or UNIX system for applications processing. As a result, users can perform up to 32 simultaneous mainframe sessions

without affecting performance.

DataTalker 3270 provides full emulation of IBM 3278 terminals and 3274 controllers, along with 32 LUs, 512K

RAM, file transfer (IND\$FILE), BSC or SNA support, and IBM 3287 printer emulation. Line speeds of up to 56K baud are supported.



Adds only 1K to DOS applications, 40K to UNIX

To learn more, call us today at 1-800-233-2536. Or write to us at 3796 Plaza Drive, Ann Arbor, Michigan 48108. FAX: 313/662-1965.

CLEO 
CLEO Communications
A Division of Interface Systems, Inc.

AVAILABLE WORLDWIDE!

In Europe, call Sintec Peripherals Ltd. in Slough, England, at 0753-811888 (FAX: 0753-811666).



UNITE OR DIE

For LANs to continue their explosive growth, networks must become essential parts of everyday life

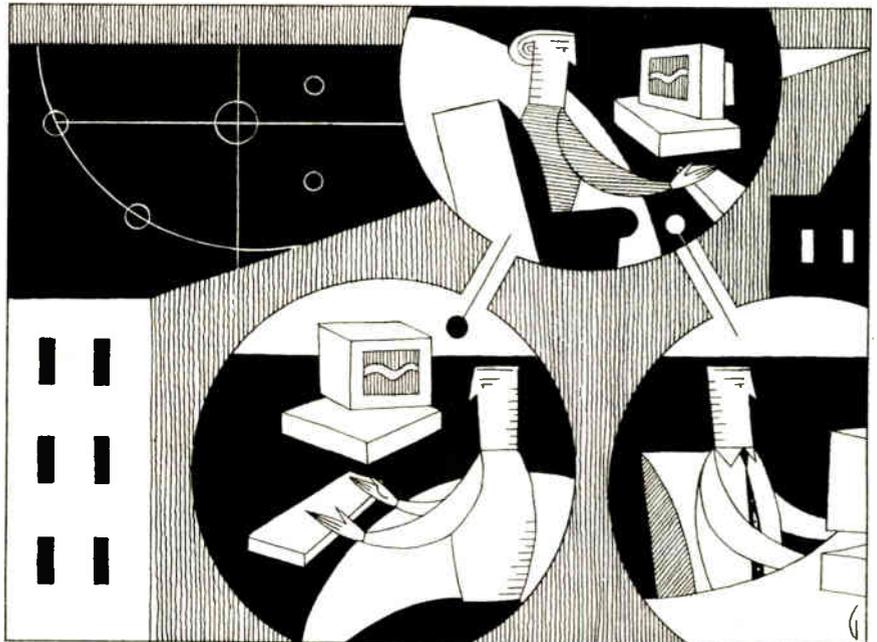
Like mainframes and minicomputers before them, LANs are rapidly approaching a critical juncture at which they must either make a major leap forward or face diminishing sales. Mainframes and minicomputers never made that leap, but we hope that LANs will. To do so, they must evolve from a merely useful technology into an essential one.

Current LAN applications won't take LANs over this hurdle. The vast majority of today's LANs let their users share files and printers. Those functions are important, to be sure, but cheaper solutions—such as peripheral-sharing devices and sub-LANs—are available.

The future of LANs will involve a union of three of today's hottest application areas: groupware, database servers, and multimedia. Each of these areas holds a key component that the others lack. Alone, each will undoubtedly enjoy a great deal of success, but together, either united into stand-alone applications or as pieces in a cooperative system, they have the potential to help LANs take that next step forward. To see why, we'll briefly consider each area individually.

Groupware

Many industry observers have hailed groupware as the class of killer applications that will "make" LANs. Indeed, the idea of groupware—software that helps people work together better—is a good one. Most groupware products aim first at the central problem of any group



interaction: communication.

Not surprisingly, E-mail is typically the cornerstone of most groupware packages. For example, the heart of Higgins, a package from Enable Software (Ballston Lake, NY) is a strong E-mail system. Higgins's other features, such as group scheduling, are closely linked to its E-mail.

With a basic communication mechanism in place, different groupware packages concentrate on other aspects of group interactions. For Syzygy from Information Research (Charlottesville, VA), the focus is project scheduling. Syzygy uses a central database of projects and resources to let users coordinate work on potentially large endeavors. Notes from Lotus Development (Cambridge, MA) concentrates on managing shared documents. And so on.

All those goals are worthy ones, but they are neither particularly new nor enough to maintain the phenomenal

growth rate that LAN sales have enjoyed to date. Many of the same features have been available for years in such minicomputer "office automation" (read "groupware") packages as Digital Equipment's All-In-1 and Data General's CEO Mail (CEO stands for Comprehensive Electronic Office). The minicomputer packages definitely helped minicomputer sales and even landed many new sales, but the march of technology is still, for the most part, leaving minicomputers behind.

Database Servers

Like groupware, database servers, the usual center of the oft-touted "client/server" architecture, have played the role of LAN savior for some time. They hold the promise of many LAN users not just sharing files, but also running transactions against the same data sets. Before long, these LAN database servers will

continued

ship in large quantities.

The primary feature of these LAN database servers will be one that has long been available on minicomputers: concurrency control, the good management of multiple users of a single database. Instead of the file-locking or manual record-locking of most current LAN applications, these servers will provide integrated transaction-management systems that correctly handle multiple simultaneous users. Solid, record-level concurrency controls are a crucial aspect of sharing data, and they are generally lacking in LAN applications.

LAN database servers also will bring to LANs a feature that is not available from minicomputers: the ability to move a large part of the application processing—the client portion—off the server system and onto the client systems. This step, however, is not as new as it might seem. Most minicomputer database systems already run as their own processes, with applications as separate processes. The client/server architecture involves little more than moving the application process from the server machine to the client machine and making sure that the

Products
in the areas of
groupware, database
servers, and multimedia
must work together in
cohesive packages.

two processes can communicate efficiently—not a trivial task, but certainly not one that represents a major step forward.

Regardless of their technical virtues, database servers alone won't save LANs. Like office automation packages, database systems prolonged the life of minicomputers and mainframes and in some cases even gave those large systems new jobs as powerful central servers, but they were not enough to maintain the high

sales growth that those systems once enjoyed.

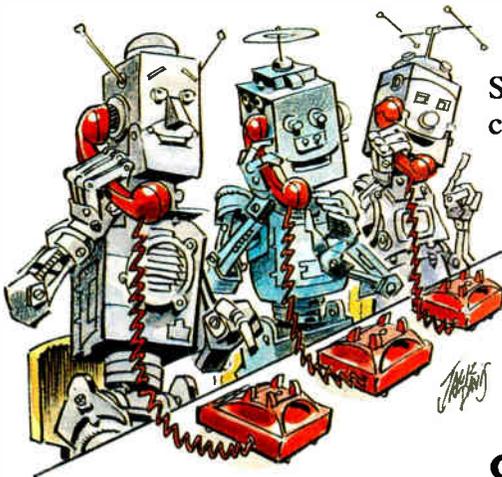
Multimedia

People don't communicate solely with the written (or typed) word. Sound and visual information are a key part of the interactions in any office. No matter how automated an office gets, people will still hold meetings, want to see each other's faces, and just talk. A picture will still be worth a thousand words.

The current push toward multimedia on many different fronts is the computer market's recognition of this fact. Most of the push is coming in two areas. The one that gets the most ink these days is the multimedia presentation, in which often-dazzling, MTV-like demonstrations combine traditional computer displays, animation, video, and digital audio. The other, only slightly quieter area is the re-wiring of America with fiber-optic cable and other high-bandwidth technologies. Fiber-optic cable's high capacity gives it the potential to bring computer data, telephone calls, TV, and streams of other data surging into our homes and

continued

Customer Support BBS



...for the IBM PS/2, XT, AT and compatibles.

Support your customers via modem. Electronic mail between your customers and you gives them the answers they need, 7 days a week!

- They can upload questions and problem reports to you
- You can download updates and product information to them
- Multiple users may be online at once, on one computer
- SIGs, teleconferencing, and questionnaires too
- Very easy to install and configure, works under MS-DOS
- Works with COM1/COM2/COM3/COM4, or multi-port serial cards or multi-modem cards

Only \$59 for the complete 2-line software!

Call our "demo" system with your modem: (305) 583-7808

GALACTICOMM

© 1990 Galacticomm, Inc. • 4101 S.W. 47th Avenue, Suite 101, Fort Lauderdale FL 33314 • Voice: (305) 583-5990

Announcing the end of the
SCSI compatibility crisis:

SmartConnex



The SCSI disk controller from DPT
that's so intelligent, it doesn't
need special software drivers!



SEE US AT BOOTH #1497
NETWORLD90
SEPTEMBER 11-13
DALLAS CONVENTION CENTER

*Makes the grade
without software drivers*

SCSI connectivity hassles are a thing of the past! SmartConnex makes it possible for the first time to run SCSI disk drives without special software drivers or BIOS ROMs that cause compatibility problems. Just plug in SmartConnex and you're all set—exactly as though you were using a standard ST506 drive. And, you'll enjoy optional connectivity to hundreds of other peripherals with appropriate software, including tape and optical drives.

A Ph.D. in compatibility

SmartConnex is compatible with *all* PC ATs and operating systems, and is guaranteed to work with *all* existing AT applications. So it isn't necessary to buy new programs or make any changes to system software. No matter what operating system or SCSI disk drive you use, you won't have to worry about controller compatibility.

A 68000 I.Q. on board

SmartConnex's on-board 68000 processor and custom-designed ASIC chips make it the highest-performance controller on the market. Its unique design pushes the fastest SCSI disk drives to their top performance limits!

An A+ in affordability

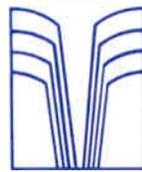
SmartConnex costs less and performs better than other products—it's that simple. When you consider cost along with SmartConnex's other great advantages, there's no smarter move!

Backed by the best: DPT

Distributed Processing Technology was the first to develop caching disk controllers and hardware disk mirroring for microcomputers, and is the recognized leader in the industry. Our products have been at work for over a decade, speeding up minis and mainframes. We offer a 1-year warranty, clear documentation, and outstanding technical support.

Put SmartConnex to the test!

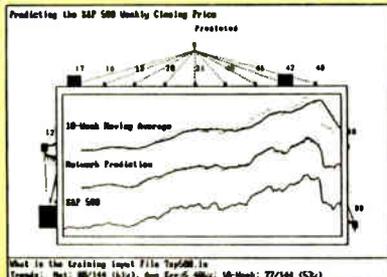
Call today and find out more about the end of the SCSI compatibility crisis—with SmartConnex, from DPT.

 **DPT
Distributed
Processing
Technology**

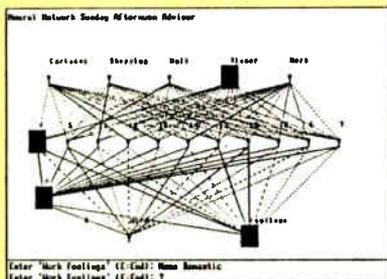
132 Candace Drive
Maitland, FL 32751
Phone: (407) 830-5522
FAX: (407) 260-5366

Circle 96 on Reader Service Card (RESELLERS: 97)

Introducing NeuralWorks™ EXPLORER



Stock Market Forecasting



Expert Systems

NeuralWare, Inc. presents NeuralWorks Explorer, a neural network tutorial that provides the novice user with a method of learning neural network theory as well as an environment in which to build practical applications. Available on both the MAC and PC. Price \$199.00. Visa and Mastercard accepted.

The NeuralWorks product line is currently used in:

- Oil Exploration
- Medical Diagnostics
- Industrial Inspection
- Credit Approval
- Process Control
- Insurance Underwriting
- Economic Modeling
- Noise Filtering
- Signal Processing
- Fraud Detection
- Bankruptcy Prediction
- Targeted Marketing



Penn Center West, Bldg. IV, Suite 227
Pittsburgh, Pennsylvania 15276

412-787-8222

businesses on a single glowing cable.

Both of these areas—particularly the high-bandwidth technologies—have the potential to help LANs, but they are still young. We're only just beginning to deal well with sharing text documents on LANs; sharing multimedia presentations is necessarily a step or two behind. Fiber-optic cable has the potential to be great, but it's still relatively expensive, and we're just learning how to use it well.

All Together Now

If LANs are to make the crucial transition from useful to essential, products in the areas of groupware, database servers, and multimedia must learn to work together in cohesive packages. Each offers an answer to some of the crucial weaknesses of the others. Consider the following cases in point:

- Groupware provides textual communication (e.g., E-mail) and the ability to share selected information (e.g., projects and documents), but the database core is rarely strong enough to let many users work simultaneously without compromising the integrity of the shared data.
- Database servers handle the above problems, but they don't yet deal well with crucial information like text and graphics.
- The database systems now commercially available also don't do a good job with truly distributed databases, where single logical databases are spread across multiple servers—a must in almost any organization with multiple sites. Concurrency problems are hard enough on a single-system database, but they become extremely difficult when the data is on multiple machines. The theoretical answers to these problems have been around for years, but vendors are just now beginning to ship systems with two-phase transaction commits and the other necessities of distributed databases.
- Groupware and E-mail products are also facing their version of this distributed data problem, because it is increasingly important for users on different servers in a local- or wide-area network to be able to exchange messages. Many of these products now can work with multiple servers, but, as on a single server, they generally do so without a strong database core.
- Multimedia packages let people merge voice, video, and computer-generated graphics with more traditional data, but they are generally not integrated with databases or with underlying communi-

cation (e.g., E-mail) technologies.

- The high bandwidth of fiber-optic cable offers the potential for LANs to move the large amounts of data that these complex unions necessarily involve, but first we must figure out how to store and manage such integrated messages.

A system that unites all these elements, a network in which your personal computer is your gateway onto a network of shared information of all kinds—from today's record- and file-oriented data to voice and video—now that's a system that you'll rapidly find essential.

We don't expect such a system to come from a single vendor. We don't even want it to come from one vendor. Instead, such a system will probably be a set of cooperating products from several different vendors.

For that to happen, these different technologies must be able to work together cleanly. Standard interfaces, such as the E-mail MHS (Message Handling System) and X.400 protocols that let different packages exchange messages, are an important part of the answer. They let vendors of different components concentrate on their particular slices of the pie, knowing that, as long their products use the standard interfaces, they will be able to work with the important products in the other areas.

Equally important are new capabilities that each of these products must offer the others. Databases, for example, must provide tools for storing and managing text and graphics better. Groupware and multimedia packages must, in turn, yield their data management problems to the more capable hands of the database systems. You get the picture.

If such systems actually appear, being tied to a network will be as natural as holding a meeting or making a call—and as crucial to successful business. Personal computers, and the networks that link them, will become information appliances much like telephones and phone networks, and they'll be just as essential. With such systems, the question about LANs will not be who needs them, but rather, who can afford not to have one. ■

Mark L. Van Name and Bill Catchings are BYTE contributing editors. Both are also independent computer consultants and freelance writers based in Raleigh, North Carolina. You can reach them on BIX as "mvanname" and "wbc3," respectively.

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.



Our Printer Sharing Unit Does Networking!

An Integrated Solution

Take our **Master Switch™**, a sophisticated sharing device, combine it with **MasterNet™** networking software for PCs, and you've got an integrated solution for printer and plotter sharing, file transfer, electronic mail, and a lot more. Of course you can also share modems, minis, and mainframes or access the network remotely. Installation and operation is very simple.

Versatile

Or you can use the Master Switch to link any computer or peripheral with a serial or parallel interface. The switch accepts over 20 commands for controlling the flow of data. It may be operated automatically, by command, or with interactive menus. Its buffer is expandable to one megabyte and holds up to 64 simultaneous jobs. The

MasterLink™ utility diskette for PCs comes with every unit and unleashes the power of the switch with its memory-resident access to the commands and menus.

Other Products

We have a full line of connectivity solutions. If you just want printer sharing, we've got

it. We also have automatic switches, code-activated switches, buffers, converters, cables, protocol converters, multiplexers, line drivers, and other products.

Commitment to Excellence

At Rose Electronics, we're not satisfied until you're satisfied. That's why we have thousands of customers around the world including large, medium, and small businesses, factories, stores, educational institutions, and Federal, state, and local governments. We back our products with full technical support, a one-year warranty, and a thirty-day money-back guarantee.



 **ROSE**
ELECTRONICS

Call now for literature or more information.
(800) 333-9343

Give a Rose to your computer

P.O. Box 742571 • Houston, Texas 77274 • Tel (713) 933-7673 • FAX (713) 933-0044 • Telex 4948886

Circle 255 on Reader Service Card



Cure For The Common Clone

IMAGINE. 386sx power, 200 MB-HD, 8 MB RAM, 1024 x 768 VGA with an internal modem...and it fits in a briefcase!

Introducing the Brick™. A 386sx with enough power, storage and graphics capability to run the most demanding applications. And it's the first desktop PC that's quiet enough, small enough and elegant enough not to be banished instantly to the floor. This remarkable computer measures 3"x 8"x 11" and weighs only 8.3 lbs.

More Practical Than A Portable

The Brick offers an alternative to the usual trade-offs associated with laptops. Simply keep a full sized monitor and keyboard at your home and office, and carry just the Brick in between. You save half the cost, half the weight, and all the hassle of coordinating files between multiple machines. *You can have one machine with all your files wherever you need it.*

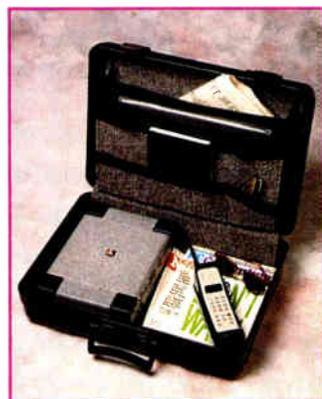
A Powerful And Quiet Desktop

Bricks are available with a 16 or 20 MHz 386sx; a 387sx coprocessor; 1 to 8 MB RAM; and your choice of a 40 (25ms), 100 (25ms), or 200 MB (16ms) hard disk. Bricks also deliver superb VGA graphics with 1MB video RAM supporting 800 x

600 and 1024 x 768 resolution for CAD, DTP or Windows. As an added benefit, the Brick is very quiet. Its rugged aluminum case serves as a heat sink so the whisper fan rarely runs.

832k for DOS

The Brick provides another welcome bonus: an extra 192k of memory above the DOS 640k limit. This unique feature allows you to load resident programs, such as a network or TSRs, into a contiguous 192k block of



The Brick fits in half a briefcase, leaving room for everything else you have to carry.

Circle 111 on Reader Service Card (RESELLERS: 112)



The Brick
3"x 8"x 11"
Only 8.3 lbs.

high memory, and still leave the lower 640k free. The regular Brick shown above also accepts an internal ISA 16-bit half length card, while the "Stretch Brick," shown at right, accepts one full and one half length card.

Great Value

Complete Brick systems start at just \$2,495. For your convenience, we also offer pre-installed software packages – including the DESQview™ or the new Windows® 3.0 environments – and top-rated applications. For example, the system (shown above) including all standard Brick features with optional color VGA monitor; 4 MB RAM; and a 100 MB hard disk pre-programmed with DESQview 386, Quattro®, Sprint®, askSam™, DOS™ and Tree86™ is only \$3,995! With this package, we also include our exclusive interactive "Talking

Tutorial" that quickly teaches you how to use each program. Yes, the Brick actually talks.



Optional paper white VGA LCD display with back-lit super twist technology.

Guaranteed Satisfaction

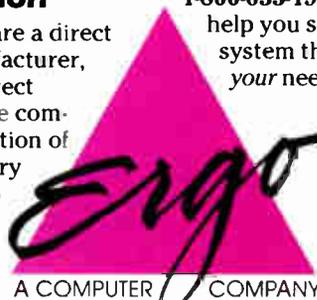
Because we are a direct selling manufacturer, we have a direct interest in the complete satisfaction of each and every customer. To ensure that satisfaction,

Ergo offers: a 30-day money back guarantee, a One Year Warranty, unlimited 800-line support and our exclusive Advanced Diagnostics via modem.

Free Catalog

You'll find complete information on all Brick systems, plus a full complement of enhancements including FAX and networking cards, tape backup unit, cases, monitors and more in our 32-page catalog. Why not call for it today?

Ergo also offers a line of traditional 386 computers, from 16 to 33 MHz, starting at just \$1,895. Call us at 1-800-633-1925 and we'll help you select the system that best meets your needs.



\$2,495
System Includes

- ▲ Stretch Brick
- ▲ 16 MHz Intel 386sx
- ▲ 1 MB RAM, Exp. to 8 MB
- ▲ 40 MB hard disk with password protection
- ▲ Mono VGA monitor
- ▲ 16-bit full and 8-bit half card expansion slots

Standard Features

- ▲ 1024 x 768 VGA controller with 1MB video RAM and EGA, CGA, MDA support
- ▲ 101 keyboard
- ▲ 2,400 bps modem
- ▲ 3.5" 1.44 MB floppy
- ▲ 2 serial & 1 parallel port
- ▲ World wide AC power
- ▲ Hypertext manual
- ▲ 832k DOS capable
- ▲ LIM 4.0 EMS support
- ▲ One Year Warranty
- ▲ Freight included

Free 32-Page Catalog
1-800-633-1925

Ergo Computing, Inc., One Intercontinental Way,
Peabody, MA 01960

BY0990

SHORT TAKES

BYTE editors' hands-on views of new and developing products

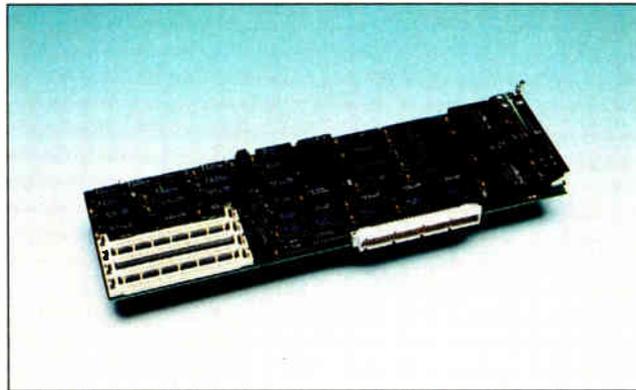
RasterOps Accelerator

Backpack

Legacy

Norton Utilities 5.0

HardFacts



RasterOps Accelerator Speeds Mac Graphics

A Mac II combined with a 24-bit color video board produces dazzling graphics. It makes the Mac a useful tool for professional art, graphic design, image manipulation, and color desktop publishing. However, working with near-photo-quality images or fancy graphics is *slow*. That's because you're working with 32-bit pixels (only 24 of the bits actually contain color data, hence the term 24-bit color). This means the Mac must muscle around about a megabyte or more of data when the screen is redrawn.

A faster Mac does little to help the situation: Even a 24-bit color screen redraw on a Mac IIx using a 640- by 480-pixel display is a trifle poky. The solution is to off-load some of the QuickDraw graphics operations performed by the Mac's CPU onto a dedicated graphics coprocessor. Several vendors—Radius, SuperMac, and even Apple—have introduced graphics boards that accomplish this.

Now there's the **RasterOps Accelerator**, which off-loads and boosts the speed of certain QuickDraw operations like fills and window movement. Like Radius, RasterOps uses a separate NuBus board that contains the accelerator logic. The Accelerator can't generate video signals itself: It

boosts screen performance by minimizing CPU-to-NuBus traffic and directly manipulating the frame buffer of a separate NuBus video board.

An Accelerator cdev/INIT patches QuickDraw so that certain drawing operations become coprocessor commands. It is these commands, not the usual pixel data, that the CPU writes out onto the NuBus. This reduces the amount of data that passes through the slow NuBus interface logic. These commands are executed by the Accelerator, which then modifies the frame buffer's contents at NuBus transfer rates. The Accelerator supports both NuBus block transfers (a special mode where up to 64 data bytes are rapidly sent across the bus) and bus locking (the Accelerator owns the bus continuously over numerous transfers). This last feature provides a claimed 25 percent to 50 percent boost for accel-

erated graphics operations.

Finally, like the Radius and Apple graphics boards, the Accelerator operates as a NuBus bus master. This lets it control and accelerate not only its Imager 8L and Imager 24L video boards, but other NuBus video boards that support block transfer operations (e.g., Apple's 8•24 card and Radius's DirectColor/24). The Accelerator's bus-locking feature also boosts the speed of video boards that support this capability, such as RasterOps video boards and Apple's Mac II 8-bit board.

The Accelerator provides four single in-line memory module sockets, where you can mount four 1- or 4-megabit-density, 80-nanosecond SIMMs to create a RAM buffer that is 4 or 16 MB in size. The Accelerator intercepts special graphics functions (called *GWORLD*) and routes the off-screen image data they work with into this

buffer. This lets the Accelerator operate on the image in its local buffer, rather than wait for the Mac's CPU to write it to the frame buffer. *GWORLD* functions are new; not many Mac applications take advantage of them, so the buffer can serve as a RAM disk. You don't need this RAM for the board to operate.

I tried the Accelerator with its version 1.0 software, a RasterOps Imager 24L 24-bit color video board on a Mac IIci and a Mac IIx running System 6.0.5. Both machines were equipped with 4 MB of RAM and an 80-MB hard disk drive. The Mac IIci drove a 1024- by 768-pixel monitor, while the Mac IIx drove a 640- by 480-pixel monitor.

Screen updates and desktop drawing were noticeably faster with the Accelerator. I used PageMaker 4.0 to create a 6-MB test file populated with two 24-bit PICT images, two 24-bit TIFF images, and several typefaces. I then scrolled about the document's pages and recorded the times. Depending on the position and type of image on the pages, scrolling rates improved by from only a few percent to nearly 50 percent. I also tried Apple's 8•24 board with the Accelerator and observed a performance improvement of about 11 percent peak—not as fast as RasterOps' own board, but an improvement. I also installed 4 MB of RAM on the Accelerator, and when I rebooted, a RAM disk of that size appeared on the desktop. Both the Accelerator and the Imager 24L worked reliably. The fact that the Accelerator works with other vendors' boards and multiple boards is a plus. If you plan on doing lots of 24-bit color work on your Mac, you might want to check out the Accelerator.

—Tom Thompson

THE FACTS

RasterOps Accelerator without RAM, \$495; 4-MB RAM expansion kit, \$795

Requirements:
Mac II running System 6.0.3 or higher with

32-Bit QuickDraw and 2 MB of RAM.

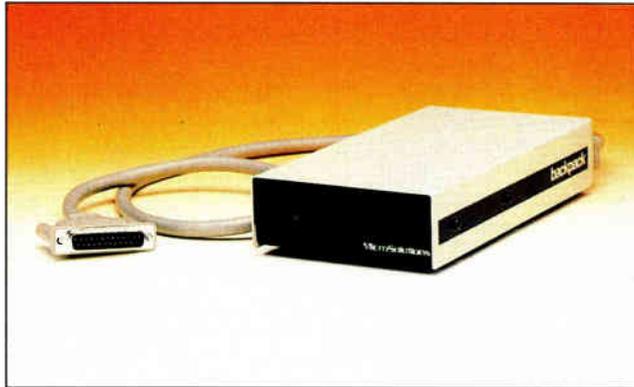
RasterOps
2500 Walsh Ave.
Santa Clara, CA 95051
(408) 562-4200
Inquiry 999.

Stuff Your Data into a Backpack

You wouldn't take MicroSolutions Computer Products' **Backpack** on a hike, but it does hook up to the back of most computers, and it adds an extra external floppy disk drive (either 3½- or 5¼-inch) to your system with an absolute minimum of fuss and bother.

Backpack's biggest selling point is that it doesn't need an expansion slot or special gadgets to get connected; it simply plugs into a parallel port. And that doesn't mean that you lose a printer port, because Backpack has a jack on its own panel where you plug in your printer. The drive and the printer cooperate and manage to share the port without getting in each other's way.

To install the Backpack, I plugged it into my computer's parallel port, hooked up its power supply, and switched it on. Then the installation software installed the device



THE FACTS

Backpack
5¼-inch (360K-byte or 1.2-MB), \$425; 3½-inch (720K-byte or 1.44-MB), \$349

Requirements:
IBM PC, PS/2, or compatible with a parallel port.

MicroSolutions Computer Products
132 West Lincoln Hwy.
DeKalb, IL 60115
(815) 756-3411
Inquiry 1000.

driver that Backpack needs and copied a special formatting program to my hard disk. It was then a simple matter to reboot the system and get to work. Backpack became the

next drive (E) on my system. No muss, no fuss.

The Backpack that I tested was the newest version, handling the new 2.8-megabyte *extended-density* disks that

will undoubtedly soon become a standard. Backpack formatted an ED disk in just a bit more time than a 1.44-MB floppy disk, showing a formatted capacity of a healthy and handy 2,931,712 bytes. Backpack also handles 720K-byte and 1.44-MB floppy disks flawlessly.

Backpack expects a fully IBM-compatible parallel port, and some ports on low-cost clones aren't. They may work fine with a printer, but Backpack gets terminal indigestion. You should try before you buy.

Of course, at about \$10 a crack, the special ED disks are expensive. You have to decide if you really need the storage space (and want to spend the extra \$75 the ED drive costs). If not, there are MicroSolutions' lower-capacity (and lower-cost) alternatives.

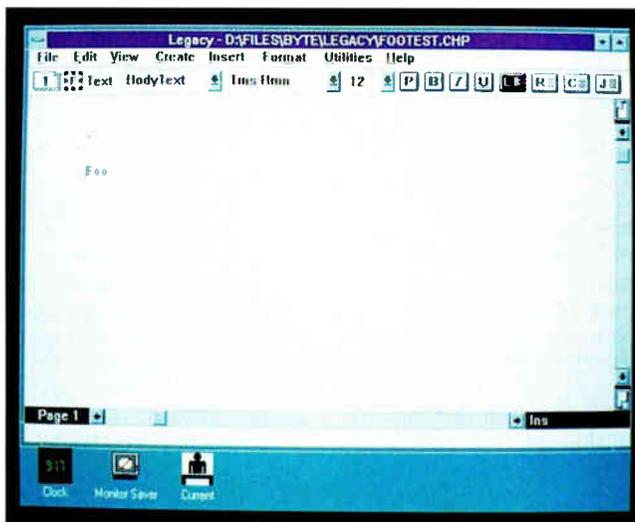
The drives aren't cheap, but if you need to add a drive to a computer that doesn't have room for one, or want to add some utility to your laptop, Backpack fills the bill.

—Stan Miastkowski

Legacy: Processing Words Under Windows 3.0

If a Macintosh is the computer for the rest of us, NBI's **Legacy** must be the word processor for those rich in free space on their hard disk.

Legacy is a flexible and powerful program in most ways, but it is a disk-space pig. How so? Well, a file containing four printable ASCII characters takes up 15,322 bytes of storage space when stored in Legacy (.CHP) format. By way of comparison, the same file in Am! Pro (.SAM) format takes up 4183 bytes on the disk; in Word for Windows (.DOC) format, 1754 bytes; in Microsoft Windows Write (.WRI) format, 640 bytes; and



in raw ASCII, 6 bytes.

As the amount of text in the file grows, the disparity between it and the disk space used shrinks, of course. For example, this entire Short Take, before editing, required 3393 bytes of disk space as an ASCII file. In Legacy format, it took up 18,706 bytes, and in Word for Windows format, 5338 bytes. This means that if your writing runs to memos, single-page letters, and other short compositions, Legacy is probably not the program for you. However, if you're looking for a program that adds some desktop publishing capa-

continued

bility to a full-featured word processor, Legacy should be on your check-it-out list.

Legacy requires DOS 3.2 or higher and Microsoft Windows 3.0, so you may need to upgrade your software. It's a full WYSIWYG word processor and allows screen images of up to 200 percent of actual page size. I found its draft-mode screen to be rather cluttered: Draft mode, in addition to displaying the actual text, also displays all tokens as a guide to what the formatted page would look like.

All the expected word processing features (e.g., cut, copy, and paste; search and replace; style sheets; spelling checker; thesaurus; automatic footnote, list, and endnote

THE FACTS

Legacy
\$495

Requirements:

A 286- or 386-based computer with at least 640K bytes of RAM (1 MB is recommended), a hard disk drive (20 MB minimum is recommended), DOS 3.2 or

higher, Windows 3.0, a Windows-compatible display device, and a mouse.

NBI, Inc.
3450 Mitchell Lane
Boulder, CO 80301
(800) 624-1111
(303) 444-5710
Inquiry 1001.

generation; hyphenation; headers and footers; and mail merge) are there. Dynamic Data Exchange and file linking are supported.

It can import and export text files in 15 different formats and import and export graph-

ics files in 13 different formats. Tabular data in Lotus 1-2-3 and Microsoft Excel format can be imported, also.

Formatting and page layout are very powerful. There's no limit to the number of text, graphics, or table frames that

can be used on a page. (A frame is simply a virtual box that holds a specific type of data. By having unlimited frames, it is—at least in theory—possible to build such complicated documents as a newspaper's supermarket ad or an illustrated page for an electronics component supply catalog.) A built-in editor can create vector graphics using object-oriented methods, much as high-end design programs like Micrografx Designer and Corel Draw can do. Text can flow across pages and columns into linked frames. Type sizes range from 1 to 792 points, and in normal, bold-face, italic, overstrike, underline, superscript, and subscript.

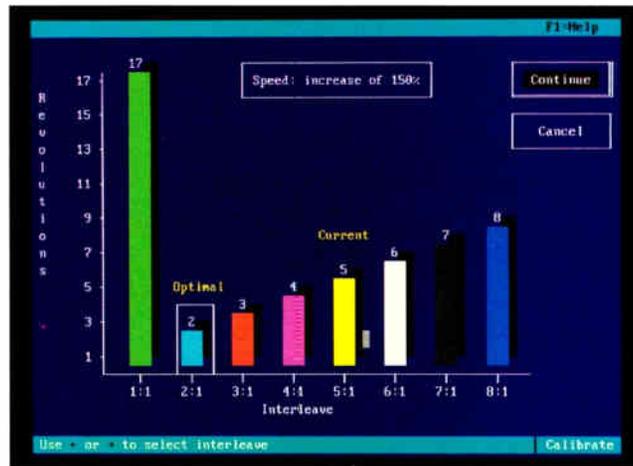
—George Bond

New Norton Utilities Puts on a Too-Happy Face

Norton Utilities 5.0 is loaded (or perhaps more accurately, weighed down) with a huge array of features that can be lifesavers for files, hard disk drives, and even whole systems. They're all tied together with a new Common User Access-like textual (pseudographic) interface that (for the first time) works with a mouse.

Ever since 1982, when Peter Norton released his seminal unerase utility and got the PC utility business off to a rousing start, the thing that I've liked best about Norton software is that it's always been lean, mean... and superb. Previous versions of NU were never chocked with features. They just did their job with a minimum of hassle. Sure, naive users could do real damage to a hard disk if they didn't know what they were doing, but that was part of the game.

In NU 5.0, Norton has unfortunately succumbed to the blatant featuritis that's recently affected the PC utility business. It's a cruel and competitive world out there, and today's conventional wisdom says you have to stuff your



products with every possible feature under the sun, and then add a few more.

Don't get me wrong. Some of NU 5.0's new features are ground-breaking, as Norton attempts to stay ahead of arch-competitors like Mace Utilities and PC Tools. In the limited space I have here, I can't do more than scratch the surface of the long list of what the new NU can do.

All the old familiar NU abilities are still in NU 5.0. Some have been vastly expanded. Norton Disk Doctor II is the most obvious example.

Like the original, it does a highly competent job of diagnosing (and recovering from) even the most esoteric hard disk problems. But in a nod to competitors like Disk Technician and SpinRite II, it now includes various levels of schedulable disk diagnosis and interleave tuning. If your drive's being occasionally cranky, you can even run a diagnosis that will chunk along for a few days.

Going beyond fixing a whole disk, Norton has come up with a new File Fix utility that attempts to recover the

contents of corrupted files. The first release of NU 5.0 works with Lotus 1-2-3 and dBASE files, and the Norton folks say that file fixers for other popular applications are in the works. No utility can recover all damaged data; there are just too many variables involved. But NU comes close indeed.

NU 5.0 is the first Norton Utility that works on a network, and new utilities like Disk Monitor and Diskreet are designed for connectivity. Disk Monitor (a TSR program) keeps a record of all

continued

THE FACTS

Norton Utilities 5.0
\$179

Requirements:

IBM PC, AT, PS/2, or compatible; hard disk drive required to run advanced diagnostics.

Peter Norton Computing
100 Wilshire Blvd.,
Ninth Floor
Santa Monica, CA 90401
(213) 319-2000
Inquiry 1003.



Embedded systems designers have already used CrossCode C in over 577 different applications.

CrossCode C comes with four powerful tools to help you program your 68000-based ROMable applications

From C source to final object, each tool takes you one step closer to your finished ROMable design

CrossCode C is designed specifically to help you write ROMable code for all members of the Motorola 68000 family. Four powerful tools take you from C source to object code:

1. COMPILER: To get truly ROMable code, you have to start with a truly ROMable compiler. Here are three CrossCode C features that you won't find in any ordinary C compiler:

- Compiler output code is split into five independent memory sections that you can assign into ROM or RAM as you please.
- You can optimize the code for your application because *you* control the sizes of data types. For example, you can optimize for speed by using two byte *ints*, or get maximum versatility by using four byte *ints*.
- You can easily write assembly language routines that call C functions and vice versa, because the compiler uses simple, well documented parameter passing conventions.

2. ASSEMBLER: CrossCode C comes with a Motorola-style assembler that has all the features that assembly language programmers require. In fact,

you could write your whole application with it:

- The assembler features an advanced macro language, conditional assembly, "include" files, and an unlimited size symbol table.
- Detailed cross references show you where you've defined and referenced your symbols.
- After a link, you can actually convert your "relocatable" assembler listings into "absolute" listings that contain absolute addresses and fully linked object code.

3. LINKER: The CrossCode C linker is designed to handle truly huge loads. There are no limits on the number of symbols in your load or on the size of your output file. And you can always count on full 32 bit target addressability, because the linker operates comfortably in the highest ranges of the 68030's address space.

4. DOWNLOADER: CrossCode C comes with a *downloader* that puts you in touch with all EPROM programmers and emulators. It can convert your load into Motorola S-Records, Intel Hex, Tek Hex, Extended Tek Hex, and Data I/O ASCII

Hex. You can also produce a binary image and convert that image into any format you might want. In all formats, bytes can be split into EPROMs for an 8, 16, or 32 bit data bus.

Why Wait

Once you start using CrossCode C, you may just wonder how you ever got the job done before! It's available under MS-DOS for just \$1995, and it runs on all IBM PCs and compatibles (640K memory and hard disk are required). Also available under UNIX, XENIX, and VMS.

CALL TODAY for more information:

1-800-448-7733

(ask for extension 2002)

Outside the United States, please dial

PHONE: 1-708-971-8170

FAX: 1-708-971-8513

SOFTWARE DEVELOPMENT SYSTEMS, INC.
DEPARTMENT 22
4248 BELLE AIRE LANE
DOWNERS GROVE, ILLINOIS 60515 USA

CrossCode™ is a trademark of SOFTWARE DEVELOPMENT SYSTEMS, INC. MS-DOS® is a registered trademark of Microsoft. UNIX® is a registered trademark of AT&T. XENIX® is a registered trademark of Microsoft.

disk reads and writes, and of who does them. Diskreet (get the pun?) lets you store files in an encrypted form with password protection. Even better, the newest incarnation of File Find works across multiple drives (and across a network). Since I'm always tucking files away in some odd directory, File Find is the utility that I use most.

NU 5.0 keeps delivering surprises. A case in point is File Save, which essentially assigns priorities to files so that when you delete them (accidentally or on purpose), the areas they're stored on

aren't immediately overwritten the way DOS normally does. It works like this: Say you've purposely erased an old version of a spreadsheet file and you realize several days later that you shouldn't have. Without File Save, chances are its area would already have been overwritten. But if you used File Save and gave the files high priority, there's a good chance you can still recover the original file by using NU 5.0's unerase utility.

Probably the biggest change in NU 5.0 is the System Information utility. In previous versions, it was a single screen

of essential data about your system. In NU 5.0, it's been vastly expanded. The new SI gives you 20 screens full of data, from the essential to the esoteric. The whole thing's capped off by a little graphics show that presents your system's Norton SI rating on a graph and compares it to some other common hardware.

Topping off the list of new bells and whistles are Norton's first caching utility and a vastly improved disk sector editor (with split screen, cut and paste, and data links). Last, and certainly not least, Norton's unerase utility is

faster and much easier to use.

The Norton folks say they've redesigned their utilities for today's "real business world," with many computer users who don't have lots of technical expertise. True. Norton Utilities 5.0 is chock full of text screens filled with explanations and helpful suggestions. But I can't help but feel that by stuffing in features and making it so user-friendly that it's almost bothersome, something's been lost for advanced users. There was something to be said for living dangerously.

—Stan Miastkowski

Hardware Directory Fits on Your Hard Disk

One of the nice things about this industry is that when you go to buy something, there are so many choices available. But that can easily be frustrating as well. How do you keep up with all the new products that become available? How do you decide among them?

A new software product for IBM systems that's called **HardFacts** attempts to solve this problem. This product includes approximately 6 megabytes of data on about 6000 hardware products. Almost every type of hardware product is included, from lightweight laptops to desktop i486-based systems, from keyboards to color monitors, and from scanners to tape backup systems.

HardFacts includes a large amount of information about each product. For most products, this entails about 50 pieces of information. Also, if the product has been reviewed in a magazine or has won any awards, that information is included. HardFacts mentions both the list price of the product and the street price, along with its distributors.

HardFacts was created using Nantucket's Clipper database manager and has a fairly straightforward user interface. When you are looking

for a particular product, HardFacts lets you easily narrow the criteria for your search.

For example, HardFacts presents you with a large number of product categories. If you are interested in looking at tape backup systems, you simply select that category from the list. You can then choose to look at a list of all 140 tape backup systems, or you can narrow the search simply by selecting criteria from a criteria menu. You can, for example, select to see only those backup systems with capacities of less than 40 MB.

Of course, in any product like this, the value of the product depends on the quality and timeliness of the information

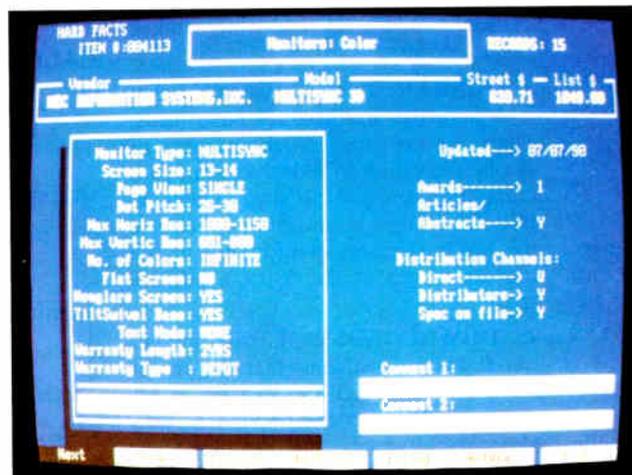
presented. HardFacts solves the problem of timeliness by providing monthly updates for its database on a yearly subscription basis. As for the quality of the information, I will have to wait for a shipping version of the product before I give the final word. A prerelease version I worked with contained some good information. You can also judge the quality for yourself, since HardFacts has a 30-day money-back guarantee.

But no matter how good the database is, once you zero in on a particular product, you will usually want to see a brochure on it as well. And HardFacts has a good solution for this. For most products, all you

need to do is call a special telephone number using the phone that's connected to your fax machine and feed in your subscription number and the code number of the product you are interested in, and the HardFacts folks will fax you the manufacturer's spec sheet.

HardFacts is a fairly expensive product and is not for everyone. But it is one of those products that can surely be used by everyone at one time or another. The question is whether you will need it often enough to justify the cost. For people who purchase or work with large amounts of hardware, HardFacts will be extremely hard to pass up. ■

—Rich Malloy



THE FACTS

HardFacts
\$695

Requirements:
IBM PC or compatible
with 640K bytes of
memory and a hard disk
drive with 6 MB of free
space.

HardFacts
292 Cabot St.
Beverly, MA 01915
(508) 927-1370
Inquiry 1002.

Here's How We Protect Your Software And Profits Better.

SOFTWARE PROTECTION

We'll Never Tell...

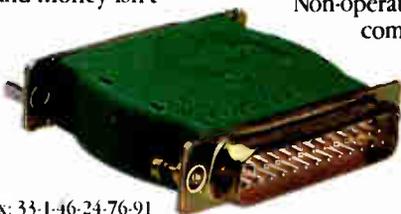
... the world how we protect your hard work. But then, why should we? It's not that we're hard to get along with. On the contrary. We'll show you how our unwordy approach to software protection can actually work better for you. We'll deliver the best balance of guaranteed copy control and cost-effective installation.

Unlike other manufacturers, our hardware is *uniquely custom-wired for each developer* and supplied with a specific *encrypted interrogation routine* for maximum security.

The precise routines assume responsibility for all hardware, software and timing issues so your time and money isn't wasted engineering protection schemes.

The Products That Protect Your Revenues

- ▶ **PROTECH KEY**
Identically reproduced packages.
- ▶ **MEMORY KEY**
MACINTOSH MEMORY KEY
NEC MEMORY KEY
Active protection, modular packages, customized packages, serialization, demo control, access control.
- ▶ **MEMORY-ONE KEY**
Customized packages, modular packages
- ▶ **MICROPROCESSOR KEY**
Non-operating system specific protection based on RS232C communications for minicomputers, workstations, etc.



In EUROPE:
MICROPHAR, 122 Ave. Ch. De Gaulle 92200,
Neuilly Sur-Seine FRANCE Tel: 33-1-47-38-21-21 Fax: 33-1-46-24-76-91

For distributors in:
• BELGIUM/NETHERLANDS, E2S (091 21 11 17) • GERMANY, Delta Xmit (0621 41 08 178)
• IRELAND, TMC (021 87 37 11) • ITALY, Siosistemi (030 24 21 074)
• PORTUGAL, HCR (1 56 18 65) • SPAIN, Hal 2000 (023 37 31 05)
• SWITZERLAND, SAFE (024 21 53 86) • UNITED KINGDOM, Market.I (1 446 84 31)

PROTECH
MARKETING, INC.
1-800-843-0413

In the U.S., the AMERICAS & the PACIFIC:
PROTECH, 9600-J Southern Pine Blvd.,
Charlotte, NC 28217 *Se Habla Español*
Tel: 704-523-9500 Fax: 704-523-7651
Hours: Mon-Thurs: 8:30-7:00 ET, Fri: 8:30-5:30 ET

FOR A DEMONSTRATION PACKAGE OR ADDITIONAL INFORMATION, PLEASE WRITE OR CALL.

*Macintosh is a registered trademark of Apple Computer, Inc.
*NEC is a registered trademark of NEC Information Systems, Inc.

For Europe Circle 232 on Reader Service Card

World Radio History

For Americas & Pacific Circle 233 on Reader Service Card

THE BEST USE IN TOWN. NOW SCREEN N



© 1990 Sun Microsystems, Inc. *Sun Microsystems and the Sun logo are registered trademarks of Sun Microsystems, Inc. OPEN LOOK is a trademark of AT&T. All other products or services

R INTERFACE PLAYING AT A EAR YOU.

The OPEN LOOK™ user interface. It's a real hit with independent software vendors, in-house developers and end users. In fact, over 300 applications are in development today. By people like Lotus®, INFORMIX®, Island Graphics®, Interleaf®, and Frame®. And it's the most popular front end to UNIX®. For a number of reasons.

First of all, it makes UNIX easy to use. Because there are no complicated UNIX commands. It also looks better than any other interface. From its icons to its 3D elements. And makes users more efficient. For example, our drag and drop feature gives them a simple, intuitive way to move files around the desktop. Our push-pin icon makes it even easier to use. And OPEN LOOK gives users the same interface across multiple platforms, so they learn it once. And enjoy access to a huge range of network resources.

As a developer, you'll see it's also the easiest to work with. Because it's part of OpenWindows™, a complete development environment. With the tools you need to create applications faster than

ever. And ready-made features, like our DeskSet™ graphical productivity tools, that you can give users right away.

Of course, the business reasons to choose OPEN LOOK are just as strong. OPEN LOOK is the standard interface of AT&T's UNIX System V.4, so it's included at no charge. And it will run on over 20 platforms, including DEC®, HP®, and IBM®. Since it's portable across multiple platforms, you only write your application once. Which saves thousands of man-hours. Finally, with OPEN LOOK, you have the full support of a company that leads the workstation industry in worldwide shipments*.

We've put together a videotape that shows you exactly what OPEN LOOK is all about. Just call us at 1-800-624-8999 (ext. 2068), and we'll send you a free copy.

Then find a nice comfortable seat close to your screen. Because the closer you look, the better we get.



mentioned are identified by the trademarks or registered trademarks of their respective companies or organizations. *Source, International Data Corporation, 1990. 36.3% market share.

Circle 280 on Reader Service Card

The NEC ProSpeed SX/20: Take It and Leave It

Expansion options that let laptops serve as both portable and desktop computers aren't new, but NEC Technologies' new ProSpeed SX/20 just might provide the best of both worlds in terms of totability and power. Running at 20 MHz and weighing just under 13 pounds with battery, the SX/20 not only outperforms its 16-MHz SX competitors, it's also lighter than almost all of them.

The optional Docking Station provides everything you need to transform the portable into a full-featured desktop unit. The machine's list price (\$5999 for the SX/20, including keyboard and monitor; and \$1199 more for the Docking Station) might seem steep, but \$7198 is less than what you'd pay to buy top-

Speed and light weight
separate this
desktop/laptop from
its SX competitors

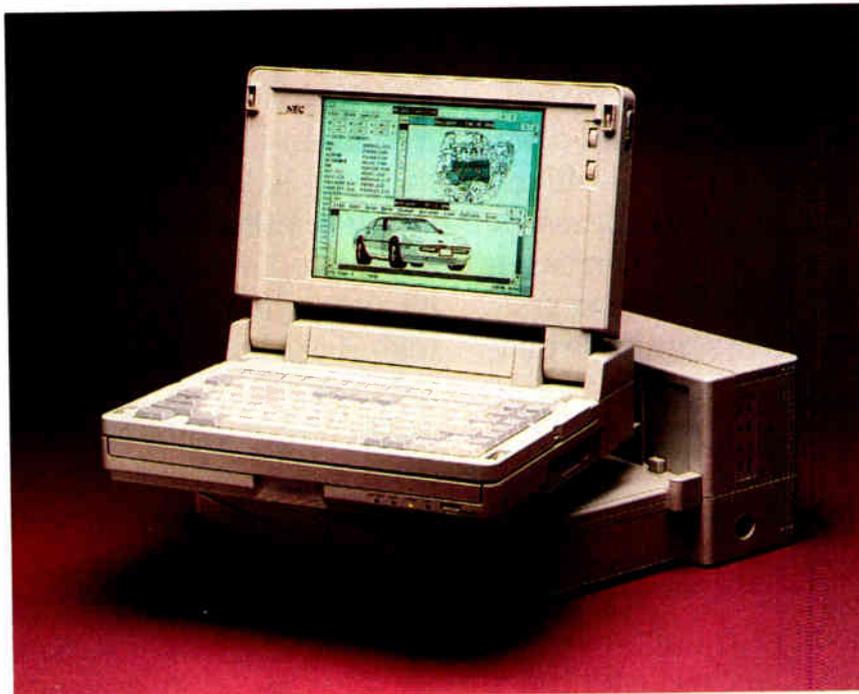


Michael Nadeau

brand desktop and portable PCs.

Speed and flexibility are just two of the SX/20's virtues. Standard features include a 2½-inch 40-megabyte Prairie-Tek hard disk drive; a 3½-inch 1.44-MB floppy disk drive; a detachable 83-key keyboard; a pull-out handle; serial, RJ-11, printer, and external monitor ports; 1 MB of RAM (expandable to 5 MB); and the best 640- by 480-pixel VGA LCD screen I've seen. MS-DOS 4.01, setup diagnostics, an EMS 4.0 driver, a disk-cache utility, and a RAM disk make up the standard software.

I tested a preproduction unit. NEC was still working on the BIOS (doing mostly performance tuning), but otherwise the system was essentially the same one that should be available in September.



Its crisp black-on-white VGA display is one of the NEC ProSpeed SX/20's most appealing features. Both text and graphics appear sharp and well-defined.

PRELIMINARY BYTE LOW-LEVEL BENCHMARK SCORES

The NEC ProSpeed SX/20's CPU performance is better than that of the Compaq 386/20 SX desktop system's. The Goupil Golf is a 16-MHz 386SX system also designed to work as both a portable and a desktop.

	CPU	Disk	Video
NEC ProSpeed SX/20	2.05	1.11	5.33
Compaq Deskpro 386s/20	1.76	2.91	8.21
Goupil Golf	2.18	1.86	4.33

Note: Benchmark results are indexed to show relative performance; higher numbers indicate better performance. For all indexes, an 8-MHz IBM PC AT running MS-DOS 3.30 = 1.

Traveling Light

Make no mistake; it's not easy lugging around 13 pounds of computer, even if it's just from your office to your home. NEC compensates for that fact by providing considerable processing power in a relatively small form factor. The BYTE low-level benchmarks indicate that the SX/20 is an able performer (see the table). And NEC promises speed gains once the BIOS is finalized.

At 13½ by 3½ by 10½ inches, the SX/20 fits snugly under your arm and is compact enough for you to carry by the handle without banging it on your legs as you walk. It will also fit into most briefcases, and NEC sells an optional carrying case. If you don't need the battery, you can simply pop it out and snap in the AC converter, thus saving yourself a pound of weight and the hassle of carrying the converter separately. By comparison, the recently introduced Compaq SLT 386s/20 is larger and more than a pound heavier.

The SX/20 will be among the first to use PrairieTek's 28-millisecond, 2½-inch 40-MB hard disk drives. This small form factor conserves space but limits disk storage options until higher-capacity 2½-inch hard disk drives become available. By contrast, Compaq offers up to 120 MB of hard disk storage on the SLT 386s/20. The optional Docking Station provides a 5¼-inch drive bay for additional mass storage.

Battery life is an adequate 2½ hours. The nickel-cadmium unit recharges in 2 hours using the AC converter with the machine off, or in 5 hours when the machine is in use. An optional battery

charger can charge two batteries at a time. Other options include a 2400-bps modem (\$399) and a 2400-bps modem with 9600-bps send/receive fax capability (\$699). These modems install in a slot located under the keyboard tray.

The keyboard is intelligently designed and has a good feel, although the keys are not quite full-travel. The cursor-control keys are in the familiar inverted "T" configuration, and all 12 function keys reside on the top row. Fold-out legs on the detachable keyboard provide a sufficient typing angle.

For video, NEC uses a backlit LCD design that's a variation of film-twisted nematic technology. By removing one layer of glass on the screen and replacing it with a film layer, NEC claims to have reduced the weight of the screen by about 35 percent and improved contrast by roughly the same amount. A high-quality diffuser evenly distributes the fluorescent backlighting. The result is a crisp and easy-to-read black-on-white text display. When running Windows 3.0, however, I found myself frequently adjusting the brightness and contrast controls after switching from one graphical application to another.

A standby switch puts the CPU into low-power mode and shuts down everything else except memory; if you push it again, the machine comes back on to where you left it. A reset button, an unusual but welcome feature on a portable, is recessed into the side of the unit, out of harm's way. A password security feature is standard.

Meanwhile, Back at the Office

For power and features, the SX/20 lacks little, yet by itself it's not a suitable office system for most businesses. That's where the Docking Station comes in. This unit provides two AT-standard 16-bit expansion slots, two serial ports, one parallel port, two RJ-11 ports, external keyboard and video ports, and a drive bay. When docked, the SX/20 redirects blocked par-

allel, serial, and RJ-11 ports to the corresponding ports on the Docking Station. It also maintains two sets of AUTOEXEC.BAT and CONFIG.SYS files—one for the portable configuration and one for the desktop. NEC says this makes for a "one-touch transition" between portable and desktop configurations.

The SX/20 locks into the Docking Station by means of a 16-bit bus interface at the rear of the unit. Once the unit is attached, you can use the system on the desktop or as a floor-standing unit. With the Docking Station, you can expand memory up to 16 MB.

Who Is It For?

The NEC SX/20 is not for everyone. It's among the most powerful of the battery-operated portables, but it's also one of the more expensive. In the desktop configuration, you're limited to just two expansion slots and one drive bay. And \$7198 will buy comparably equipped laptop and desktop systems from reputable vendors with lower list prices. (To be fair, NEC estimates that the price for a fully decked-out laptop/desktop version of the SX/20 could be as low as \$5000 after discounts.) For those who depend on a laptop as much as their desktop and who require the horsepower to run compute-intensive applications, the SX/20 looks like a slick solution.

Combining desktop and portable systems into one unit is an important trend. More and more businesses are finding ways to use portable PCs to maximize the productivity of their personnel while they're away from the office. It makes sense to have one system that can serve double-duty—not just because it might be cheaper to equip people that way, but because it creates a better, seamless link between work done on the road and work done in the office. ■

Michael Nadeau is the managing editor of the BYTE Lab. You can reach him on BIX as "miken."

COMPANY INFORMATION

NEC Technologies, Inc.
1255 Michael Dr.
Wood Dale, IL 60191
(708) 860-9500
Inquiry 858.

Laser printing

just got

OKIDATA introduces OKILASERS. A full line of business smart laser printers that's compatible with both HP® and your budget. Personal to PostScript®, OKILASERS deliver the same tank tough™ performance and reliability that OKIDATA has built into more than 3,000,000 printers. OKILASERS by OKIDATA . . . a printer for every business.

Call 1-800-OKIDATA for the tank tough dealer nearest you.

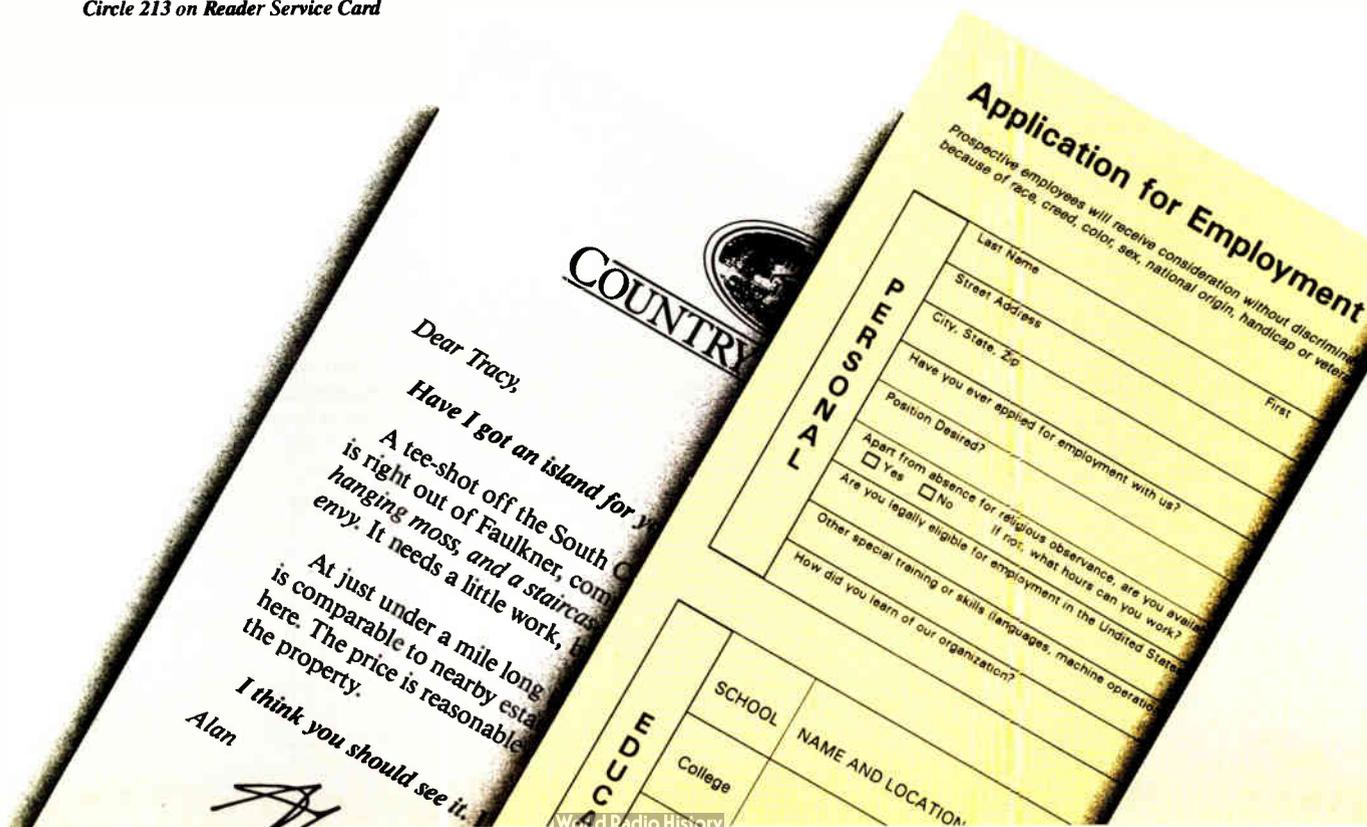
OKIDATA[®]
an OKI AMERICA company

We put business on paper.

OKIDATA is a registered trademark of Oki America, Inc., Marque déposée de Oki America Inc. OKILASER™ is a trademark of Oki Electric Industry Co. Ltd. Tank tough™ is a trademark of Oki America, Inc.

HP, Adobe PostScript, Macintosh are trademarks of their respective corporations.

Circle 213 on Reader Service Card



four times better.



OKILASER™ 400

Small. Personal. Affordable. 4 pages per minute. 17 fonts. Holds 200 sheets. A genuine laser. A genuine bargain.



OKILASER™ 800

For heavy duty use. 8 ppm. 26 fonts. Expandable to PostScript® and dual bins. A real workhorse.



OKILASER™ 820

Prints up the side, across the other, drop shadows, stretch letters, outline, fill, and sets fonts up to 2" instantly, 8 ppm.



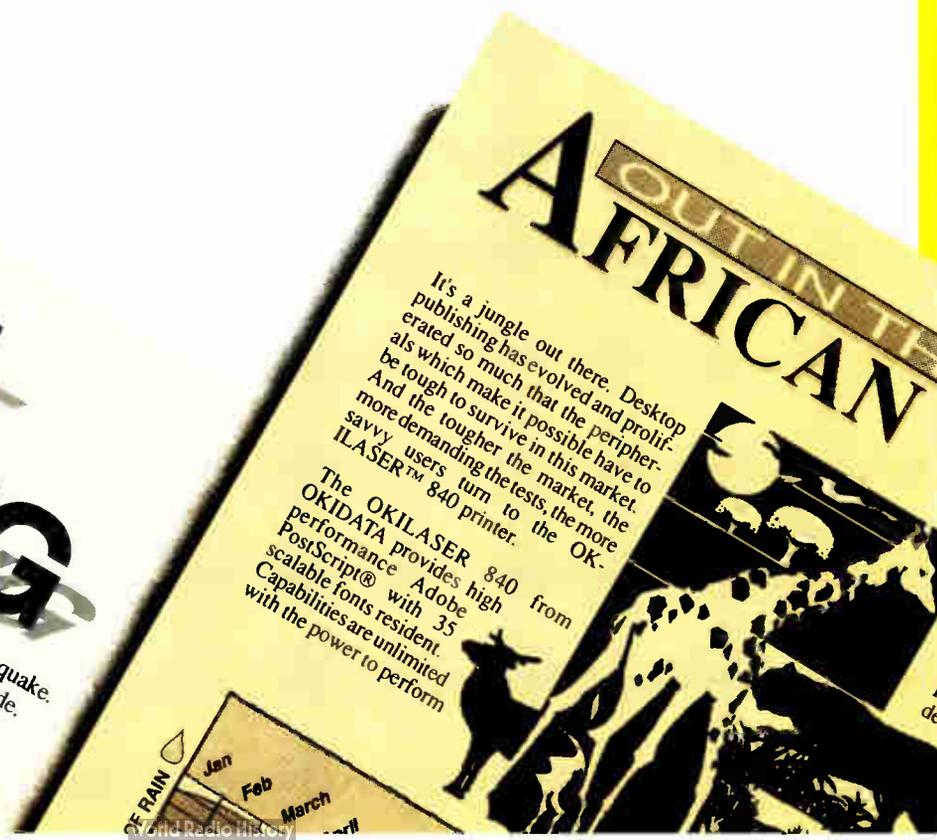
OKILASER™ 840

True Adobe PostScript®. Perfect for desktop publishing on DOS or Macintosh® systems. 8 ppm.

OPENING EYE

OKILASER 820 makes presentations pop. And correspondences quake. Track them from all angles. With messages of growing magnitude. Laser printing bliss. And then some.

Features
 character outline
 gray pattern filler
 character con...



It's a jungle out there. Desktop publishing has evolved and proliferated so much that the peripherals which make it possible have to be tough to survive in this market. And the tougher the tests, the more demanding the tests, the more savvy users turn to the OKILASER™ 840 printer.

The OKILASER 840 from OKIDATA provides high performance Adobe PostScript® with 35 scalable fonts resident. Capabilities are unlimited with the power to perform

Word Processors That Build Character

The BYTE Lab compares 15 WYSIWYG word processors for the Macintosh and the PC

Howard Eglowstein, Stan Wszola, and Tom Thompson

Word processing programs have been with us since the birth of microcomputers. Then, as now, they gave many people a tool to rapidly produce and modify large documents. The document's appearance was originally a secondary issue, partially because the printer technology at the time didn't give you much choice; you had to settle for the monospaced character font in the printer's ROM.

The situation has certainly improved since then. Today, you can select a particular typeface for your document and expect it to show up on the screen. It doesn't have to be a monospaced font, either. Even better, many laser printers will reproduce the document's typeface faithfully, at 300-dot-per-inch or better resolution.

Now that you have better control over the look of the output, you need a good idea of how the document will appear before you commit it to paper. Will adding that table of cost-justification figures to the business report bump the text explaining the costs to another page? Can you add a logo to the company's letterhead? How will it look?

Any word processing package gives you a tool to organize your thoughts and correct your grammar before you commit it to paper; WYSIWYG helps you make it look attractive.

Typing, or Typesetting?

Character-based word processing isn't dead—far from it. Modern word processors offer a lengthy list of formatting features, and they usually provide a substantial preview mode to let you check on the final output. When choosing a word processor, choose WYSIWYG when the look of what you write is almost as important as the content. Drawing a line between WYSIWYG and desktop publishing is somewhat harder; at some point, you'll finish composing your text and concentrate on the layout. Even the best of the WYSIWYG word processors fall far behind a DTP package for final formatting. If you find yourself spending lots of time adjusting fonts and moving graphics, maybe you should be using a DTP package instead.

Like DTP packages, WYSIWYG word processors allow you to integrate text and graphics onto the same page. Drawing tools, graphics file import functions, and graphical manipulation functions let you insert symbols, logos, and illustrations directly into your document. File import functions let you place high-resolution graphics, and usually the text will automatically flow around the image.

The products that we've looked at for this Product Focus cover the entire spectrum of word processors, from full-featured packages such as Ami Professional and Microsoft Word to rather specialized packages such as InText and MindWrite.

Seeing Is Believing

To test these products, we ran them on a variety of machines. We ran the DOS products on a 20-MHz Compaq 386 with a VGA monitor and 6 megabytes of memory. For the lower-end products, we wanted to see how they performed on a low-end machine. Another Compaq did the trick—a Compaq Plus portable, with the original 4.77-MHz 8088 and 640K bytes of memory. Although Windows 3.0 will run on the Plus's internal CGA, the 8088 is hardly the processor to use for se-

rious Windows work. We didn't bother testing the Windows word processors on the Plus.

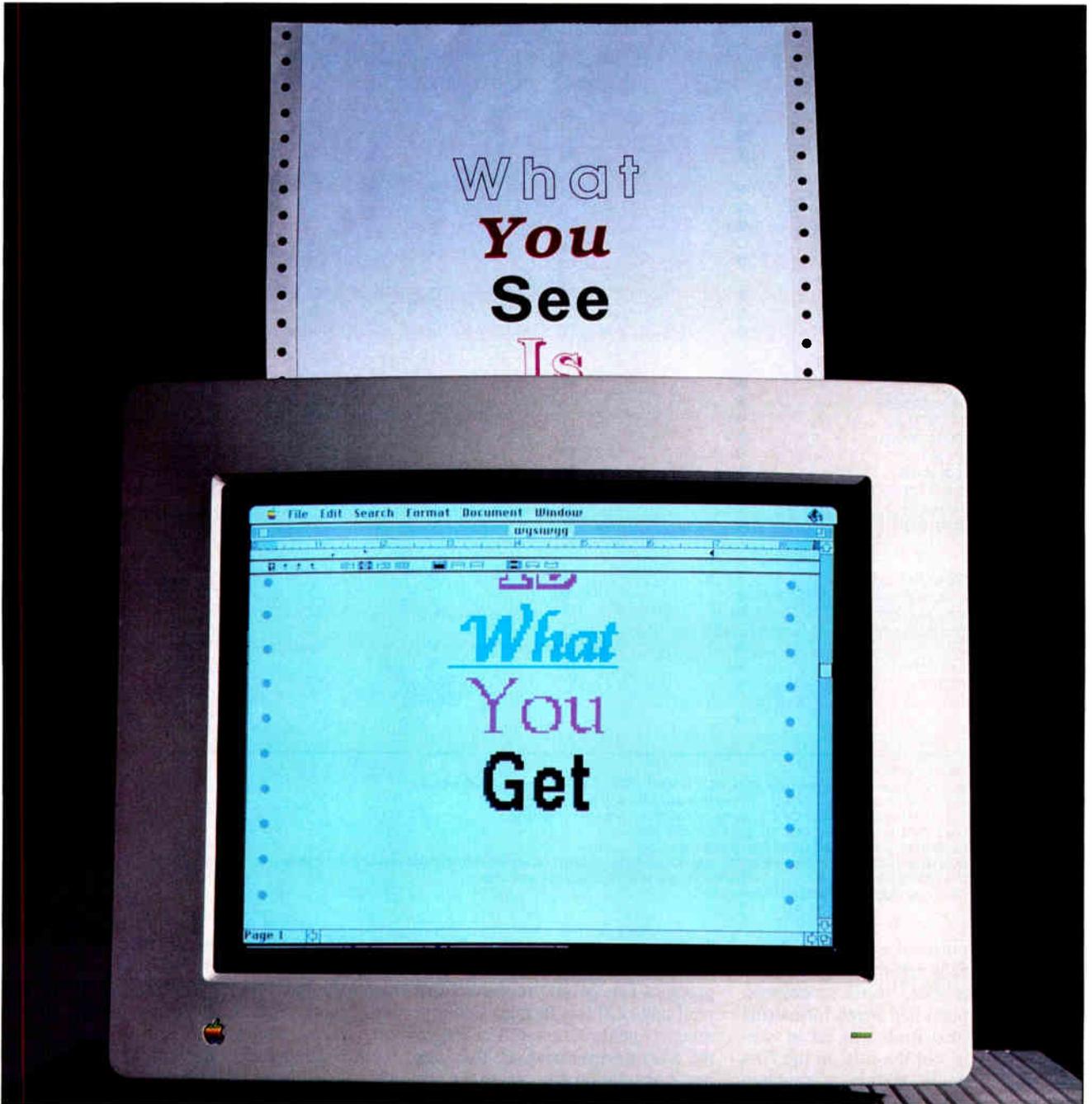
We ran all the Macintosh products on two systems: a Mac SE with 4 MB of memory, and an SE/30 with 2 MB. We found the general performance of all the word processors to be adequate on the SE. Of course, the Mac SE/30's 16-MHz 68030 had more than enough horsepower to keep up with even the fastest typist. All the test machines had hard disk drives with at least 8 MB of free space. Our PC compatibles used an HP LaserJet III with a PostScript cartridge for output, and the Macs used a networked LaserWriter IINT.

To get a feel for overall performance, we asked each of the word processors to perform general functions that typify the way you'd use a word processor. The ASCII text-import and save-to-disk tests provide information on general disk handling. Printing is another typical use for a word processor; we printed out a 45K-byte text document that consisted of 17 pages of 10-point text, and a more complex document with many font changes, a graphic, and double columns. Using the search-and-replace function to locate 10 occurrences of a phrase in the 45K bytes of text gave us a hint of how the products handle lengthy documents.

Finally, holding down either the cursor keys or the mouse button and scrolling from one end of the document to the other gave us some measure of the screen performance. The results are shown in the figure. Don't let the numbers influence you too much, though. The true test of a word processor is its ease of use, and on the Mac SE, most of the word processors were acceptable. The only package in this review that we judged acceptable on the Compaq Plus was BetterWorking Word Publisher 5.0. For anything else, we recommend a 10-MHz or faster 286 machine.

Functionality is harder to gauge, and

continued



WYSIWYG WORD PROCESSORS

The WYSIWYG packages are divided into two groups; the PC packages are on the left, and the Mac packages are on the right. Only a few of the packages, such as Ami Professional and Microsoft Word, have a complete list of features (● = yes; ○ = no).

Product name	Ami Professional 1.2 \$495	BetterWorking Word Publisher 5.0 \$59.95	InText 1.53 \$295	The Universal Word 1.5 \$395	WinText 1.54 \$195	Word for Windows 1.0 \$495
Hardware needed	PC ¹	PC ²	PC ³	PC ⁴	PC ⁵	PC ⁶
Editing						
Spelling checker	●	●	●	●	●	●
Thesaurus	●	●	○	●	○	●
Outliner	Limited function	●	○	○	○	●
Mail merge	●	●	○	○	●	●
Undo	●	○	○	●	●	●
Math functions	Tables only	○	○	○	○	●
Equation editor	○	○	●	○	○	●
Automatic timed save	●	○	○	○	●	●
Context-sensitive help	●	●	○	○	○	●
Draft mode	●	●	○	○	○	●
Maximum no. of windows	1	1 (2 files)	1	Memory-dependent	4	8
WP import formats	13	ASCII	ASCII	2	8	9
WP export formats	13	ASCII	ASCII	2	8	8
Long document features						
Create index/table of contents	●	●	○	○	●	●
Cross-referencing	●	○	○	○	○	●
Page marks	●	●	○	○	●	●
Customization tools						
Macro learn mode	●	○	●	○	○	●
Macro editor	●	○	○	○	○	●
Macro programming language	●	○	○	○	○	●
Customized main menu	○	○	○	○	○	●
Dynamic Data Exchange links	●	○	○	○	○	●
Groupwork editing						
Document notes	●	○	○	○	○	●
Strike-through	●	○	○	●	●	●
Document summary	●	○	○	○	○	●
Formatting						
Style sheets	●	●	○	○	○	●
Conditional page breaks	●	○	○	●	○	●
Widow/orphan control	●	○	○	●	○	●
Automatic hyphenation	●	●	○	○	○	●
Snaking columns	●	○	○	○	○	●
Side-by-side columns	●	○	○	○	○	●
Kerning and tracking control	●	○	○	●	○	●
Document queues	●	●	○	○	○	●
Prints in background	●	●	○	○	●	●
Graphics						
File formats imported	6	3	0	2	3	12
Sizes/crops/rotates graphics	●	Sizes	○	○	Sizes, crops	Sizes, crops
Moves graphics frames	●	●	○	○	●	Print-preview mode
Flows text around graphics	Drawing program	○	○	○	○	○
Page preview	●	Print mode only	●	○	●	●
Lines, boxes, borders	●	●	●	○	●	●
Drawing program	●	○	Polygon drawing	○	○	○
Table editor	●	○	○	○	○	●

Minimum system requirements:

- ¹ 286, 640K bytes of RAM, graphics card (Hercules, CGA, EGA, or VGA), DOS 3.0, mouse, and a hard disk drive.
- ² 8088, 512K bytes of RAM, graphics card, DOS 2.1, mouse for draw mode, and one floppy disk drive.
- ³ 8088, 512K bytes of RAM, graphics card, DOS 2.1, two floppy disk drives, and a hard disk drive.
- ⁴ 8088, 640K bytes of RAM, graphics card, DOS 3.0, and a hard disk drive.
- ⁵ 8088, 512K bytes of RAM, graphics card, DOS 3.0, and a hard disk drive.
- ⁶ 286, 640K bytes of system RAM, 1 MB of expanded RAM, graphics card (EGA or better recommended), DOS 3.0, and a hard disk drive.
- ⁷ Mac Plus, 1 MB of RAM (2 MB recommended), a hard disk drive, and an 800K-byte floppy disk drive.
- ⁸ Mac Plus, two 800K-byte floppy disk drives, and System 6.0.

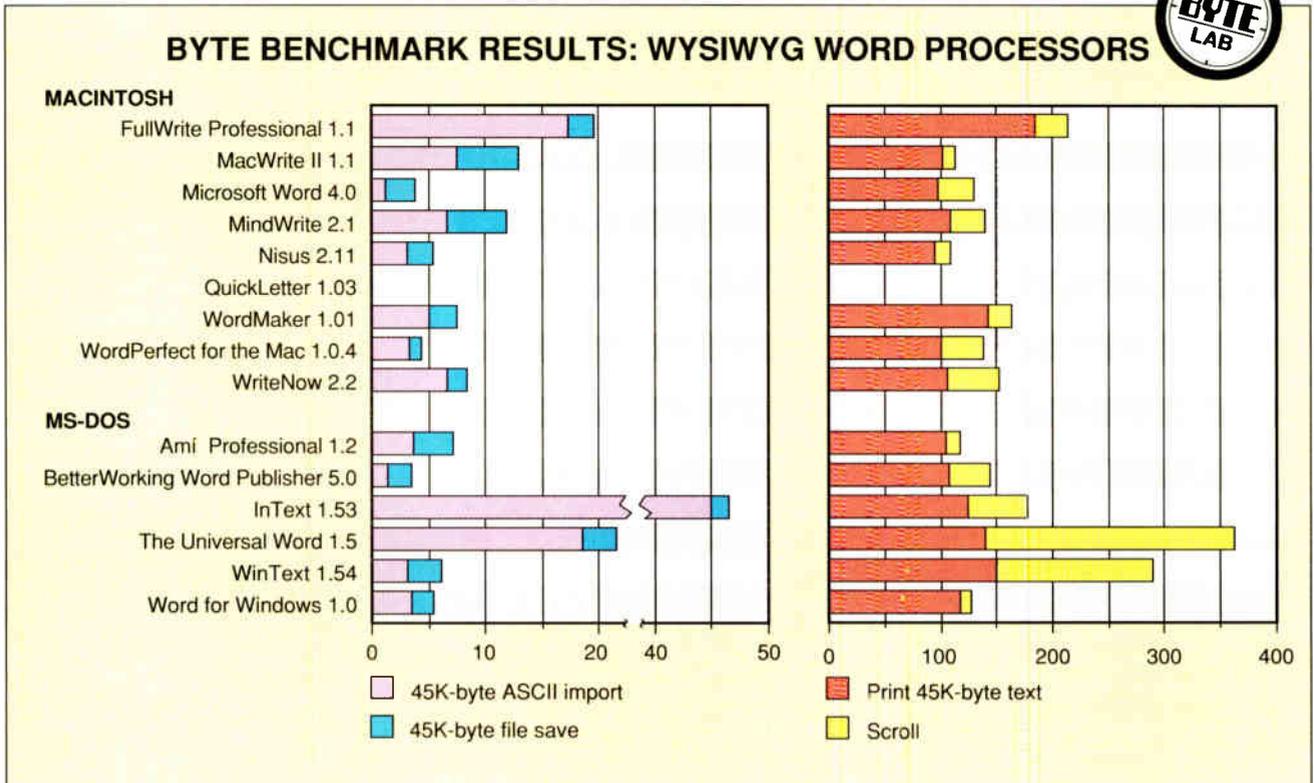
for that we contrived a complex document typical of the applications for which you might use these word processors. Our test document had seven formatting changes. The text itself was set in two-column format, but the title on the first page was a single column of centered text. The first page also contained a 2- by

2-inch graphic, scanned at 300 dpi as either a TIFF-, PICT-, or PCX-format graphics file. Word processors unable to read any of those formats could get the image from the Clipboard in Windows or the Mac environment. In that case, the image resolution dropped to the standard screen resolution of 72 or 75 dpi.

More Than Just a Pretty Typeface
All the packages that we looked at have the basic word processing features and more. You can enter text, edit it, cut and paste, and search and replace—every writing function, with varying levels of ease. Most of these packages are rich in features. They have so many capabilities



BYTE BENCHMARK RESULTS: WYSIWYG WORD PROCESSORS



Loading and saving files, printing, and text scrolling are the functions you'll use most often. BetterWorking Word Publisher was particularly quick with file I/O. Print speed is largely printer dependent. We tested the Macintosh products with a LaserWriter II NT; we measured the PC times on an HP LaserJet III with the PostScript cartridge. If your editing involves a lot of cutting and pasting, a fast scroll is essential—Word for Windows, Ami Professional, Nisus, and MacWrite II all did an exceptional job moving through text. QuickLetter could load only 31K bytes of the test file. The Universal Word printed in HP LaserJet mode, not PostScript. All times are in seconds.

applications; the non-Windows-based packages don't have that luxury. Mac product designers rely on the Macintosh's ability to automatically give their software access to data from every other Mac application. For that reason, people who design products for the PC have to incorporate more features than would be necessary on a Mac. On a Mac word processor, you can paste in a graphic that you drew in MacDraw. On a PC, if your word processor doesn't have a drawing package, you may have to live without fancy graphics. MultiFinder on the Macintosh provides background printing on LaserWriters to any application. Under Windows, the Print Manager/Spooler does the same for Windows applications.

Most of the packages use or provide a direct Mac or Mac-like environment. The work environment consists of a window with mouse and keyboard interface, pull-down menus, and function selection by clicking the mouse buttons. If you feel at home with the Mac, then all the Mac-based packages should be easy to learn. For those who are more comfortable with

the keyboard, most packages do a fair job of mapping keystrokes to commonly used functions.

We tested the PC-based packages under both Windows 2.11 and Windows 3.0. Windows 3.0 is considered by most to be very Mac-like, and Ami Professional, Word for Windows, and WinText all use this to their advantage. The others? Well, the interfaces are a bit different.

The relative importance of each feature depends on the type of document you require. Most of these packages should prove more than adequate for memos, form letters, brochures, and contracts.

Ami Professional 1.2

With the release of version 1.2, Samna's Ami Professional fully supports Microsoft Windows 3.0 (see photo 1). There's simply no two ways about it—Ami Professional is a serious word processor. It has full word processing and editing capabilities; paragraph control

with choice of fonts, alignment, and spacing; page-formatting control; and a spelling checker, a thesaurus, and an index and table of contents generator. Products such as Ami Professional and Word for Windows make the line between word processing and DTP a thin, gray one.

Ami Professional has the standard look and feel of a Windows application. It takes full advantage of all the Windows features, including Dynamic Data Exchange. With DDE, you can set up links between Ami Professional and Excel so that any changes made in the spreadsheet will update the Ami Professional document automatically.

File handling is another of Ami Professional's strengths. Besides handling the usual ASCII, it can import and export to or from most of the competitors' products. Ami Professional's index feature enables you to create multiple-level indexes. Go through your document and mark words that you want in the index. The program will then build an index or

continued

They Left out Features.... We Left out the **COMMA!!**

The only thing missing...

is the comma in the price. If you look at the chart on the right you will see prices charged by our competition. All but one contain a comma. **DesignCAD 3D** sells for \$399.00. Period. No Comma!

In order to draw the complex pictures shown below it is desirable to have the following 3D features:

- Interactive design with 3D cursor
- Blending of surfaces
- Boolean operations such as add, subtract, and intersection
- Complex extrusions
- Cross sectioning
- Block scaling
- On screen shading
- Shaded output to printers and plotters

All of these competitors left out one or more of these desirable features in their standard package. They didn't forget the most horrible feature - the comma.

DesignCAD 3D offers **ALL** the listed features plus many more!

If **DesignCAD 3D** has the power to create the 3D objects shown below, imagine how it could help with your design project!

DesignCAD 3D sells for \$399. We left out the comma. We didn't think you would mind!

PC MAGAZINE SAYS...

DesignCAD 3D, the latest feature-packed, low-cost CADD package from American Small Business Computers, delivers more bang per buck than any of its low-cost competitors and threatens programs costing ten times as much. For a low-cost, self-contained 3D package... DesignCAD's range of features steals the show."

\$399

AutoCAD rel. 10	\$3,000.00	AutoCAD AEC \$1,000.00	AutoShade \$500.00
CADKEY 3.12	\$ 3,195.00	Solids \$995.00	IGES translator \$1,995.00
DataCAD with DC Modeler	\$ 3,990.00	DataCAD Velocity \$2,000.00	
DesignCAD 3D ver. 2.0	\$ 399.00	NO expensive options! IGES Free, Shading Free	
MaxxiCAD 1.02	\$ 1,895.00	N/A	
Mega Model	\$995.00	MegaDraw \$195, List \$295, MegaShade \$395	
MicroStation PC 3.0	\$ 3,300.00	Customer Support Libraries \$1,000.00	
ModelMate Plus 2.8	\$ 1,495.00	N/A	
VersaCAD Design 5.4	\$ 2,995.00	N/A	

Source: Byte Magazine

BYTE MAGAZINE SAYS...

"At \$399, DesignCAD 3D was the least expensive package we saw, yet it was one of the more powerful. ..Don't be fooled by the remarkably low price, this program can really perform."

May 1989, page 178

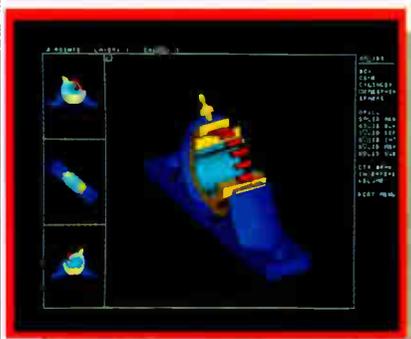
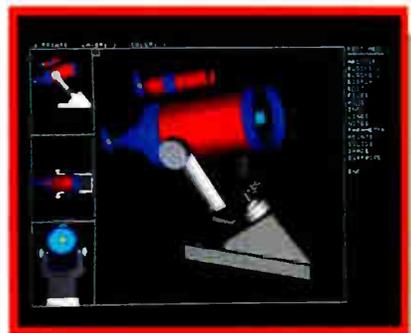
Complete 3-Dimensional design features make it easy for you to construct realistic 3-D models. With full solid-object modeling capabilities you can analyze your drawing to determine the volume, surface area or even center of gravity! **DesignCAD 3-D** even permits you to check for interference between objects! Aeronautical Engineers can now find the center of gravity for a new airplane design with a couple of keystrokes. The Architect can determine the surface area of a roof for decking in a matter of minutes. The Civil Engineer can calculate the volume of a lake or dam in seconds. The Mechanical Engineer will know for sure if certain parts fit together without interference. The uses for **DesignCAD 3-D** are only limited by YOUR imagination!

HOW DO I GET ONE?

DesignCAD 3-D and **DesignCAD 2D** are available from most retail computer stores, or you may order directly from us. If you have questions about which program to purchase please give us a call. All you need to run **DesignCAD 3-D** is an IBM PC or compatible computer with 640 K RAM memory and a hard disk. Both products support most graphics cards, printers, plotters and digitizers. Free Information and a demo disk are available by faxing (918) 825-6359 or telephoning:

1-(918) 825-4844

American Small Business Computers • 327 South Mill Street • Pryor, OK 74361 U.S.A.



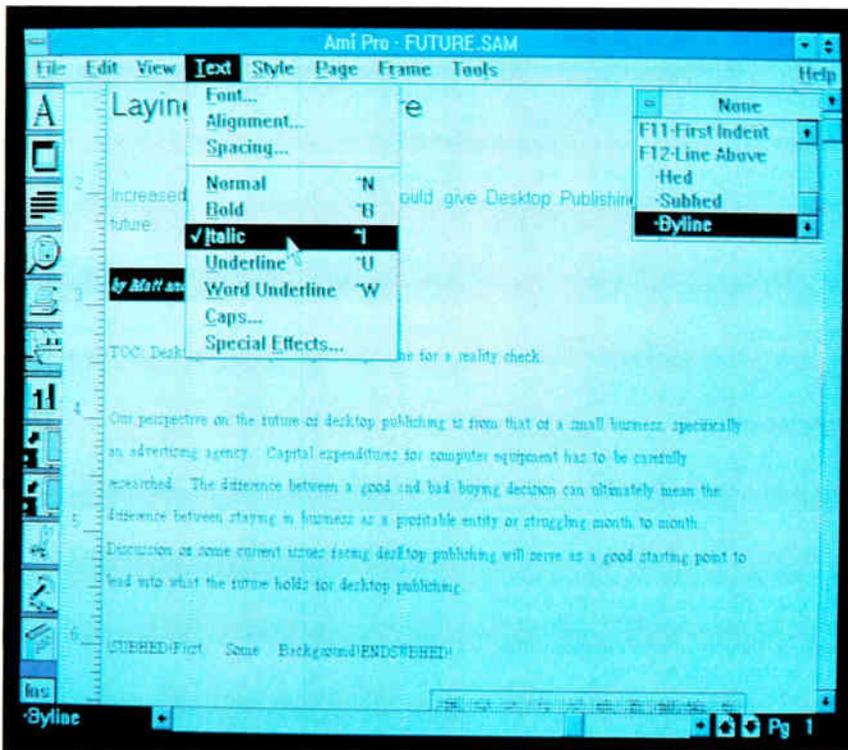


Photo 1: Amí Professional under Windows 3.0 uses a menu structure that should feel comfortable to any Windows user. To select a type style or pick from a style sheet, you simply click and drag with the mouse.

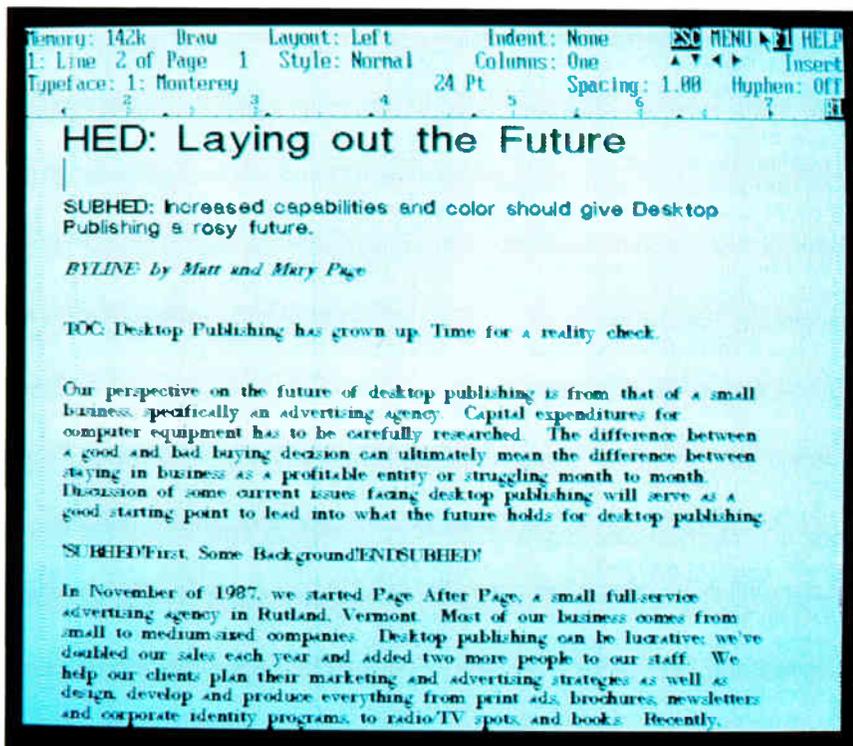


Photo 2: BetterWorking Word Publisher's screen fonts, while low-resolution, give you a good idea of how your text will print. A status area at the top of the screen shows you pertinent setting, font selections, and the amount of available memory.

table of contents, or cross-reference with page references to the appropriate words in the text.

Amí Professional gives you five different document views: a full-page view, a working view showing full lines of text, a standard view for size compatibility with other Windows applications, an enlarged view for examining fine details in small type or for visually impaired users, and a facing-page view for examining two pages simultaneously.

Like Word for Windows, Amí Professional has a particularly powerful macro language. With it you can automatically record keystrokes for performing almost any function. The keystrokes are saved in a macro command, and you can "play" the macro with a click of the mouse. The Amí Professional Macro Language is similar to BASIC in look and syntax.

Amí Professional is also well suited for groupwork editing. It offers document notes, a strike-through ability, and document summary. Style sheets allow you to save and reuse common document and font settings. The next time you format a document to be faxed, save the settings as a style sheet, and you'll never have to reformat a fax again. Samples include newsletters, memos, and press releases. Graphics support includes six graphics file formats: TIFF, Encapsulated PostScript, Lotus PIC, PCX, Windows Metafile, and Windows Clipboard. An object-oriented drawing package makes it easy to annotate text with geometric shapes.

Amí Professional carries a full-featured price tag, too. The retail price is \$495.

BetterWorking Word Publisher 5.0

With a list price of \$59.95, Spinner's BetterWorking Word Publisher 5.0 is the least expensive product in this review (see photo 2). Despite that, it's a true WYSIWYG editor, complete with various magnifications, full-page review, and support for different screen types (it does not run under Windows). It's not as fully featured as some of the other packages—but, again, it's not very expensive, either. It comes with an adequate outliner and support for an impressive array of printers.

Mouse support comes from the mouse manufacturer's driver; you install that first, and Word Publisher uses the mouse BIOS calls to get the screen location. The

continued

See the Future.

The FLEXSCAN® 9070U has been designed to offer maximum CAD/CAE performance in the PC environment.

Our 16" flicker-free display is ideal for creating 3-D projections, and the 20kHz-50kHz horizontal scan range allows PC CAD capabilities at resolutions of up to 1024 dots × 768 lines. In the CAD/CAE field, non mutual image interference in dual monitor systems is an important issue. Our advanced deflection yoke eliminates mutual interference with 15cm distance between both units as opposed to the regular requirement 60cm and thus allows you to take full advantage of dual systems.

The FLEXSCAN's ergonomic design minimizes static, glare, and magnetic radiation to provide the most user-friendly environment possible.

Other monitors meet the standards.
FLEXSCAN® sets them.

NANAO®

NANAO USA CORP.

23510 Telo Ave., Suite 5
Torrance, CA 90505 USA
Phone (213)325-5202
Fax (213)530-1679

Circle 192 on Reader Service Card
(RESELLERS: 193)



FLEXSCAN 9070U

16" (15V), 0.28mm dot pitch CRT
Scan Frequency: Automatic Adjustment
H: 20kHz-50kHz
V: 50Hz-80Hz

Front-mounted controls for easy access
2 Video inputs for professional use
VGA; Hi-Res VGA (up to 1024 × 768),
EGA and Mac II compatible



Laugh, sob, growl, warble, wail (or just talk) across your LANtastic PC Network.

The newest version of our LANtastic PC network has really got people talking.

You see, LANtastic is the first PC network to support Voice. So you can actually send voice messages from one PC to another across the LAN.

It's easy. Just pick up the telephone handset provided with the LANtastic Voice Adapter (sold separately at \$149* per adapter), bring up a handy menu, and talk. Use Voice Chat to carry on a realtime conversation or save the voice message in a digital format for playback later in your own voice—just like regular E-mail.

Only LANtastic has Voice. And Voice is just one of the reasons people are talking about LANtastic version 3.0.

Another is our new easy installation program that'll have you up and running in minutes.

And disk caching to boost network speed. Plus enhanced printing, E-mail, security and more.

All of which led PC Magazine to conclude:

"LANtastic blows away the DOS-based competition in terms of performance."

—May 29, 1990

And don't worry. Even with all these new features, LANtastic still has the smallest RAM overhead of any network.

LANtastic version 3.0. Call 602-293-6363.

Developers. Artisoft offers a Voice Programmer's Interface so you can create your own "talking" software using the LANtastic Voice Adapter. Order it directly from Artisoft.



ARTISOFT
Revolutionizing Connectivity

*Manufacturer's suggested retail price. Before voice messages can be sent from one PC to another, optional LANtastic Voice Adapters must be installed on both PCs.

**Manufacturer's suggested retail price is \$249 for LANtastic 2Mbps adapters and \$345 for LANtastic Ethernet Adapters. © 1990 ARTISOFT. LANtastic is a trademark of ARTISOFT.

and handling of imported graphics is limited. Nevertheless, MindWrite has a good outliner and a Clipboard function that allows you to cut and paste more than one item at a time. The result is that MindWrite seems crafted more for the creation of words than for their appearance.

Of all the word processors we looked at on the Mac, MindWrite has the easiest and most versatile outliner. You create a topic by simply typing new text; you make subsequent topics by pressing Return and typing more text. You make sub-levels within a topic either by dragging text to the right with the mouse or by typing Command-r and typing text. If you want to exit a level and start a new topic, you either drag text to the left or type Command-l.

There's no limit to the number of sub-levels a topic can have, and you can also select and drag sublevels to other parts of the outline, or even make them topics. MindWrite assigns either diamonds or numbers to items in the outline, depending on a user selection. If you're using numbers, they're automatically updated

continued

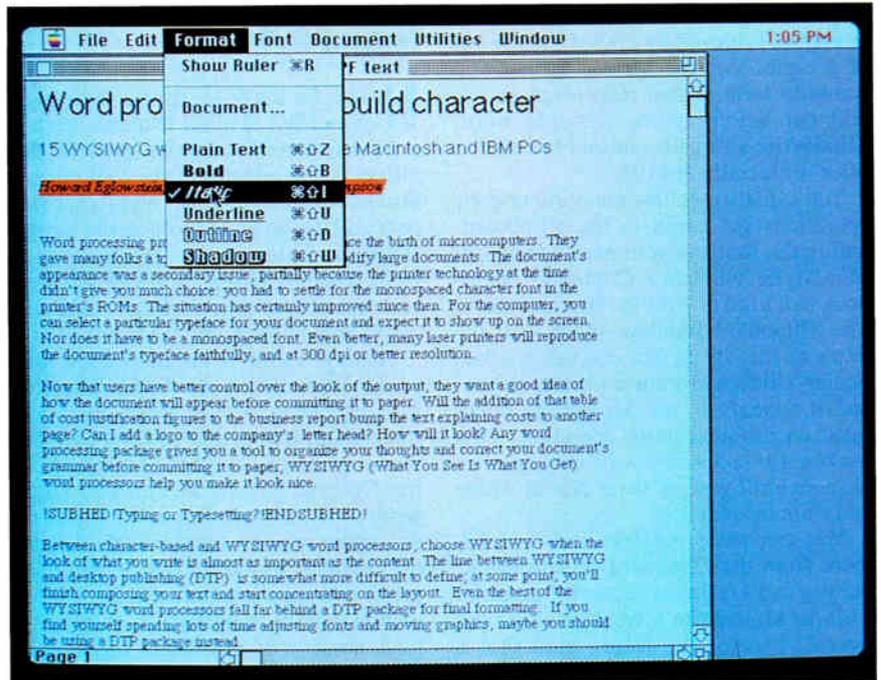


Photo 3: The pull-down menus in Microsoft Word are typical of the Macintosh products in this review.

Here's the world's



as you change the outline. You can hide or expose sublevels by clicking to the left of a topic. For the serious writer who wants to have a road map of an article laid out before typing a single word, MindWrite's flexible outliner has a lot to offer, especially at \$195.

You can also set how many cut or copy operations get saved to the Clipboard, within the limits of your Mac's memory. MindWrite will save Clipboard operations in a kind of first-in, first-out stack. The Clipboard window shows you the items on this stack. You can select a particular Clipboard item with the mouse, and it appears in the MindWrite document on the next paste operation. This makes for a handy way of juggling phrases until you get them placed where you want in an article.

You can paste graphics into a document from the Clipboard or scrapbook, but you can't resize or center the graphic. This is MindWrite's weakest area, but overall we get the impression that a MindWrite user is worried only about the contents of the text itself; someone else with a page layout application will worry about the text's form and style.

Nisus 2.11

Nisus, for the Mac, sports some higher-end WYSIWYG features, such as a sophisticated graphics palette that allows you to add objects to your page. It also has extensive header and footer support and lets you add footnotes to a page. However, although you can have up to eight columns of text, you can see these columns only within a print preview window—an odd omission, we think.

Nisus gives the writer quite a few tools to help with the job of writing. There's a user-selectable level of Undo operations (the default is 300) and 10 Clipboards for stashing choice swatches of text or holding figures. For the author who has to write to fit, an Info Bar at the top of the document window continuously displays the character count for the current paragraph and page (the default). This information can be modified to display the total number of characters or the total word count. A line-numbering function adds line numbers to the beginning of every text line. This function is handy for legal papers or for documents in

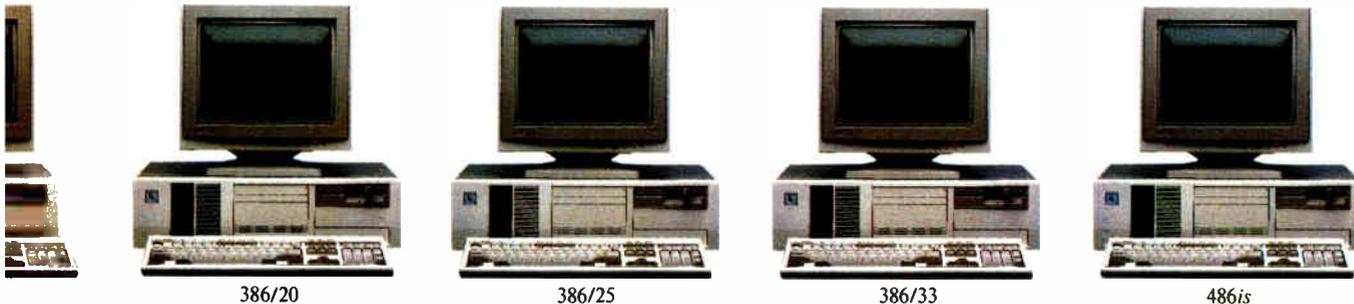
which you have to reference something by line number—in, for example, an article proof faxed to an author.

Nisus's strong point is its editable macros. You create, edit, and use macros to perform repetitive operations. For example, if you want to keep certain gremlin characters in an imported text file (e.g., the formfeed characters), you can create your own macro that strips out all gremlin characters but those. An Easy-GREP and GREP facility allows you to do sophisticated pattern matching, including finding text that's in a particular typeface, style, or size. These latter features will be of use to advanced users, which makes Nisus more suited for technical documents. Nisus also costs a bit more than the less capable word processors: \$395.

WinText 1.54

Palantir's WinText program has been around since the early days of Windows, long before anything else was available. As this article went to press,

longest line of high perform



Workstation, file server, stand-alone PC or node—whatever you need, it's in the Everex™ line.

And all these machines rank at or near the top of their class in performance benchmarks.

There are two main reasons. Zero wait-state design. And Everex's proprietary Advanced Memory Management Architecture (AMMA™).

Thanks to AMMA, for example, the STEP 386/33 turns in a smoking 8.3 MIPS.

But if you think that's fast, take a look at Everex's 88000 RISC-based systems. At up to 21 MIPS, the STEP 8820 and 8825 guarantee the highest performance under both UNIX* and MS-DOS®.

Even the STEPserver™ systems run like

STEP 486is, STEP 386is, STEPserver, STEP 386cis, 286c, AMMA and Everex are trademarks of Everex Systems, Inc. 80386 and 386SX are trademarks of Intel Corporation. Other brands

Palantir had not yet announced Windows 3.0 support for WinText. We tested WinText under Windows' real mode, and it ran perfectly. Although its functions are limited, it's certainly adequate for simple word processing. And at \$195, it was the least expensive of the Windows products we reviewed.

WinText reminds us a little of the original MacWrite: It offers only a spelling checker and basic editing features—insert, delete, cut, paste, and font selection. Before buying WinText, you might want to take a peek at Amí, Amí Professional's little brother. Amí lacks the professional version's thesaurus and drawing packages but retains much of the usability. Amí lists for \$199.

Word for Windows 1.0

In April, we ran a comparative review of Word for Windows, Amí Professional, and NBI's Legend 2.0 ("Word Processing in Windows"). In that review, Lamont Wood found Amí Professional to be somewhat faster than Word for Win-

dows under Windows 2.11. Using Windows 3.0, however, we found the opposite to be true. While both word processors are excellent performers, Word for Windows is a tad faster than Amí Professional under Windows 3.0 in real mode. In 386 extended mode, the difference is small enough that it's barely measurable.

Like Amí Professional, Word for Windows has full macro capability, style sheets, and various display modes. Draft mode gives you the entire text, unformatted, in a monospaced font for faster editing. Normal mode is full WYSIWYG, with the columns extended straight down the page for easier editing. Page mode moves the columns and graphics to their correct page positions. Word also includes a very easy-to-use outliner. Word for Windows' macro language is akin to BASIC, sharing the same constructs and many of the same keywords.

Word for Windows 1.0 holds its own against Amí Professional in most respects, even in price (\$495). Perhaps the biggest difference between the two is Word's binary file compatibility with the Macintosh.

WordMaker 1.01

For basic editing needs, WordMaker is an inexpensive way to get into Mac word processing. For \$124.95, you get standard Mac editing tools and a clean, professional interface. Simply running on a Mac gives a product a full-featured environment. Outside of that, WordMaker doesn't add any remarkable editing features, but it does include support for text in eight colors.

We had only two problems executing our test document: WordMaker doesn't handle multiple columns, and it won't wrap text around a graphic. It was simple enough to add extra carriage returns to make room for the image, but the other packages didn't require the extra step. To get the multiple columns, it would be easy enough to print out two thin columns and combine them on a photocopier—not a bad compromise.

WordMaker is ideally suited for people who don't need fancy columns and heavy formatting. Sometimes, it's best to get back to basics.

continued

ance desktop computers.



8820



8825



STEPserver 286



STEPserver 386

wildfire. The STEPserver 386, for example, combines a 33MHz 80386™ chip with AMMA, making it the fastest machine in its class. And they're both specifically designed for maximum performance and compatibility with Novell NetWare.®

But the Everex systems offer more than sheer speed. Most are upgradable. All come

with a one-year extendable warranty and a one-year renewable on-site service contract that also covers all Everex peripherals in the system.

To find out more, call 1-800-334-4552.

We'll hand you the longest line in the world.

And the best performing. 

WordPerfect for the Mac 1.0.4

The Mac version of WordPerfect is as full-featured and monolithic as the DOS version. As you'd expect, WordPerfect also saves files in DOS format. It was more difficult to feel comfortable with WordPerfect than with the other word processors, because the menu structure has a look and feel entirely its own. Pull-down menus are often arranged oddly, with the same feel as the DOS version's function keys. When you know that a function is "in there somewhere," an easy way to find it is to press the mouse button and scroll through the menus, looking for an entry that you remember. WordPerfect's extensive use of daughter menus makes that difficult, so you find yourself walking through, activating menu after menu, until you find the function you need.

Perhaps the unusual interface is a small price to pay for all that power. If you want both parallel and newspaper-style columns, no problem. If you like to

nest macros within other macros, WordPerfect has you covered. It should be no surprise that WordPerfect had no problem with the test document formatting, once we found the necessary functions.

The documentation for this product is complete but hard to use. If you're a poor speller, think about what it's like to find the correct spelling for a word in the dictionary. If you know where to look for it, you can find it. But that would require knowing how to spell, and if you could do that, you wouldn't need to look it up. Welcome to WordPerfect documentation. The reference section is alphabetized by menu choice or concept, not by functionality. For example, the kerning capability lets you alter the spacing between individual characters. It's handy for giving a special look to a phrase, and we wanted to use it in the document title. On some products it's called "tracking"; on others, "character spacing." WordPerfect calls it "kerning" and puts the reference information by itself under *K*. We'd rather see it in a section of the manual in a discussion of the Format menu, listed in the order in which it appears on the menu.

If you opt for WordPerfect for the Mac, it will cost you \$395. You won't be disappointed, but don't expect to use the reference manual as a learning aid.

WriteNow 2.2

WriteNow, at \$199, is another package that prides itself on being a fast implementation of a minimalist Mac word processor. Like WordMaker, it provides the standard font support; select, cut, paste, and print functions; and a spelling checker and thesaurus.

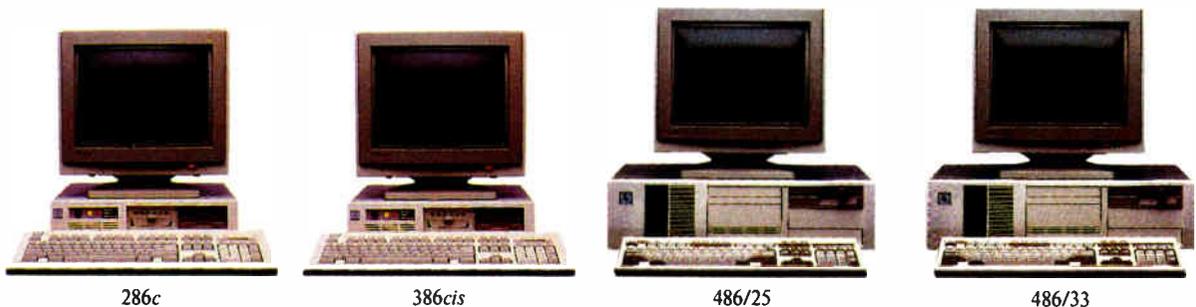
A short function list makes WriteNow easy to learn and incredibly fast. Like WordMaker, WriteNow runs well on a single floppy disk drive and is a superb product for most editing needs.

Scratching That Niche

A few of the packages that we reviewed aren't really general-purpose word processors. Nevertheless, they are WYSIWYG, and they do the specific jobs for which they're intended.

continued

And here's four more.



The world's longest line just got longer. The 286c™ and the 386cis™ are based on the 286/12 and 386SX™ processors. (The 286c is easily upgraded.) Both feature an attractive, low profile design. And zero-wait state gives them the high performance you expect from Everex.

The new STEP 486/25 and 486/33 are hot

even by Everex standards. The 486/33, for example, clocks in at about 20 MIPS—well into mainframe territory.

To find out more, call 1-800-334-4552.

Better hurry. There's no telling how long the line will be if you wait.



Pocket Power

The world's first 3.5 inch, Erasable Optical Drive.

Pinnacle Micro, the leader in 5.25 inch optical storage systems now brings you the first 3.5 inch erasable optical drive.

The new REO-130™ with it's small size and quick 28 msec. speed is what the world's been waiting for in optical storage.

Each 3.5 inch disk holds 128 megabytes of valuable data, safe and secure.

You can hold the disk in the palm of your hand. You can put it in your pocket, or drop it in the mail.

If you need to distribute or archive large amounts of data, the REO-130™ is the perfect choice.

The drive system is available in both internal or external versions. Interface kits available for MAC, SUN, DEC, IBM and compatibles.

Pocket sized. Amazingly fast. Large capacity, is optical storage now.

Another first from Pinnacle Micro, the Optical Storage leader.

Call today for the name of your nearest authorized dealer.



The world's fastest 3.5 inch,
Erasable Optical Drive.

☎ (800) 553-7070

PINNACLE MICRO

THE OPTICAL STORAGE COMPANY™

15265 Alton Parkway • Irvine, CA 92718 • In CA (714) 727-3300 • FAX (714) 727-1913

Circle 223 on Reader Service Card

World Radio History

COMPANY INFORMATION

Ashton Tate, Inc.
(FullWrite Professional 1.1)
6411 Guadalupe Mines Rd.
San Jose, CA 95120
(408) 927-5154
Inquiry 1071.

Claris Corp.
(MacWrite II 1.1)
5201 Patrick Henry Dr., Box 58168
Santa Clara, CA 95052
(408) 987-7000
Inquiry 1072.

Delta Point
(MindWrite 2.1)
200 Heritage Harbor, Suite G
Monterey, CA 93940
(408) 648-4000
Inquiry 1073.

Huff Software
(InText 1.53)
2103 Farlow St.
Myrtle Beach, SC 29577
(800) 678-4833
Inquiry 1074.

Microsoft Corp.
(Microsoft Word 4.0,
Word for Windows 1.0)
1 Microsoft Way
Redmond, WA 98052
(800) 426-9400
(206) 882-8080
Inquiry 1075.

New Horizons
(WordMaker 1.01)
P.O. Box 43167
Austin, TX 78745
(512) 328-6650
Inquiry 1076.

Palantir
(WinText 1.54)
4455 South Padre Island Dr.,
Suite 43
Corpus Christi, TX 78411
(512) 854-8787
Inquiry 1077.

Paragon Concepts
(Nisus 2.11)
990 Highland Dr., Suite 312
Solana Beach, CA 92075
(619) 481-1477
Inquiry 1078.

Samna Corp.
(Ami Professional 1.2)
5600 Glenridge Dr.
Atlanta, GA 30342
(404) 851-0007
Inquiry 1079.

Spinnaker Software Corp.
(BetterWorking Word Publisher 5.0)
201 Broadway
Cambridge, MA 02139
(617) 494-1200
Inquiry 1080.

T/Maker Co.
(WriteNow 2.2)
1390 Villa St.
Mountain View, CA 94041
(415) 962-0195
Inquiry 1081.

WordPerfect Corp.
(WordPerfect for the Mac 1.0.4)
1555 North Technology Way
Orem, UT 84057
(801) 222-4000
Inquiry 1082.

Working Software
(QuickLetter 1.03)
P.O. Box 1844
Santa Cruz, CA 95061
(408) 423-5696
Inquiry 1083.

WYSIWYG Corp.
(The Universal Word 1.5)
300 Corporate Point, Suite 410
Culver City, CA 90230
(213) 215-9645
Inquiry 1084.

the standards that we've all come to expect from a modern software package. Plan on spending a few minutes getting the hang of it.

It's worth the effort. InText is a package clearly aimed at scientific and technical documentation. You enter mathematical expressions like any other piece of text; simply put them together with the equation editor, drawing any geometric shapes with the line-drawing tool. Special characters come from a special menu and can be resized to fit.

Speed isn't InText's forte. Beautiful text is, and the output quality was very impressive. HP LaserJet and PostScript drivers are included, as is support for most 24- or 9-pin dot-matrix printers. We recommend InText for any technical presentation, particularly those with mathematics or chemical symbols.

QuickLetter 1.03

QuickLetter is a Macintosh desk accessory that's ideal for occasional use or for hammering out a fast cover letter. In fact, QuickLetter comes with its own address book and special Print Envelope menu selection.

It's actually kind of fun—if you're in another word processor or database, you can select a name and address, find QuickLetter in your desk accessory list, and paste the address into a new document. Select Print Envelope, and bang out envelopes with no muss or fuss. It's also extremely handy to have a full multifont editor at your fingertips. There are many times in a telecommunication package that it would be convenient to grab a file from the disk, make text changes, and transmit the file without having to lose the connection and redial. Of course, there are shareware alternatives, but QuickLetter is a full word processor. Besides, the envelope and address book features are more useful than we would have imagined.

The package isn't expensive, either (\$124.95), and that makes it all the more attractive.

InText 1.53

InText is a full WYSIWYG scientific word processor that can easily function as a full-featured text editor. It doesn't handle graphics or multiple columns. Otherwise, it does everything that you would expect from a full-featured word

processor for \$295.

The interface looks a bit dated, and it does not support a mouse. InText includes screen drivers for CGA, EGA, VGA, and Hercules displays. One of the more unusual features is a menu that serves to bind together the editor and print module. It's hard to describe, but suffice it to say that it doesn't conform to

The Universal Word 1.5

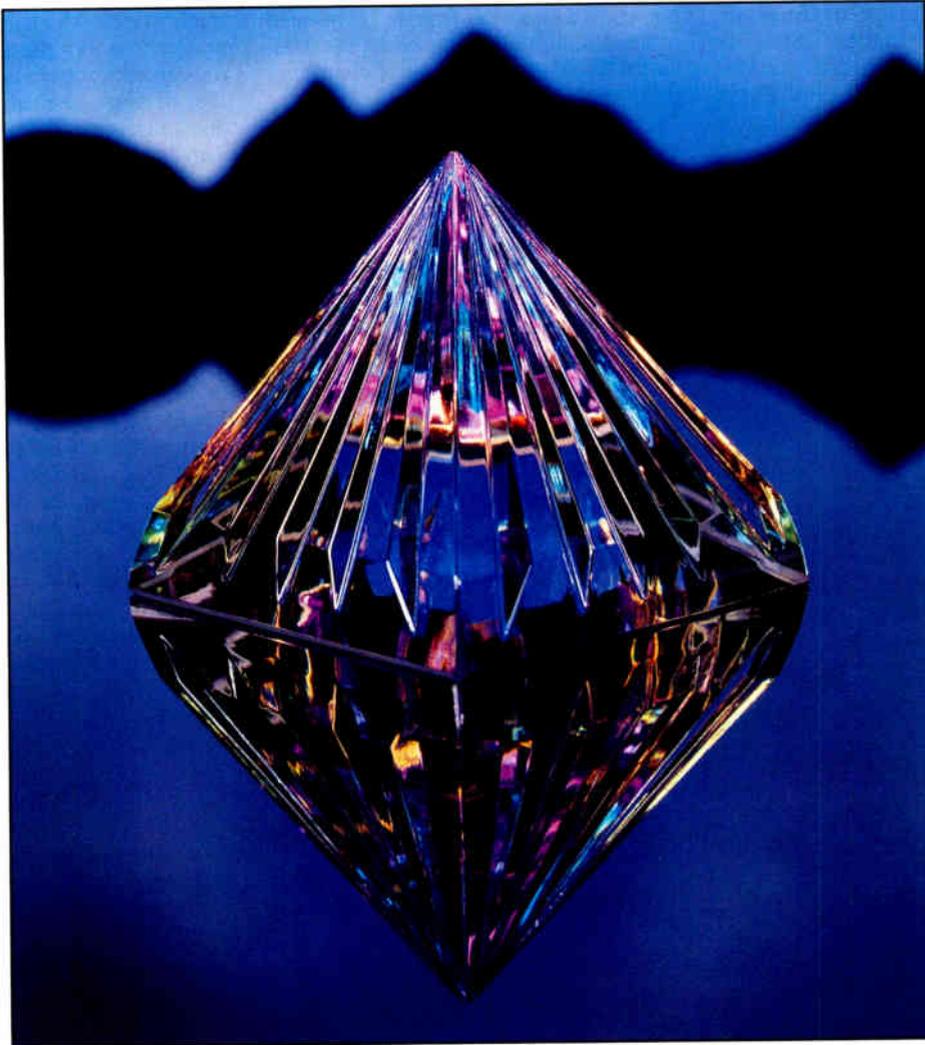
If there were a prize in this review for the prettiest screen display, The Universal Word from WYSIWYG Corp. would win hands down. We tested the English-only version of a product that is

continued

PARAGON

STRIPING ▲ MIRRORING ▲ SPANNING

A New Age in Disk Performance Software



PARAGON™ disk array software provides unparalleled performance, increased storage capacity, improved data reliability, and vast SCSI connectivity in a fault tolerant environment.

At the core of **PARAGON™** is Chantal's unique Disk Array Software Technology (DAST),™ which achieves optimal disk performance and capacity through striping, mirroring, and spanning. Users report that disk performance increases by a factor of 5 to 10. The disk I/O transaction bottleneck is eliminated. Disk drives of varying sizes from different manufacturers can be used. Striping, mirroring, and spanning can be combined for optimum disk performance, storage capacity, and system configuration.

PARAGON™ incorporates Chantal's extraordinary SCSI I/O Subsystem Software to increase connectivity and improve performance in critical areas of the operating environment. XENIX, UNIX, and AIX are supported in 286-, 386-, and 486-based personal computers using ISA, EISA, and MCA bus architectures.

A new age in disk array performance is available now from the high performance SCSI software experts at Chantal.

Call for Complete Details: (800) 527-0003 Fax (619) 452-1007
Chantal Systems Corporation, 6265 Greenwich Drive, San Diego, CA 92122

©1990 Chantal Systems Corporation

Trademarks are proprietary to their respective owners.

Circle 61 on Reader Service Card (RESELLERS: 62)



CHANTAL®

World Radio History

clearly meant for multiple languages. For \$395, you get English; for \$695, you get some combination of English, French, Italian, Portuguese, Spanish, Dutch, German, Hungarian, Arabic, Russian, Swedish, Polish, and Farsi. Standard configurations have a specific subset; WYSIWYG will also custom-configure a set for your needs.

The version that we tested didn't support PostScript, and WYSIWYG is working on adding it. As a general word pro-

cessor, we found The Universal Word to be rather slow. That doesn't mean it's not worth a look—far from it. If you need to handle multiple languages, The Universal Word might do better than anything else we looked at.

How to Buy a Word Processor

A word processor may be the most personal purchase that you'll ever make for your computer. Choosing between word processors is a bit like picking among re-

ligions, movies, or clothing styles; you will naturally gravitate toward one that "feels" right, which means that the word processor works the same way you do. You can ask your friends which ones they like, or you can read reviews in magazines. Just remember that you're not necessarily going to like the popular one or the one with the most features.

Are you planning on using your word processor to create newsletters? In that case, you won't care about counting words, retrieving foreign text files, or creating outlines. What you need for newsletters is a powerful formatting capability, preferably one with good graphics support.

Novice users may find the whole idea of a monolithic word processor much too scary. Let's face it: If you're using a word processor for day-to-day business correspondence, you're simply not going to use most of the features in a full-featured product. It's comforting to know that they're there, yet too many features can be confusing. So save some money and buy a simpler package with just the features that you'll use. In word processing, less is often more.

Sometimes you simply don't have a choice. In an office environment, it's likely that your network is made up of both Macs and PCs. In that case, it's handy to choose a word processor that works on both platforms and can share binary word processor files back and forth across platforms. In other cases, you need to share files with other users on the same platform.

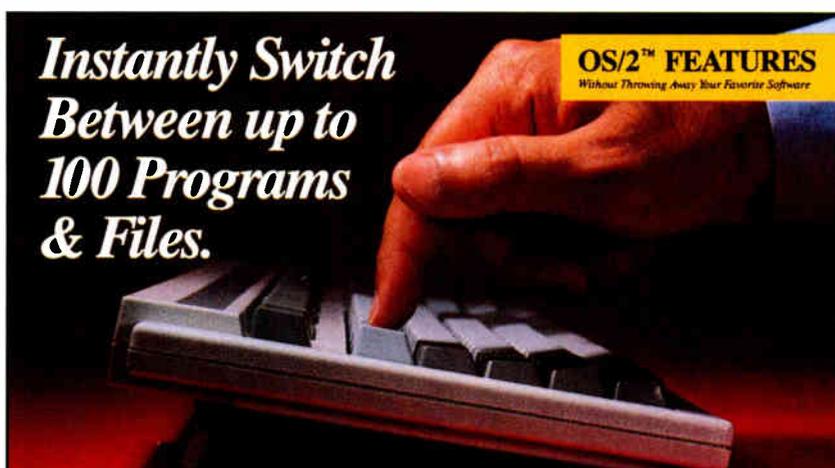
You might try borrowing a word processor from a friend or officemate and spending some time with it. Don't let anyone pressure you into using a full-featured package if you don't need it. Lastly, read the documentation. Some of the manuals in this review were difficult to use. For the popular products, many third-party books are available.

Kiss Your Typewriter Good-Bye

For the sort of editing that you might do in preparation for placing text in a DTP package, we liked Ami Professional and Word for Windows under DOS. Both have very good editing features and a draft editing mode. Choosing between the two is tough, but Ami's poor word-counting macro makes us lean toward Word. Word provides word and character counts as a standard item in its Summary Info box.

On the Macintosh, any of the word processors that we reviewed would suffice. If we were forced to pick one, we

continued



**Instantly Switch
Between up to
100 Programs
& Files.**

OS/2™ FEATURES
Without Throwing Away Your Favorite Software

Pop Up Programs and Files

Switch-It automatically lists up to 100 of your commonly-used programs in a menu customized for your IBM PC. Start your programs by simply pointing to them on the menu. Then, whether you're in the middle of 1-2-3, Word Perfect or dBase, a key-stroke moves you instantly to another program or file. Then back, or switch to another. And another.

Forget save/exit/load/restore. Forget wasted time staring at a blank screen. Easily move data between previously incompatible programs without retyping.

Give your PC OS/2 features, today!

Free TSR Memory, Share Data

Switch-It uses your hard disk or EMS memory for swapping. You have full memory (up to 600K) available for every program, even if you have only 640K of RAM, and your memory-resident programs run free, in zero RAM! No more TSR conflicts or crashes. That's why PC Magazine stated "Switch-It proved to be remarkably free of glitches."

- Scans your hard disk and builds a menu of programs
- Cut & paste functions
- TSR manager & command line editor
- Network, mouse & graphics support
- Requires only 26K RAM

Switch-It (tm) Version 3.0 (c)1989 Better Software Technology		
1	Dos Command Processor	550
2	Lotus 1-2-3 Spreadsheet	256
3	dBase III Plus	320
4	Lotus Metro	256
5	Lotus Agenda	450
6	Multi Plan Spreadsheet	320
7	Procomm Plus	192
8	Word Perfect	350
9	Ventura Publisher	550
10	Switch-It Configuration	256
11	Microsoft Excel	640
12	Cross Talk XVI	256
13	Sidekick Plus	256

F1 = Select, ← = Run, Del = Abort
←F12 = Switch

In Canada call: 800-663-6157

Order Toll Free: 800-848-0286

Visa/MasterCard accepted. Include \$5 s/h (overseas \$15). Technical Info: 508-879-0744

Switch-It™ \$99.95

Free ET-Phone™ with Switch-It Purchase.

Every imaginable phone directory and dialing function for your PC, including 2000 built-in phone numbers. \$79 if purchased separately.

Better Software Technology, Inc., 55 New York Ave., Framingham, MA 01701

A SMALL PRICE TO PAY FOR GREATNESS.



THE DELL SYSTEM 325 25 MHz 386.

An even better value at these low prices.

STANDARD FEATURES:

- Intel® 80386 microprocessor running at 25 MHz.
- Standard 1 MB of RAM, optional 2 MB or 4 MB of RAM* expandable to 16 MB (using a dedicated high-speed 32-bit memory slot).
- Advanced Intel 82385 Cache Memory Controller with 32 KB of high-speed static RAM cache.
- Page mode interleaved memory architecture.
- Socket for WEITEK 3167 math coprocessor.
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
- 1 parallel and 2 serial ports.
- MS-DOS® compatible and Novell certified.
- 8 industry standard expansion slots (6 available).

****Commercial Lease Plan. Lease for as low as \$131/month.**

- 40 MB VGA Monochrome System \$3,599
 - 80 MB VGA Color Plus System \$4,099
 - 190 MB Super VGA Color System (800 x 600) \$4,699
 - 330 MB Super VGA Color System (800 x 600) \$5,499
- Prices listed reflect 1 MB of RAM. 100 and 650 MB hard drive configurations also available.

Who are we to argue with the experts.

The leading computer publications in nine countries, including all the major ones here in the U.S., have voted the Dell System® 325 the number one, or one or uno 25 MHz 386™ based personal computer in their respective markets.

The Editors of *PC Magazine* chose to give it their prestigious Editor's Choice award. *PC Week* polled corporate volume buyers who voted it top in all 12 attributes measured (among competition including every major PC manufacturer), and called the Dell™ 325 an exceptional value.

At an exceptional price. A price that includes the best documentation in the business and diagnostic and utilities diskettes. A full 30-day satisfaction, or your money back guarantee with no questions asked. Toll-free technical support and a one-year limited warranty. And next business day on-site service from the Xerox Corporation.△

TO ORDER, CALL NOW:
800-365-1240
IN CANADA, CALL 800-387-5752

FOR NETWORK/UNIX® INFO
800-678-UNIX
HOURS: 7 AM-7 PM CT M-F 9 AM-2 PM CT SAT.



ABOVE AND BEYOND THE CALL.

Best of all it's from the company that finished #1 in customer satisfaction, 6 out of 6 times in *PC Week* polls of corporate volume buyers for PCs.

It's a machine you can afford to buy or lease today, and expand with it in the future.

All it takes is one free call to order a great Dell PC now.

AD CODE 11E10

*Performance Enhancements: Within the first megabyte of memory, 384 KB of memory is reserved for use by the system to enhance performance. System photographed with optional extras. Prices and specifications subject to change without notice. Dell cannot be responsible for errors in typography or photography. In Canada, configurations and price may vary. DELL SYSTEM is a registered trademark and Dell is a trademark of Dell Computer Corporation. Intel is a registered trademark and 386 is a trademark of Intel Corporation. MS-DOS is a registered trademark of Microsoft Corporation. UNIX is a registered trademark of AT&T in the United States and other countries. Other trademarks and trade names are used to identify the entities claiming the marks and names of their products. Dell Computer Corporation disclaims any proprietary interest in trademarks and trade names other than its own. △On-site service may not be available in certain locations. Shipping, handling and applicable sales tax are not included. For information on and a copy of Dell's 30-day Total Satisfaction Guarantee, limited warranty, and Xerox's Service Contract, please write to Dell Computer Corporation, 9505 Arboretum Blvd., Austin, TX 78759-7299, ATTN: Warranty. ©1990 Dell Computer Corporation. All rights reserved.

Circle 86 on Reader Service Card

World Radio History

would take MindWrite for its outliner or Nisus for its clever word counter and excellent macro language. MindWrite is a little thin on formatting features, but that's OK if the formatting is completed in a DTP package. It's responsive, and it has an outliner that nothing else could touch.

Some word processors do a superb job of formatting pages—particularly handy for doing newsletters. If not Ami Professional, try Word for Windows. If you

want to save some money, the baby in this review, BetterWorking Word Publisher, is an amazingly capable package. Having fine control over your layout is somewhat more difficult with Word Publisher, but for a product that runs fine on floppy disk-based 8088 machines, it's downright awesome.

WYSIWYG is the Mac's realm, and, again, any product in this review would probably do the job. It was hard not to like Microsoft Word 4.0 and FullWrite

Professional, although a more basic editor might be enough for most desktop publishing text preparation. In that environment, WriteNow's and WordMaker's lack of multiple-column support would be a nonissue.

The full-featured packages do feel somewhat stuffed with menu choices. It's likely that a novice at word processing would take one look at these big packages and head straight back for the security of the old typewriter. We would feel better about WinText if it was updated to run under Windows 3.0. InText was slanted toward scientific applications. Although it was not part of this review, Ami (Ami Professional's little brother), at \$199, might be a good choice. It has most of Ami Professional's features, except for the thesaurus and drawing package. Windows doesn't provide the range of word processors that the Mac has had for years. In the Windows environment, it might be better to pick a full-featured product and ignore the features that you don't need.

Mac users have it much easier. Both WordMaker and WriteNow follow the Macintosh interface guidelines down to the last punctuation mark, and once you get them started, you instantly feel as though you have been using them for years. WriteNow comes with a thesaurus; WordMaker does not. If you don't want to be that basic, MacWrite II gives you the same ease of use, but with a bit more power, better file import/export capability, and a slightly higher price tag.

For mixed computing environments, IWord (for Windows and the Mac) is an obvious choice. The two versions can easily transport documents back and forth across serial links or networks, preserving full formatting in the process.

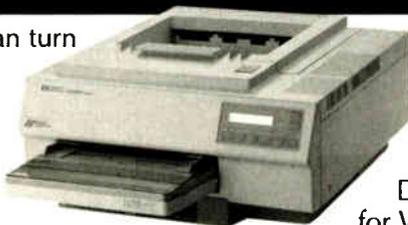
If you're incorporating a Mac into a DOS WordPerfect shop, why not use the real thing? WordPerfect for the Mac is a superbly crafted product, and it does seamless translation to and from the DOS environment. If you're starting a mixed environment, Word might be better than WordPerfect, simply because the Windows and Mac versions are much closer in feel than the Mac and DOS WordPerfect versions. ■

Howard Eglowstein and Stan Wszola are testing editors/engineers for the BYTE Lab. You can reach them on BIX as "heglowstein" and "stan," respectively. Tom Thompson is a BYTE senior technical editor at large. He can be reached on BIX as "tom_thompson."

1000 DPI!

From Your HP LaserJet Series II or III

It's true! We can turn your existing Series II or III printer into a 1000 x 1000 TurboRes™ Plain-Paper Typesetter! National TeleVAR™ (Raster Devices Direct) introduces the **1000 Enhancer Kit™** for your HP Series II or III printer.

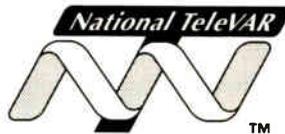


Windows (such as PageMaker, CorelDRAW!, Micrografx Designer, Word for Windows, etc.), GEM (such as Xerox Ventura Publisher, GEM Artline, etc.) and Word Perfect.

By using a new imaging technology called TurboRes™ on our PC-based controller, we can transform your 300 dpi printer into a state-of-the-art Plain-Paper Typesetter that gives you print quality previously undreamed of, even on devices costing over \$20,000.

Send us your HP Series II or III laser printer and we will do the rest. We factory install a video board and connector in your Series II or III, and supply a PC/XT/AT or MCA 6Mb printer controller, 135 scaleable fonts, direct driver software for

CALL NOW! 1-800-468-1732, Source Code #103 (In MN: 612-941-4919) and ask about the 1000 Enhancer Kit for your Series II or III printer. The 300 dpi barrier will fall by the wayside as you experience 1000x1000 TurboRes. Note that all your existing PCL functionality remains unchanged, so your printer can live in both worlds—PCL and 1000x1000 TurboRes!



PrePress Systems Specialists

Formerly Raster Devices Direct, Inc.

©1990. Raster Devices Direct, Inc., National TeleVAR and 1000 Enhancer Kit are trademarks of Raster Devices Corporation. TurboRes is a licensed technology and a trademark of LaserMaster Corporation. All other product and brand names are trademarks and registered trademarks of their respective companies. All prices and specifications are subject to change without notice. Please call for current pricing and warranty details.

VISA, MASTERCARD AND AMERICAN EXPRESS ACCEPTED

AN EVEN SMALLER PRICE TO PAY FOR GREATNESS.



PC Magazine described the Dell System® 310 as the best price performance package on the market.

We've now lowered the price, which makes it an even better package.

The Editor's of PC Magazine also described the Dell™ 310 as being "Fast enough to burn the sand off a desert floor." Now, that's some performance.

Which we think, makes it the best 20 MHz 386™ PC on the market.

That's why the Dell 310 easily outperforms the Compaq DeskPro 386/20e and the IBM PS/2 Model 70-121 on both the MIPS Test and the Norton Computing Index.

And leaves them cold when it comes to price. Whether you buy or lease.

A price that includes a full 30-day satisfaction or your money back guarantee, one-year limited warranty, toll-free technical support, and next-

day, on-site service from Xerox Corporation.△ As well as the most comprehensive documentation in the business.

And if you consider that the Dell 310 comes from the company that's finished #1 in customer satisfaction 6 out of 6 times in PC Week polls of corporate volume buyers for

PCs, then the price you see above is a small one indeed to pay for greatness.

So give us a call and we'll tell you more about how you can own the Dell 310.

Even the call is a small price. It's free.

TO ORDER, CALL NOW.

800-365-1240

IN CANADA, CALL 800-387-5752

FOR NETWORK/UNIX® INFO

800-678-UNIX

HOURS: 7 AM-7 PM CT M-F 9 AM-2 PM CT SAT.

THE DELL SYSTEM 310 20 MHz 386.

The best combination of performance and value available in its class.

STANDARD FEATURES:

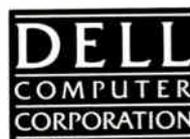
- Intel® 80386 microprocessor running at 20 MHz.
- Standard 1 MB of RAM, optional 2 MB or 4 MB of RAM* expandable to 16 MB (using a dedicated high-speed 32-bit memory slot).
- Advanced Intel 82385 Cache Memory Controller with 32 KB of high-speed static RAM cache.
- Page mode interleaved memory architecture.
- Socket for WEITEK 3167 math coprocessor.
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
- 1 parallel and 2 serial ports.

- MS-DOS® compatible and Novell certified.
- 8 industry standard expansion slots (6 available).

**Commercial Lease Plan. Lease for as low as \$112/month.

40 MB VGA Monochrome System	\$2,999
80 MB VGA Color Plus System	\$3,499
80 MB Super VGA Color Plus System (800 x 600)	\$3,599
190 MB Super VGA Color System (800 x 600)	\$4,099

Prices listed reflect 1 MB of RAM. 100, 330 and 650 MB hard drive configurations also available.



ABOVE AND BEYOND THE CALL.

AD CODE 11E10

*Performance Enhancements: Within the first megabyte of memory, 384 KB of memory is reserved for use by the system to enhance performance. System photographed with optional extras. Prices and specifications subject to change without notice. Dell cannot be responsible for errors in typography or photography. In Canada, configurations and price may vary. DELL SYSTEM is a registered trademark and Dell is a trademark of Dell Computer Corporation. Intel is a registered trademark and 386 is a trademark of Intel Corporation. MS-DOS is a registered trademark of Microsoft Corporation. UNIX is a registered trademark of AT&T in the United States and other countries. Other trademarks and trade names are used to identify the entities claiming the marks and names of their products. Dell Computer Corporation disclaims any proprietary interest in trademarks and trade names other than its own. On-site service may not be available in certain locations. Shipping, handling and applicable sales tax are not included. For information on and a copy of Dell's 30-day Total Satisfaction Guarantee, limited warranty, and Xerox's Service Contract, please write to Dell Computer Corporation, 9505 Arboretum Blvd., Austin, TX 78759-7299, ATTN: Warranty. ©1993 Dell Computer Corporation. All rights reserved.

Circle 87 on Reader Service Card

World Radio History

BYTE REVIEWS

SYSTEM

Tom Yager

REVIEW

DEC's Latest RISC



The DECstation 5000 packs some serious performance into a compact box. The expansion cabinet atop the main unit holds the hard disk drive.

DECstation Model 5000/200CX

Company

Digital Equipment Corp.
146 Main St.
Maynard, MA 01754
(508) 897-5111

Components

Processor: 25-MHz MIPS R3000 with 128K-byte cache; MIPS R3010 math coprocessor; LSI Logic LR3220 memory buffer controller

Memory: 16 MB of DRAM, expandable to 120 MB; 128K bytes of static RAM cache

Mass storage: 665-MB SCSI hard disk drive

Display: 16-inch Sony Trinitron monitor; 32-bit DEC graphics adapter (displays 1024 by 864 pixels with 256 simultaneous colors)

Keyboard: DEC VT220-compatible

I/O interfaces: Three serial ports; thin-wire Ethernet port; SCSI port; video port; three Turbochannel expansion slots

Price

System as reviewed: \$28,500

Inquiry 854.

Walk into the temperature-controlled computer room of any university or Fortune 500 company, and you'll almost certainly see minicomputers from Digital Equipment Corp. As users like these have turned to smaller, less expensive machines, DEC has worked hard to diversify, introducing workstations such as its DECstation 3100 (see "DEC's RISC Powerhouse," November 1989 BYTE). DEC's newest entry, the DECstation 5000, offers the best desktop performance the company has to offer, and it illustrates DEC's increasing commitment to standards.

Despite this new system's kinship to earlier DECstations, the 5000 is much

more than a rehash. The juice flows from a 25-MHz MIPS R3000 RISC microprocessor, backed by a 128K-byte static RAM cache. My review system, a Model 5000/200CX, came equipped with 16 megabytes of memory, an external 665-MB SCSI hard disk drive, and a copy of Ultrix, DEC's flavor of Unix. A 256-color, 1024-by 864-pixel graphics adapter drives the 16-inch Sony Trinitron display. The review system's list price came to \$28,500; an 8-MB diskless (and displayless) system sells for \$14,995.

The 5000 accommodates up to 120 MB of RAM and 21 gigabytes of disk space. Its SCSI connector lets you attach up to seven devices. Enhanced graphics

options range from simple two-dimensional vector acceleration to a complex 3-D pipeline. The system unit is a sleek 3½ inches high, but the pizza box-size external hard disk drive doubles the total system height.

Driving the Turbocharged Bus

The 5000 incorporates DEC's new Turbochannel 32-bit bus architecture. This internal I/O channel routes data to expansion boards through three 44-pin slots. The Turbochannel specification lets the bus operate at any speed from 12.5 to 25 MHz; the 5000's bus cranks at full throttle. How fast is that? Claims like this are hard to prove, but DEC says



UNIX BENCHMARKS

PERFORMANCE SUMMARY

DECstation 5000/200CX



20.8*

Opus PM/8000/30



18.2

DECstation 3100

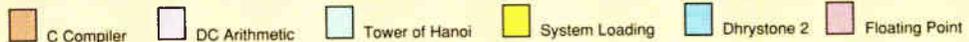


11.1

Everex Step 386/33



6



HIGH-LEVEL PERFORMANCE

	Time	Index
* C Compiler	1.57	1.32
* DC Arithmetic	0.12	5.25
* Tower of Hanoi (17-disk problem)	0.20	2.80
System Loading[†]		
1 concurrent background process	3.47	1.17
2 concurrent background processes	3.80	1.53
4 concurrent background processes	5.96	1.61
* 8 concurrent background processes	9.39	1.84

* Cumulative index is formed by summing the indexed performance results for C Compiler, DC Arithmetic, Tower of Hanoi, System Loading (with 8 concurrent background processes), Dhrystone 2, and Floating Point tests.

[†] System loading was performed using Bourne shell scripts and Unix utilities.

Note: All times are in seconds unless otherwise specified. Figures were generated using the BYTE Unix benchmarks version 2.6. Indexes show relative performance; for all indexes, an Everex Step 386/33 running Xenix 2.3.1 = 1. N/A = Not applicable.

LOW-LEVEL PERFORMANCE

	Time	Index
* Dhrystone 2 (without registers; Dhry./sec.)	31250	2.26
Arithmetic (10,000 iterations)		
Arithmetic overhead	0.10	7.20
Register	2.32	1.26
Short	2.32	1.52
Integer	2.30	1.36
Long	2.30	1.36
* Floating Point	1.63	7.31
Double	1.30	10.17

Throughput

	Time	Index
System call overhead (5 x 4000 calls)	0.21	5.24
Pipe throughput (read and write 2048- x 512-byte blocks)	0.21	4.38
Pipe-based context switching (2 x 500 switches)	0.10	6.30
Process creation (100 forks)	0.20	6.15
Excel throughput (100 execs)	1.12	3.06

Filesystem throughput

	Time	Index
(1600 1024-byte blocks in Kbytes/sec.)		
Read	393	N/A
Write	393	N/A
Copy	169	N/A

that the Turbochannel's peak DMA performance is 93 megabytes per second.

The Turbochannel communicates with connected devices by exchanging messages. Each board receives a 4-MB chunk of address space (the top 32 MB of the system's 512-MB range is reserved), and commands and data pass through these memory-mapped regions. A proprietary protocol governs the format of these exchanges. DEC is making the protocol available to third-party vendors, along with the rest of the Turbochannel specification.

Internally, the Turbochannel does it all. All the outside-world interfaces deal with the CPU through an internal chan-

nel. The 5000's standard interfaces include thin-wire Ethernet, SCSI, and a trio of serial ports, one of which accepts the keyboard and mouse.

The Sony Trinitron display has become a standard among workstation vendors, and with good reason. The screen is cylindrical, giving it a flatter appearance, and the color rendition, sharpness, and image quality are impressive.

Of course, there's more to using a workstation than staring at the screen, and here the 5000 could use a little work. Like the DECstation 3100, the 5000 uses a VT220 terminal keyboard. That may make veteran users of DEC equipment happy, but I couldn't get used to the odd

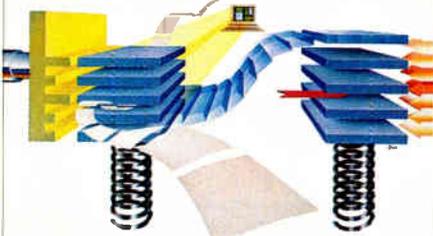
VT220 placements, which include relegating the Escape and Backspace keys to unlabeled function keys. The 5000 also comes with the same awkward mouse. It's round, heavy, and a tubby 3½ inches in diameter.

Bring On the BSD

Users who find the keyboard and mouse aggravating may take comfort in the Ultrix Worksystem Software bundle. The foundation for UWS (I tested version 2.2) is Ultrix, DEC's version of BSD Unix. BSD has earned a reputation as an environment for hackers, but DEC has added enough value to make it a

continued

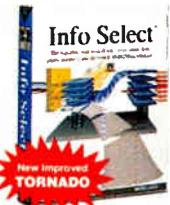
Announcing the fastest new \$99 way to deal with notes, ideas, lists, plans, projects ...



Surprisingly, there is a whole new world of uses for your computer! You can now deal with all the countless bits of **RANDOM INFORMATION** you handle every day: plans, notes, lists, actions, contacts, ideas, and much more. INFO SELECT™ will not only give you instant access to this important information ... it will help you make better decisions and see important new relationships. Try INFO SELECT risk-free.

"First rate" - Jonathan Matzkin, PC Magazine

INFO SELECT is like having a **PHOTOGRAPHIC MEMORY** that gives you perfect superfast recall of up to 64,000 items of information. INFO SELECT is even better than a personal secretary. You can ask for information and get the answer -- faster than a secretary could walk into your office! When Harry calls you on the phone, you'll display the six windows on Harry before he finishes his first sentence! No more embarrassing pauses or scrambling for information.



Do you forget things like which day you placed an order or important numbers? If so, you need INFO SELECT - the software that remembers almost everything for you. INFO SELECT is the next generation of the award winning **TORNADO™** software. Best of all, INFO SELECT is easy to learn. You'll know the basics in 15 minutes. INFO SELECT has an introductory price of just \$99.95! Try it **RISK-FREE** with our 30-day money back guarantee. But hurry - this is a limited time offer. Order today and get ready for a new dimension of computing.

Micro Logic

POB 70 • Dept 603
 Hackensack, NJ 07602
 Tel: (201) 342-6518
 Fax: (201) 342-0370

(800)342-5930

BASIC OPERATION: You will see several windows of different sizes tiled on your screen. Windows can hold: notes, plans, lists, facts, letters, contacts, and much more. You can: open a new window, type into it, and shape it; edit an existing window; resize, remove, or print a window; browse through windows with the arrow keys; search for a group of windows related by a word or phrase, and much more. **FEATURES:** five overview modes; hypertext; fast sort; line draw; tickler; dialer; search by text or date; add columns of numbers; EMS; import / export; efficient on portables; stand-alone or memory-resident; and much more. Data is structured in multiple stacks of intelligent text windows; uses a unique easy powerful system of parallel text processing and progressive resolution searching without keywords. LAN version available. **SPECIFICATIONS:** 10 megabytes max; text searches to 700k/sec; up to 32k per window; up to 64,000 windows per infobase; takes just 7K in swap mode; for IBMs and compatibles; not copy protected. **MAIL ORDERS:** Send name, address, phone number, and payment by check, Visa, or MC to address shown. Please include \$3.50 shipping (\$15 outside continental USA). **TORNADO OWNERS:** INFO SELECT includes everything in Tornado and much more. Call today for our special limited time trade-up offer. **EUROPEAN CUSTOMERS:** Contact Atlantex U.S.A. (203) 655-6980. © 1990 Micro Logic Corp. U.S.A.

REVIEW

DEC'S LATEST RISC

contender for serious users as well.

Even System V users owe a lot to BSD: The C shell, the Berkeley socket network interface, the vi editor, and many other enhancements to Unix have their origins in BSD. These transplant well to System V, but it's good to work in an environment where all these things come together and combine with other Berkeleyisms that haven't yet found their way to System V. Little touches, like the intelligent TTY drivers (which can delete words and won't backspace past the beginning of a line) and the job control mechanism, are easy to get used to.

The base Ultrix operating system on the review system (version 3.1) combines the features of BSD 4.3 and AT&T System V Unix. The core environment is pure BSD, and the operating system handles all system administration in a BSD-standard manner. A set of libraries and header files provides System V compatibility and lets you port System V applications to Ultrix. Since the System V Interface Definition (SVID) forms the basis for the Posix and X/Open operating-system standards, DEC has smoothed the road to compliance with these standards.

The 5000 supports TCP/IP, NFS, and the proprietary DECnet through its standard thin-wire Ethernet interface. The TCP/IP and DECnet protocols can share the same cable, so the DECstation can be part of a network that includes not only other Unix workstations and systems, but VAXes, terminal servers, and other DECnet-specific devices. I quickly had the 5000 connected to BYTE's Unix lab network, and I had no difficulty sharing files and data with systems from other vendors.

DEC is active in the development of the X Window System and has some of the industry's foremost X experts on its payroll. So it's not surprising that the 5000's DECwindows graphical user interface is fast and clean. Beyond its X foundation, the environment created by DECwindows is quite comfortable.

DECwindows runs only on DEC hardware, but there's a lot to like about it. The interface is much more Mac-like than OSF/Motif's. It's mainly a monochrome interface; the defaults set up black and white as standard, even on a color display. Unlike Motif, DECwindows looks as good in monochrome as in color. But next to Motif, DECwindows looks boring. On closer inspection, however, the services that DEC has added to X put most other vendors to shame.

The session manager provides log-in services and adds a primitive desktop manager from which you can launch ap-

plications. One of those applications is dxterm, the DECwindows terminal emulator that's fast, stable, and robust. Without such programs, it's impossible to run text-based applications under X. The one that's shipped standard with X (xterm) is notoriously bad.

Another exciting feature of DECwindows is Display PostScript. Licensed from Adobe and enhanced by DEC, this is more than just a utility for displaying PostScript-format files. DEC has modified it to become an integral part of X, allowing programmers to mix traditional X functions with those from Display PostScript. Without it, X remains a severely limited application environment, lacking scalable fonts and a workable graphical description format.

Developers must often work up their own solutions to these issues, adding significantly to the time it takes to bring a product to market. Display PostScript on the 5000 responded well and managed to display every raw PostScript file I threw at it. Images appeared with surprising speed, laying to rest any notion that Display PostScript might not be fast enough for demanding applications use.

For the programmer, DEC provides just about everything that you could want from X. In addition to libraries for building DECwindows applications, DEC also ships GKS (Graphical Kernel System), OSF/Motif, and PEX (the PHIGS extension to X). The PEX package builds 3-D capability into X, extending the server to support the creation and drawing of 3-D objects. As mentioned, there is also support for building PostScript capability into applications. This killer combination represents one of the most powerful X software bundles available.

Putting It All Together

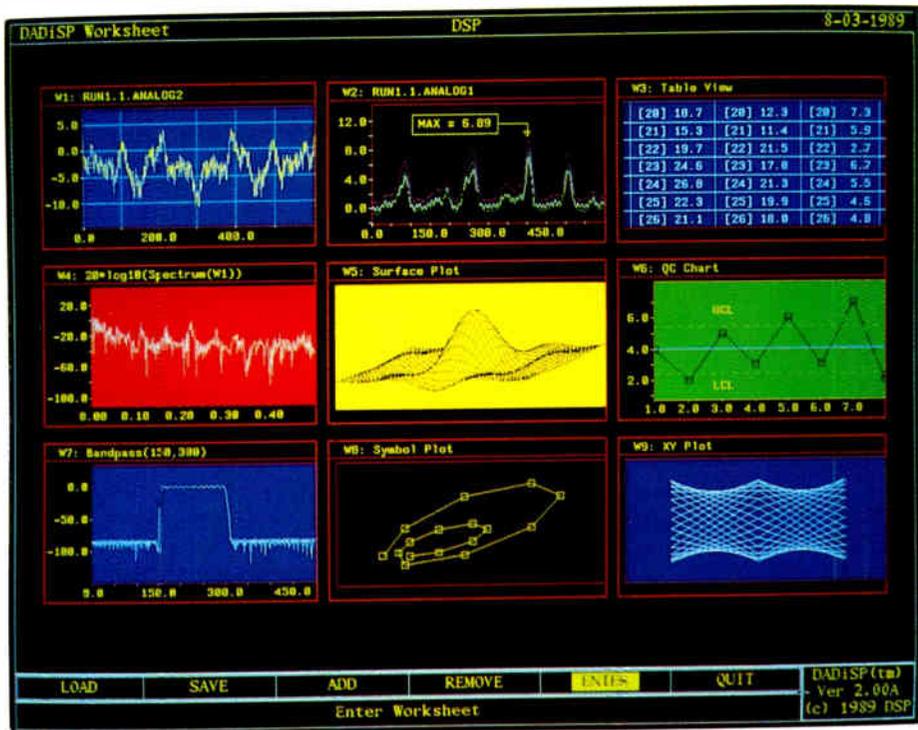
As the benchmark table illustrates, the DECstation 5000 has earned the flagship spot in DEC's line. It outguns its predecessor, the 3100, by a wide margin. Also interesting is the contrast with machines using another RISC processor, the Motorola 88000. While the 33-MHz Opus Personal Mainframe handily bests the 5000 in Dhrystones and other integer tests, in the domain of floating-point, the 5000 shows amazingly well.

The DECstation 5000 is a top-shelf workstation. The excellence evident in performance, software, and company reputation combine to place this system at the head of its class. ■

Tom Yager is a technical editor for the BYTE Lab. You can reach him on BIX as "tyager."

Introducing DADiSP 2.0

Now
Supporting
Popular
A/D Boards



NEW!
Data
Acquisition
Support

DADiSP. The Big Picture in Data Analysis

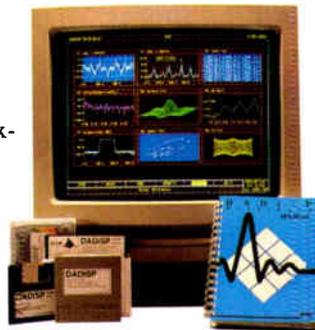
DADiSP — interactive graphics and data analysis software for scientists and engineers. DADiSP 2.0 delivers unprecedented power, through easy-to-use menus. Choose from hundreds of analysis functions and graphic views — from tables to 3-D. Simultaneously display multiple windows, each with different data or analyses, for unlimited perspective on your toughest data analysis problems.

Build your own analysis worksheets — build and display an entire data analysis worksheet, *without programming*. And DADiSP's powerful graphic spreadsheet automatically recalculates and updates the entire worksheet if you change your data or an analysis step.

Do serious signal processing...the way you always pictured it! FFTs, digital filter design, convolutions, waterfall plots, and more — all at the press of a key.

Let your instruments do the talking — use DADiSP-488 to bring data from your instruments directly into a DADiSP window for immediate viewing and analysis.

Flexible, expandable, customizable — annotate your graphs and send them to printers, plotters, or publishing packages. Create your own macros, automate routine tasks, and run any program written in any language from within DADiSP. *DADiSP even lets you build your own menus.*



A proven standard — already used by thousands of engineers and scientists worldwide, in a whole range of applications like medical research, signal processing, chemistry, vibration analysis, communications, manufacturing quality control, test & measurement, and more. DADiSP supports the IBM PC and PS/2, SUN, DEC VAX, HP 9000 and Concurrent families of personal computers and workstations.

**GET THE PICTURE!
CALL TODAY 617-577-1133**

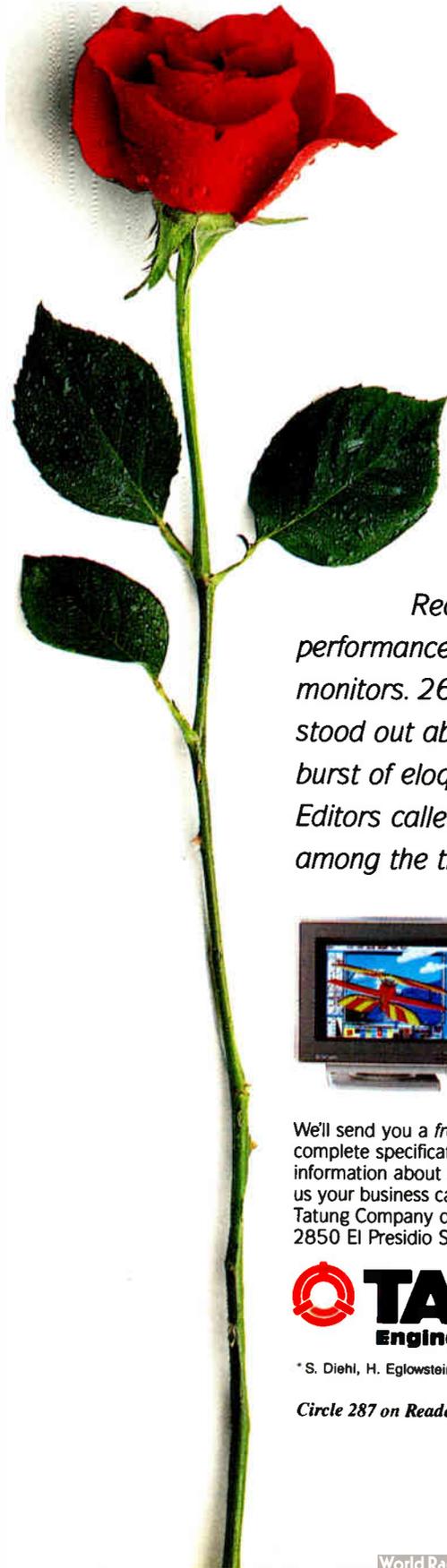
Ask for our Evaluation Disk. For more information, write to DSP Development Corporation, One Kendall Square, Cambridge, MA 02139, or FAX: 617-577-8211.



Australia-Interworld Electronics, 03 521-2952; England-Adept Scientific, (0462) 480055; Biosoft (0223) 68622;
France-SM2I, (1) 34810178; Sacasa, 69077802; West Germany-Datalog, (02166) 46082; Stemmer Electronik, 089-809 02-0; Israel-Racom Electronics,
03-491-922; Italy-BPS Computers, (02) 61290221; Japan-Astrodesign, 044-751-1011; Netherlands-Computer Engineering Roosendaal, 01650-57417;
New Zealand-GTS Engineering, (09) 392 464; Sweden-Systek, 013 110140; Switzerland-Urech & Harr AG, 61 611325; Taiwan-Advantech, 2-351-2117

Circle 103 on Reader Service Card

World Radio History



*Recently Byte magazine performance tested 26 VGA monitors. 26! Of the 26, one monitor stood out above all the rest. In a burst of eloquence, Byte's Testing Editors called that monitor "a rose among the thorns."**



We call it the CM-1296

You'll call it "remarkable."

We'll send you a *free* reprint of the *Byte* article, complete specifications of the CM-1296, and detailed information about all the monitors in our line. Just send us your business card, or call 1-800-827-2850, ext. 213. Tatung Company of America, Video Display Division, 2850 El Presidio St., Long Beach, CA 90810

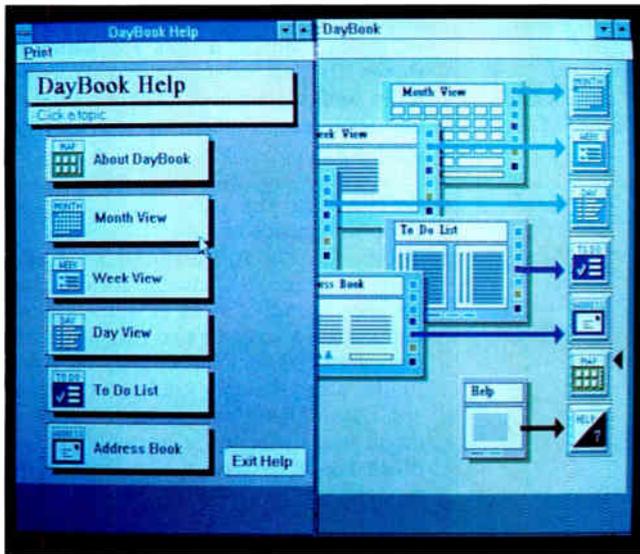
 **TATUNG**[®]
Engineering at its best.

* S. Diehl, H. Eglowstein, BYTE, 3/90

Circle 287 on Reader Service Card (RESELLERS: 288)

REVIEW

Windows 3.0 Software Tool for End Users



ToolBook applications, such as DayBook, take full advantage of the Windows 3.0 graphical user interface.

Icon-based commands, buttons you "press" with the mouse, pop-up screens, data displayed in boxes—it's mouth-watering stuff. So mouth-watering that you had hoped someone might come up with a way to make such power accessible to the end-user programmer—in other words, to someone who wants to whip out a Windows 3.0 application this week, without having to spend two years learning C.

The answer might be ToolBook, a \$395 package from Asymetrix, a little-known firm in close proximity (geo-

graphical and otherwise) to Microsoft. ToolBook provides that graphical programmability for Windows 3.0, and you don't need a degree in computer science to use it.

Yet ToolBook is not a crippled development system. For instance, ToolBook's programming language, OpenScript, has nearly 600 commands, constants, functions, and other keywords. You could make a career out of ToolBook, and I expect a lot of programmers will.

With ToolBook, an application is called a book. Each book is a stack of pages, and when you create an object (which ToolBook calls a container), it's akin to pasting a paper cutout on a clear sheet of gel. The bottom page is the background, and the contents of the foreground page are superimposed over it. You can rapidly flip pages, replacing one with the next. And, yes, you can do animation this way, placing slightly different pictures of the same thing in the same spot on successive pages and then flipping through them. The examples that come with ToolBook include a running horse, a sailboard in use, a turning globe, and balls bouncing around in the background of an application.

Besides animation, you can also create hypertext links to form automated footnotes. You can designate hotwords within text, and when you invoke the words, a linked body of text is displayed—presumably a definition or an exposition on a related subject.

Clearly, ToolBook parallels Apple's HyperCard toolkit for the Macintosh, with its HyperTalk programming language. HyperCard uses stacks of cards, while ToolBook uses books with pages. ToolBook, however, seems to have more features—for instance, it can handle color, and the size of its windows is not fixed.

With ToolBook, the book as a whole, plus each page and each object, can have its own script file, and each can pass commands to the others. Clicking on an object is not necessary—the mere presence of the mouse cursor atop an object can trigger an action, if that's what the script calls for. And you can assign books password protection.

There are two operating modes in ToolBook—reader and author. Reader is for running or testing applications, and author is for writing applications. Scripts are written on a special screen that you can invoke after selecting an object in author mode. The screen includes a syntax checker, and unlike with HyperTalk, there is a debugging facility with which you can add breakpoints to your program. In addition, there is a command window that you can invoke in author mode; from it, you can type individual OpenScript commands to test their results.

OpenScript, like HyperTalk, uses very English-like command words and syntax, and the meanings of many program lines are immediately apparent, such as get the first word of the text of the recordfield comment (using "the" is optional). You need to declare variables, but you don't have to worry about variable types—as long as a variable contains numeric data, OpenScript will perform numeric operations on it without fussing.

In keeping with the attempt to make programming seem natural, you can use the pronoun "it" as a local variable to refer to the last-mentioned data item, whatever it was. For instance, the programming example above could be followed by put it into the commandwindow, and OpenScript would understand. (HyperTalk also uses "it," but you don't see it used much elsewhere.)

Writing Your Own Book

To test ToolBook, I set out to write a file query application that would work with some dBASE data I had. The program

continued

ToolBook 1.0

Company

Asymetrix Corp.
P.O. Box 40419
Bellevue, WA 98004
(206) 637-1600

Hardware Needed

IBM PC or compatible with a 286 or higher processor, 640K bytes of RAM, at least 256K bytes of extended memory, a hard disk drive, Windows-compatible graphics, and a mouse

Software Needed

DCS 3.1 or higher; Windows 3.0 or higher

Price

\$395

Inquiry 888.



Listing 1: *ToolBook's OpenScript isn't difficult to understand. This program goes through a dBASE file by repeatedly sending the buttover condition to an existing subroutine for a button labeled Next (i.e., get next record). It also uses an existing system (global) variable from the main program called currentrecord (i.e., the current file record number). The variables are declared and set in the opening lines. Then, the first if...end if checks the first file record. The following do...until loop walks through the rest of the file. The ongoing total is displayed in a box called ireult.*

```
to handle buttover
  local tot, total
  system svcurrentrecord
  set tote to 0
  set total to 0

  if text of recordfield code = "1"
    put text of recordfield amount into tote
    set total to sum(total, tote)
    put total into text of field ireult
  end if

do
  send buttover to button "Next"
  if text of recordfield code = "1"
    put text of recordfield amount into tote
    set total to sum(total, tote)
    put total into text of field ireult
  end if
until svcurrentrecord=294

end buttover
```

(see listing 1) filtered through a 294-record dBASE file with fields called Date, Amount, Code, and Comment, adding up the Amounts in the records where the Code field equaled 1.

I took advantage of the dBASE Browser Book that came with ToolBook and adapted it to my needs. To simply access the file and get the data on the screen, I had only to input the filename and then make about four mouse-clicks.

Then things bogged down. The script file for the Browser Book was long, complicated, and replete with calls to system-level subroutines or dynamic link libraries. Certainly, it didn't lend itself to tinkering. Using its subroutines from a script for a particular button proved workable, but then the second problem arose—OpenScript looks like English, but it isn't.

After all, it's easier to read a foreign language than to write it. When it comes time to write something, a novice is likely to foul up the grammar—but a reader may still figure out the meaning, thanks to common sense. Computers, however, lack common sense. The result is like constantly repeating a magic spell to a genie who will not respond until you get it precisely right.

Of course, this is true with every programming language. However, in the case of OpenScript, the language seemed

so natural that I was constantly ambushed by sticky little points: Put the text of recordfield comment into it will work, while put the text of recordfield comment in it or put recordfield comment into it will not. Using the command window to test commands became essential—slowly, I learned the dialect.

And once you learn it, there's little the Windows 3.0 world offers that is not at your disposal. You can add scroll bars to text displays. You can run other programs, including other "instances" of ToolBook, from within ToolBook. You can change the shape of the cursor, make use of whatever fonts are installed in Windows, use colors at will, have bar graphs that draw themselves as the data is totaled, and so on. You can even do Dynamic Data Exchange (DDE) links, although there is no mention of Structured Query Language.

In author mode, ToolBook has a graphics facility so that you can draw screen objects. Thus, screen objects can be irregular—for instance, to get information on Idaho, you could click anywhere in a map of that state. In HyperCard, you can stack a map of Idaho with a button, but you would still have to click the button within the map rather than just the map.

The program also comes with a selec-

tion of canned clip art for livening things up, including the 16 different drawings of the globe used for the turning-world animation. There are a tutorial, extensive help files, interesting programming examples, canned scripts for handling things like data validation and Windows tools, and two manuals. There's little to ask for—except, perhaps, the time to learn it all.

Software for the Preponderance of Us

ToolBook is a full-featured programming language. It's suitable for cooking up user-friendly business applications, but you can also use it to create elaborate games and educational courseware. Actually, about the only kind of interactive application that it's unsuited for is communications—there are no modem-handling functions. However, you could probably get around that through DDE links to a separate Windows-based communications package.

Perhaps ToolBook's fate is to become as ubiquitous in the PC world as HyperCard is in the Macintosh world. Consider that Asymetrix was founded by Paul Allen, previously known for having co-founded Microsoft (maker of both MS-DOS and Windows) with Microsoft's present head, Bill Gates. Allen left Microsoft around 1983, but Asymetrix's funding was secured by Allen's equity position in Microsoft, and Allen was recently renamed to the Microsoft board of directors. Meanwhile, Microsoft has announced that a run-time version of ToolBook (with a ToolBook application called DayBook) will be included with each English language copy of Windows 3.0. And Microsoft Press has come out with a guide called ToolBook Companion.

Basically, ToolBook has Microsoft's clout behind it, and you might as well think of ToolBook as part of the Windows 3.0 environment. Now that you have a Windows that lives up to its potential, you can think of Windows 3.0 as part of the PC environment. So you're likely to see a lot of ToolBook.

One thing that you are sure to see a lot of is powerful, Windows-based applications, whether for a single chore for an individual user, for departmental applications, or for sale at the national level, because the tool is definitely available. ■

Lamont Wood is a freelance computer journalist and consultant who lives in San Antonio, Texas. He can be reached on BIX as "lwood."

The new look of power.

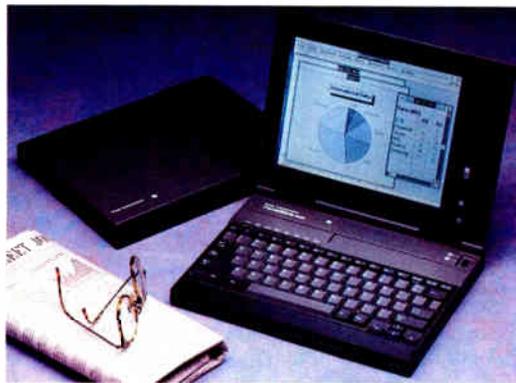


286 processing in a computer that's notebook size,
1.4" thin and 4.4 lbs. light.

Introducing the TI
TravelMate™ 2000
notebook computer —
from the company
that pioneered portable
computing solutions.

Since inventing the first portable data terminal in 1969, TI has led the way in packing more and more functionality into smaller and smaller products. Now TI brings you the next generation in portable computing — the TravelMate 2000.

This sleek, 4.4-lb. notebook computer gives you the power of a PC-AT® in an ultrathin 8½" x 11" package. It's designed to fit your workstyle — wherever you work — in the office, at home or on the road. Just slip it in your briefcase with your file folders, journals and other business materials, and you're ready to go.



**Large VGA screen with
leadership display technology.**

You'll appreciate the technology behind the 10" diagonal VGA display. It's a remarkable feature for a computer that's notebook size. The high-resolution 640 x 480 supertwist screen easily handles demanding windowing and graphics applications.

**More features to meet
your application needs.**

The TM 2000 has the power to run your favorite software — 12 MHz 80C286 processor, 20MB hard disk drive and 1MB of RAM. A built-in, rechargeable battery lets you work up to two hours. With an optional add-on battery, you can work up to five hours — enough for coast-to-coast flights.

You also get a full-function AT enhanced keyboard, so you can work with the same feel of your desktop PC.

In addition, we've loaded MS-DOS® and LapLink™ in ROM, and preformatted the hard disk.

For more information call
1-800-527-3500.


**TEXAS
INSTRUMENTS**

Circle 292 on Reader Service Card

©1990 TI 66063

TravelMate is a trademark of Texas Instruments. AT is a registered trademark of International Business Machines Corporation. MS-DOS is a registered trademark of Microsoft Corporation. LapLink is a trademark of Traveling Software, Inc.

REVIEW

The Mac at 40 MHz



Paired with Apple's 8•24 display board, the high-performance Mac IIx soars as a personal workstation.

Mac IIx**Company**

Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010

Components

Processor: 40-MHz Motorola 68030;
40-MHz Motorola 68882 math coprocessor
Memory: 4 MB of 80-ns SIMM DRAM
Mass storage: 3½-inch 1.44-MB SuperDrive;
80-MB internal SCSI hard disk drive
Display: 13-inch 640- by 480-pixel
AppleColor RGB monitor; Macintosh Display
Card 8•24 24-bit color NuBus board
Keyboard: 63-key standard keyboard
I/O interfaces: 2 mini-DIN-4 ADB ports;
two mini-DIN-8 RS-232C/RS-422 serial
ports; DB-25 SCSI connector; internal
SCSI connector; internal floppy disk
drive port; stereo sound port

Price

\$11,896

Inquiry 851.

ber-crunching power has doubled.

I was disappointed, however, with the disk I/O subsystem tests. Where the test made heavy use of the CPU, performance jumped, while purely disk-intensive jobs showed little improvement over the IIci. True, the IIx can use SCSI DMA to improve disk I/O throughput, but the current version of the Mac OS (6.0.5) doesn't make use of this feature. Nor, it turns out, will the long-awaited System 7.0.

SCSI DMA requires a preemptive multitasking operating system to function properly (i.e., to release the CPU so that it can carry out other tasks). System 7.0, unfortunately, still uses Multi-Finder for cooperative multitasking. Since Unix is a preemptive multitasking operating system, it's ironic that for now only A/UX users stand to benefit from this feature. Fortunately, A/UX 2.0 promises to look more like a Mac than you might expect (see "A/UX 2.0: Unix with a Friendly Face," August Short Takes).

Hex, Lies, and Backup Tape

Not long after the IIx's introduction, rumors of major software incompatibilities

If you measure power by clock speed, Apple's Macintosh computers always seem to come up short. Even the Mac IIci putters along at 25 MHz, versus many 386-based PCs' 33 MHz. The newest member of the Macintosh modular family, the Mac IIx, changes that.

The Mac IIx's 68030 CPU and 68882 FPU race along at 40 MHz; I/O processors off-load serial, mouse, and floppy disk drive activities; and a much-needed 32K-byte cache of fast RAM boosts performance. (For more information, see the First Impression "Apple's Special fx," April BYTE.) No doubt PCs soon will run at this speed, but that doesn't diminish the fact that the IIx got there first, doing what the Mac does best: providing a consistent user interface, seamless data exchange, and gorgeous 24-bit color graphics.

I tested a Mac IIx equipped with 4 megabytes of RAM, an 80-MB hard disk drive, and a Macintosh Display Card 8•24. I also evaluated a beta copy of A/UX 2.0, Apple's version of Unix. After extensive testing, I've determined that the IIx is indeed a fast machine, especially in its floating-point performance. Combined with A/UX 2.0, the IIx becomes a powerful Unix machine.

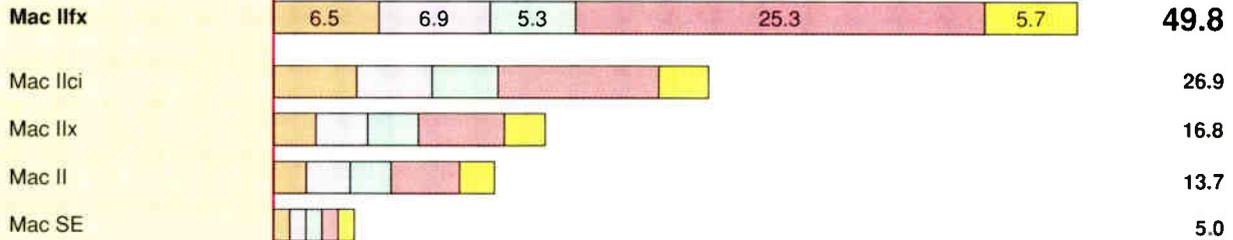
Taking It Out for a Spin

During its design, the IIx carried the code name F-19. BYTE Lab tests show that the IIx performs like its jet fighter namesake: The machine flew through most jobs with its afterburners on. The CPU and memory subsystems run about 60 percent faster than those of the Mac IIci, reflecting the increase in the IIx's clock speed. The FPU subsystem's num-

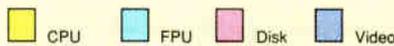
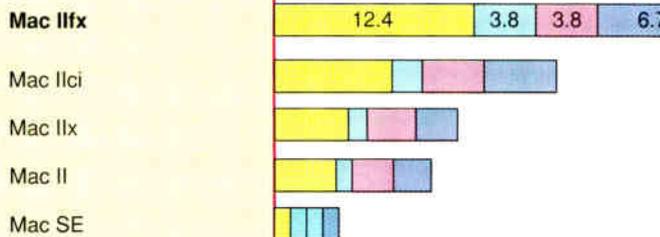


MACINTOSH BENCHMARKS

APPLICATION-LEVEL PERFORMANCE



LOW-LEVEL PERFORMANCE



cropped up. This was inevitable, as the new IIfx design consolidated more functions into custom application-specific ICs. During this process, registers disappear and I/O addresses change, causing software that's hard-coded for a particular hardware setup to break. Applications that stick to using Mac Toolbox and OS calls don't have problems, since these calls are hardware-independent.

To investigate these rumors, I tested a large number of applications. Most of the debuggers worked—an amazing feat, considering how close they operate to the hardware. Jasik Designs' MacNosy and Debugger V2, the premier industrial-strength disassembler and debugging package for the Mac, functioned just fine, as did Icom Simulations' TMON 2.8.4 debugger. Some graphics software, such as Adobe Illustrator 1.9.3 and PhotoMac 1.1, crashed; they couldn't deal with 32-Bit QuickDraw, which Apple has embedded in the IIfx's ROMs. This isn't a new problem: Users first en-

Except for the conventional benchmarks, all results are indexed; for each test, a Mac SE = 1, and higher numbers indicate faster performance. In the Dhrystone test, higher numbers indicate faster performance, in the LINPACK tests, lower numbers are better. The floating-point benchmarks use the SANE library. Comprehensive test results for all tested machines are available on request.

countered it with the Mac IIci. The solution is to get an upgrade from the application vendor (Illustrator 1.9.5 and PhotoMac 1.52).

More serious problems surfaced with software that hammered directly on the Mac IIfx's serial and Apple Desktop Bus ports, or the Super Wozniak Integrated Machine (SWIM) controller for the floppy disk drive. The I/O processors (IOPs) that manage these devices get in the way of these programs and cause trouble.

CONVENTIONAL BENCHMARKS

	LINPACK (single)	Double LINPACK	Dhrystones
Mac IIfx	125	116	10,752
Mac IIci	150	151	5725
Mac IIx	233	241	3680
Mac II	364	348	2861
Mac SE	2319	4229	805

Farallon's SoundEdit had mouse-handling problems (from IOP interaction with the ADB signals), and a beta version of Adobe Photoshop using key-disk copy protection crashed when the application asked for the disk (from IOP interaction with the floppy disk drive controller, and a case against copy protection if I ever saw one).

I normally use Traveling Software's LapLink Mac III to rapidly transfer the 8

continued

MB of benchmark files from one Mac to another via a serial cable. Not this time, though: Launching LapLink caused the IIfx to seize up. Apple now supplies a Compatibility cdev that reroutes the serial data so that the offending software still works. Traveling Software supplied a disk with this cdev, and it corrected the problem.

I suspected that telecommunications software might be a casualty of this IOP/serial port interaction, but I'm pleased to report that I was wrong. White Knight 11.07 let me connect to BIX and download files without a hitch, as did Mac-Acknowledge 1.02 and America Online's software.

I tried some SCSI peripherals to check for SCSI hardware interaction. An Apple scanner worked, as did Apple's CD-ROM drive. (Apple experienced a minor gaffe when the then-current CD-ROM driver failed to work with the Mac IIci.) I was also able to back up and restore files to an Irwin cartridge tape unit.

High Flyer

The IIfx's processing power makes it useful as a CAD workstation. AutoCAD

release 10 c5 whipped through displaying the sample files, making real-time CAD work possible. This is also the image-processing engine I've always wanted in a Mac. Adobe Photoshop 1.0 and Data Translation's PhotoMac 1.52 both inhaled megabytes of 24-bit TIFF image data and performed filtering and color corrections on the images with amazing speed.

For those who want to push the IIfx to the limit, there is Connectix's Maxima. It's an INIT that maps memory in such a way that you can have up to 14 MB of RAM for your applications (the normal limit is 8 MB, because of where the Mac ROMs reside in memory space). Additional memory gets allocated to a RAM disk.

I used 4-MB single in-line memory modules from Connectix to upgrade my IIfx to 32 MB. I made 14 MB of memory available to MultiFinder, and I designated the remaining 18 MB as a RAM disk. So, even without A/UX, you can still get lots of memory for your work. And all that additional RAM will come in handy when System 7.0 arrives, since it will eliminate the 16-MB memory ceil-

ing that the existing 24-bit Mac OS has imposed.

My only complaint about the Mac IIfx is its price. A basic system with 4 MB of RAM, an 80-MB hard disk drive, and a 13-inch color monitor and 256-color board costs \$11,896. Admittedly, you aren't going to buy a IIfx for word processing. It will be for demanding CAD, business, and engineering jobs that require every clock cycle that you can afford. In short, many people will buy the IIfx as a workstation. But even from this perspective, the price is steep, and many potential buyers might shop around for alternative workstations.

For Mac IIx owners, the cost of a motherboard upgrade (\$2999) and 4 MB of IIfx memory (\$999) will buy into Mac IIfx power at a reasonable price. But for the rest of us, if you need the most powerful computer that Apple has to offer, you had better have your checkbook handy. ■

Tom Thompson is a senior editor at large with a B.S.E.E. degree from Memphis State University. He can be reached on BIX as "tom_thompson."

L A S E R P O R T

GrayScale

CONTINUOUS TONE PRINTING ON A STANDARD LASER PRINTER

Turn your Laser Printer engine into a digital airbrush that will print 256 shades of gray.

A must for images from photos, fingerprints, medical, microscopy, I.D. cards, etc. . . . Where dimensions and detail make a difference.

- **Fast — improve printing speed**
- **Near continuous tone — unique technology**
- **Plain paper output . . . 5¢ a copy**

Laserport is a printer controller for Canon, HP, Brother. PC/AT compatible, works with Pagemaker® Ventura® and DOS drivers.

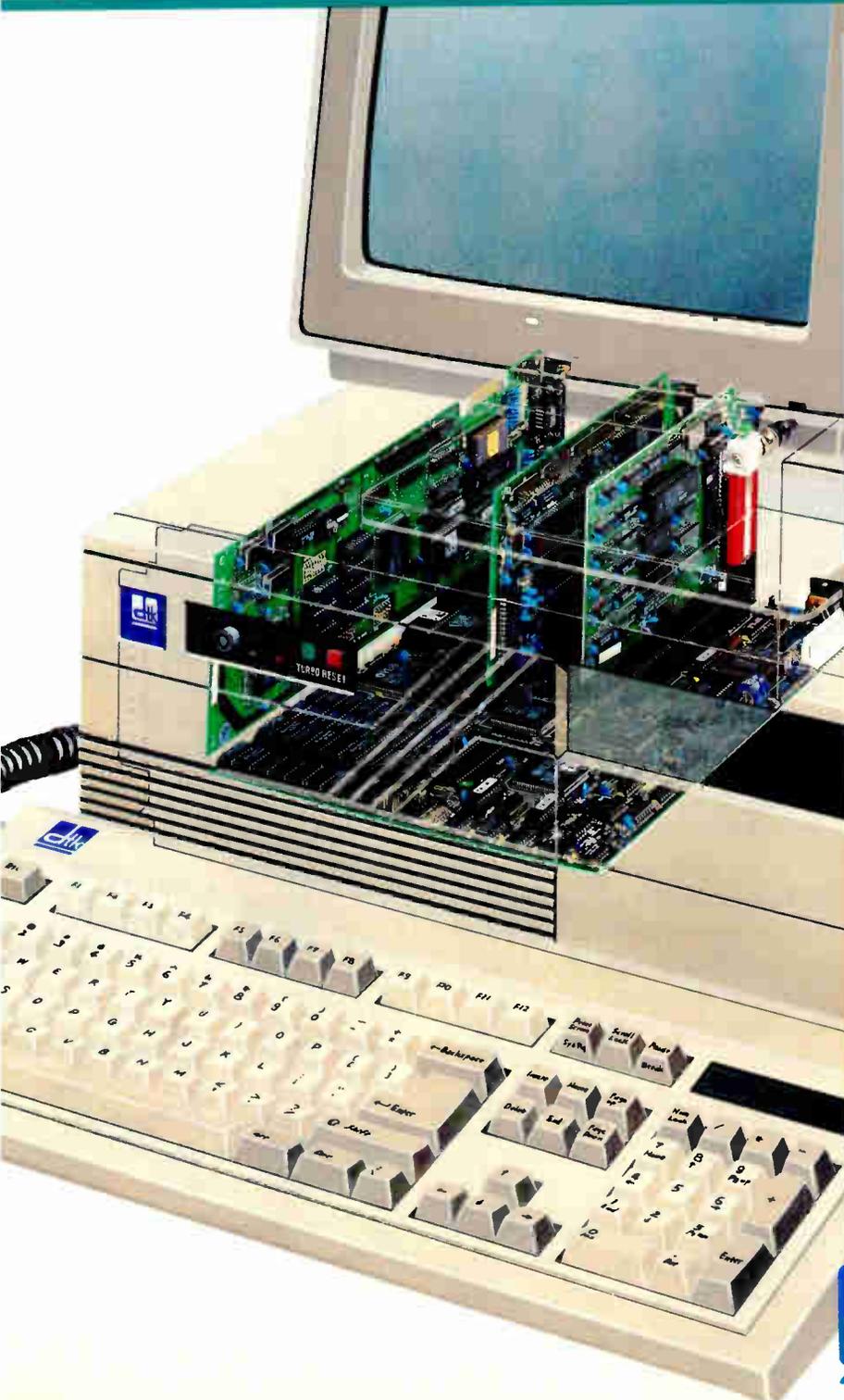
For details call us today . . . 1-800-727-3130.

DP-TEK

Products mentioned are trademarks of their respective manufacturers.



We've got the guts, you get the glory.



Whether you're building systems or simply upgrading existing hardware, you can bet your reputation on DTK.

We offer clearly superior 80386, 80286 and 8088-based Bare Bone™ systems with FCC, UL, CSA and TUV certification. Plus motherboards and fully compatible add-on cards. All built to deliver the performance and reliability today's sophisticated computer users demand.

More Guts. Choose from a dozen Bare Bone systems designed to fit every need—and every desk. Including a 33MHz 386 file server with cache memory. Or select from an extensive line of motherboards (our XT and AT compatible models are widely regarded as industry standards).

Want LAN adapters? Or VGA, I/O, or disk controller cards? Maybe you need to gain an extra slot or two with multiple function cards. DTK can provide the solutions.

At prices you'll really like.

Better Quality. Our substantial R & D capabilities and stringent QC procedures mean you can depend on us for the most reliable, highest performance products available today. And tomorrow. Our inspection conforms with MIL-STD-105D, and our boards enjoy an overall reliability rate of 98%.

So why take chances? We've got all the guts you need at prices that are hard to beat. Go for the glory.

Call or write DTK COMPUTER, Inc., 15711 E. Valley Blvd., City of Industry, CA 91744. Tel: (818) 333-7533 Fax: (818) 333-5429 BBS: (818) 333-6548.

Chicago, IL (312) 593-3080
Edison, NJ (201) 417-0300
Houston, TX (713) 568-6688
Miami, FL (305) 477-7440
West Germany (0211) 656031



Clearly superior.

DTK is a registered trademark and Bare Bone is a trademark of Datatech Enterprises Co., Ltd.
Intel 386 is a trademark of Intel Corporation. XT and AT are registered trademarks of IBM Corporation.

Circle 104 on Reader Service Card (RESELLERS: 105)

World Radio History

Multitasking

Aren't you glad Windows and OS/2™ aren't the only way to multitask and window on the PC.

It's all very well to look at screen after screen of colorful graphics and new programs. But the brutal truth is that these environments require extensive, expensive hardware upgrades for 80% of PC users. Not to mention new or upgraded software.

It all adds up to \$1,200 to \$2,500 per PC—and that's for the hardware and software alone. To say nothing about a major investment in the time it will take to learn new ways of working.

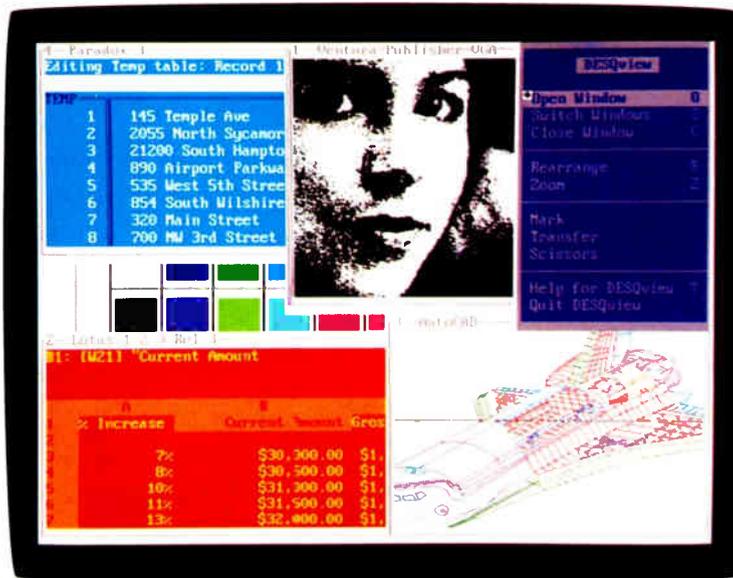
If all you want is enhanced productivity from your PC, that's too high a price to pay.

DESQview does it all.

For less.

DESQview runs the programs you know and love in multiple windows, multitasks them and even lets you choose whether or not to use a mouse. And it does it all today. In fact, DESQview's been doing it for over four years now.

People all over the world are using DESQview to manage customized work environments like those shown here. They are using it to cut and paste data between programs



DESQview lets you run all these programs in multiple windows and multitask them—all without major modifications to the computer you own now. And without replacing or even upgrading your favorite programs.

running in: multiple windows, running sorts and recalculations in the background, and they're operating in text and graphics modes in windows side-by-side.

With no drama, no fireworks and no huge memory or disk space requirements.

In fact, DESQview runs on 80386, 80286 and even 8086 and 8088 PCs. Its low memory overhead means you don't have to buy a faster computer to compensate for the demands of a complex, memory-hungry 'graphical' operating system.

And DESQview builds on and extends DOS—the most robust, stable operating system available for your computer.

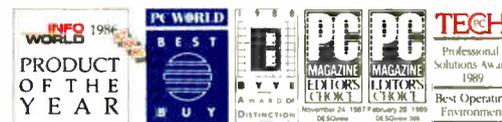
Plus, you don't give up any flexibility in choosing programs. Not only does DESQview run virtually all DOS programs, it runs most Windows programs as well.

No wonder major corporations all over the world have chosen to standardize on DESQview.

**Introducing
DESQview 2.26.
More productive
because it multitasks
more programs.**

The latest generation of DOS programs is getting better. Lotus 1-2-3 v2.2 and Release 3, Metro, Freelance, Microsoft Word, AutoCAD 386, Ventura Publisher Professional—all are smarter about using memory. And DESQview 2.26 makes them work even better.

Mice are steadily becoming more popular, and v2.26 provides improved support for mouse menus within windows. At the same time, for those who just aren't comfortable with mice, it also provides much greater flexibility for



Some of DESQview's recent awards.

assigning and reassigning special keys within windows.

Our users asked for more support for 3270 and other terminal emulation. DESQview v2.26 has it.

You asked for support for a wider range of hardware: CD-ROM, scanners, comm ports, etc., v2.26 has it.

And you asked for help in handling troublesome TSRs. DESQview helps straighten them out.

without tears

Quarterdeck's family of products is designed to enhance the way you work.

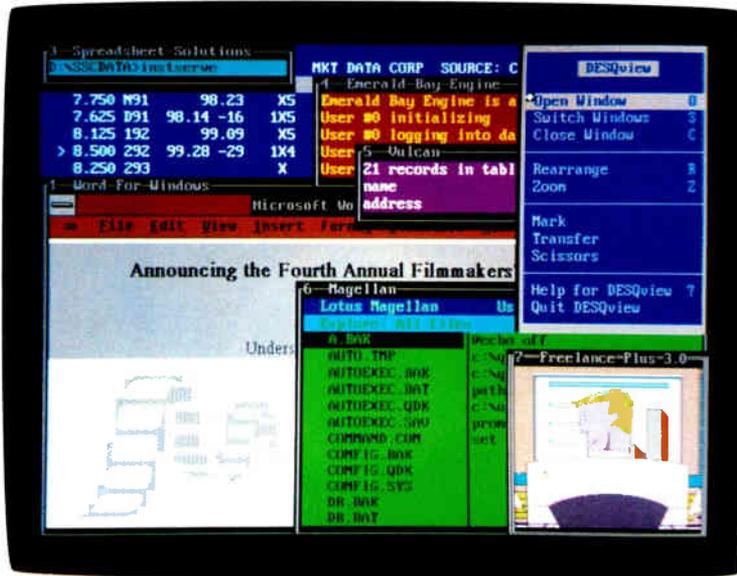
At Quarterdeck, our philosophy has always been to increase your productivity in logical, economical steps—not to invent a system that works for you.

Our best known product, DESQview, has over a million users.

And hundreds of thousands of people use our QEMM, the expanded memory manager for users of 80386 PCs and IBM PS/2™ models 50 and 60 that makes it easy for your programs to break the 640K memory barrier.

Our newest products, Quarterdeck Manifest and QRAM help you understand and optimize the critical first megabyte of your PC's memory.

Manifest does for memory what PC Tools Deluxe does for disks. It guides you under the hood' of your PC, showing how



The vast majority of programs run in DESQview—even Windows 2.0 programs! And some programs take special advantage of DESQview to enhance their operation. FNN NewsReal and products using Spreadsheet Solutions' @DV 'Hot Links', for example, use windowing, multitasking and interprogram communications.

your memory is being used; even which parts of RAM are faster. You'll see where TSRs, utilities, drivers and buffers work, and find all the pockets of idle memory. QRAM is our memory optimizing utility

to let you move utilities, drivers and TSRs out of 'lower' memory and into idle memory locations 'up high,' giving your programs as much as 130K more elbow room. QRAM makes it easy to optimize your memory. Even if you've never used anything but 1-2-3 before.

Quarterdeck products help you get the most from the software and hardware you own today.

To find out more about our family of productivity enhancement products, return the coupon below with the appropriate boxes checked. Or see your authorized Quarterdeck dealer.



Quarterdeck Office Systems, 150 Pico Blvd., Santa Monica, CA 90405 (213) 392-9851 Fax: (213) 399-3802

DESQview System Requirements: IBM Personal Computer and 100% compatibles (with 8086, 8088, 80286, or 80386 processors) with monochrome or color display; IBM Personal System/2 • Memory: 640K recommended; for DESQview itself 0-145K • Expanded Memory (Optional): expanded memory boards compatible with the Intel AboveBoard; enhanced expanded memory boards compatible with the AST RAMpage; EMS 4.0 expanded memory boards • Disk: two diskette drives or one diskette drive and a hard disk • Graphics Card (Optional): Hercules, IBM Color/Graphics (CGA), IBM Enhanced Graphics (EGA), IBM PS/2 Advanced Graphics (VGA) • Mouse (Optional): Mouse Systems, Microsoft compatible • Modem for Auto-Dialer (Optional): Hayes or compatible • Operating System: PC-DOS 2.0-4.0; MS-DOS 2.0-3.3 • Software: Most PC-DOS and MS-DOS application programs; programs specific to Microsoft Windows 1.03-2.1, GEM 1.1-3.0, IBM TopView 1.1 • Media: DESQview 2.0 is available on either 5-1/4" or 3-1/2" floppy diskette. *ademarks are property of their respective holders: IBM, OS/2, PS/2, Interleaf, TopView, Lotus, 1-2-3, Metro, Freelance, AutoCAD, Ventura Professional Publisher, PC Tools Deluxe, Intel, Above Board, AST, AMpage, Hercules, Mouse Systems, Hayes, Microsoft Windows, Microsoft Word, GEM, FNN NewsReal, Spreadsheet Solutions.

YES! Qty Product Send Info 5-1/4 3-1/2 Price Each Totals

<input type="checkbox"/>	DESQview 386 v2.26 Multitasking windowing environment	<input type="checkbox"/>		\$219.95	
<input type="checkbox"/>	DESQview v2.26 Multitasking windowing environment	<input type="checkbox"/>		\$129.95	
<input type="checkbox"/>	QEMM-386 version 5.0	<input type="checkbox"/>		\$99.95	
<input type="checkbox"/>	QEMM-50/60 version 5.0	<input type="checkbox"/>		\$99.95	
<input type="checkbox"/>	QRAM with Manifest	<input type="checkbox"/>		\$79.95	
<input type="checkbox"/>	Quarterdeck Manifest	<input type="checkbox"/>		\$59.95	

I need increased productivity now!

Payment Visa MasterCard Expires ____/____/____ Shipping & Handling \$5 in USA / \$10 outside USA

Acct # _____ California Residents add 6.75%

Name _____ Title _____ Grand Total _____

Address _____

City _____ State _____ Zip _____

For a limited time, the B and A in BASF stand for Bon Appetit.



A good appetite will come in handy with BASF's "Wine and Dine" Game. Because every time you buy BASF diskettes, you could win prizes you can really sink your teeth into.



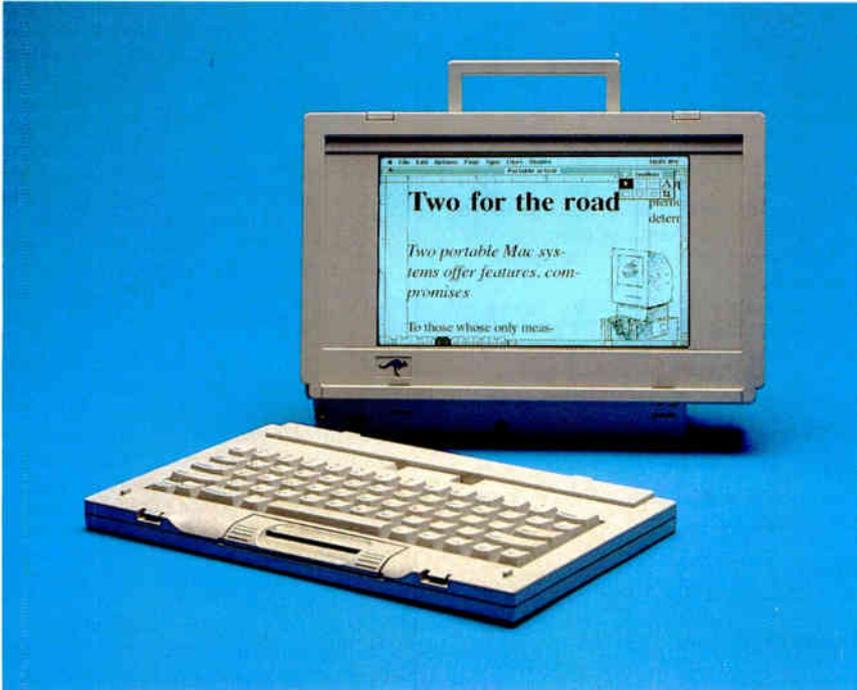
You could be one of the Grand Prize winners who'll enjoy an all-expenses-paid trip for two to the restaurant of your choice, anywhere in the U.S. It includes all transportation, meals and hotel for 6 nights. Or one of the thousands of 2nd Prize winners who'll dine in style with an American Express "Be My Guest" Restaurant Certificate worth \$100.00. There's even a second-chance drawing for a 3-day, 2-night mini-vacation. Look for game tickets in specially marked packages.

At BASF, we believe in satisfying your appetite. For the best in data protection. And the best in exquisite dining. Offer for limited time only. Call your BASF dealer today.

Try it. Depend on it.  **BASF**

REVIEW

Two Different Approaches to Mac Portability



The Outbound performs comparably to the Mac Portable, but it needs the ROMs from your Mac Plus or SE to operate. Note the IsoPoint pointing device below the space bar.



The Dynamac SE/30 offers uncompromising performance in a hefty 18-pound box.

In introducing the Mac Portable last year, Apple succeeded in freeing the Mac from its power outlet, but many users found the machine underpowered and overweight. Fortunately for those who don't want to leave their Mac applications behind when they travel, the Mac Portable isn't the only game in town: Outbound Systems' Outbound Laptop System offers comparable performance in a lighter box, and Dynamac's SE/30 will appeal to users for whom portable power is critical.

Mac Light: The Outbound

Outbound Systems markets the Outbound Laptop System (formerly the Wal-laby) as a hardware add-on to a Mac Plus or SE. This conceptual paradigm bypasses the issue of ROM usage that is vital to the Outbound's operation: Your dealer must transfer the needed Apple ROMs from your Mac Plus or SE to the Outbound. The now-ROMless Mac will not operate unless you "dock" the Outbound to it using a special cable.

The Outbound uses the same 15.67-MHz CMOS 68000 CPU as the Mac Portable, but it costs substantially less. The 9¾-pound plastic lunchbox case is also much lighter than the 16-plus-pound Portable. My review unit included an internal 3½-inch floppy disk drive that can use IBM- or Mac-formatted floppy disks. The machine has only one drive bay, however, so users who opt for the internal 40-megabyte hard disk drive must forgo an internal floppy disk drive.

My review machine included 2 MB of RAM (expandable to 4 MB) and 4 MB of battery-backed RAM in single in-line memory modules for the nonvolatile RAM disk. You can expand the silicon disk to 16 MB using 4-MB SIMMs. The base system, with 1 MB of RAM and no RAM disk, has a list price of \$2999; the hard disk drive model is \$3999. Outbound doesn't sell extra RAM.

Fluorescent backlighting in the Outbound's 640- by 400-pixel black-and-white LCD ensures visibility in low-light situations where the Mac Portable is unusable; in other respects, the Portable's active-matrix LCD is superior. LCD latency times on the Outbound produce smearing on fast-moving text or graphics screens, and finding the cursor can be problematic. When I jiggled the mouse, the cursor disappeared; at rest, the thin I-bar cursor is hard to see. Adjusting the screen contrast helps somewhat.

The Outbound's lead-acid battery provides about 3½ hours of power. Power conservation functions include Control

continued



Outbound Laptop System

Company

Outbound Systems, Inc.
4840 Pearl East Cir.
Boulder, CO 80301
(303) 786-9200

Components

Processor: 15.67-MHz Motorola MC68C000

Memory: 2 MB of RAM

Mass storage: 3½-inch 1.44-MB internal floppy disk drive; 4-MB battery-backed silicon disk, expandable to 16 MB

Display: 9¾-inch, 640- by 400-pixel, backlit, black-and-white LCD

Keyboard: 62-key Mac SE-type layout with IsoPoint pointing device

I/O interfaces: Printer port; serial port; external monitor port; host connector/expansion port for optional SCSI adapter

Size

12½ × 7½ × 3½ inches; 9¾ pounds with battery and hard disk drive

Price

System as reviewed: \$3499

Inquiry 856.

Panel settings that invoke CPU sleep mode, dim backlighting, and spinning down the hard disk drive when the machine is idle.

The keyboard uses the standard Mac SE layout, without the numeric keypad. It can attach to the case or stand alone when in use. Remote keyboard connections include an infrared link and a telephone-style cord. You attach the keyboard to the Outbound with a metal rod that fits into a hole under the screen. I found that the mechanical linkage in this arrangement made the keyboard wobble unacceptably.

Outbound Systems uses the IsoPoint pointing device, located under the space bar, in lieu of a mouse. This is a rolling cylinder that sits inside a plastic slider that, in turn, sits inside a frame. You roll the cylinder for up-and-down pointer movement; the slider handles left-to-right motion. You press on the spring-loaded frame to perform a mouse-click. To achieve accuracy, you have to make horizontal and vertical movements separately. As a device for point-and-shoot selections on files or menu items, it works fine. For other tasks, you will be a lot happier buying the nonstandard mouse for \$129.

The Outbound comes with serial and

Dynamac SE/30

Company

Dynamac Computer Products, Inc.
555 17th St., Suite 1850
Denver, CO 80202
(800) 234-2349
(303) 296-0606

Components

Processor: 15.67-MHz Motorola 68030 CPU; 68882 math coprocessor

Memory: 8 MB of SIMM-mounted RAM

Mass storage: 3½-inch 1.44-MB SuperDrive floppy disk drive; 200-MB 16-ms Conner Peripherals hard disk drive

Display: 9-inch, 640- by 400-pixel, gas-plasma display

Keyboard: 62-key Mac SE-style

I/O interfaces: SE/30 Direct Slot; two serial ports; SCSI connector; external floppy disk drive port; two ADB ports; audio port; two external monitor ports; two RJ-11 jacks (on modem)

Size

13½ × 15½ × 3½ inches; 18 pounds with hard disk drive

Price

As reviewed: \$12,995

Inquiry 857.

printer mini-DIN-8 ports. There's no SCSI port on the Outbound itself, but you can plug an optional SCSI adapter into the host/adaptor slot. When it's docked to the Mac, the host Mac takes control. Your Mac Plus or SE can then access the Outbound's faster CPU, display, memory, and disk storage, while the Outbound's serial ports and keyboard are disabled. A special cdev lets you use either the Mac's display or the Outbound's as the main screen, or both can operate as a single screen.

When I docked the Outbound to a Mac Plus to use the Plus's external SCSI hard disk drive, the combination still booted off the Outbound's RAM disk. Since the Mac Plus has no start-up device setting, there's no way to get around this. This means that Mac Plus owners must store INITs that they use only in docked mode in the Outbound's limited silicon-disk memory. Fortunately, you can use Fifth Generation Systems' Suitcase II to bring in fonts and desk accessories that you need from the SCSI disk when the Outbound is docked.

The Outbound ran neck and neck with the Mac Portable on the CPU, FPU, and video tests, but its fast silicon disk result-

continued

HOW TO AUTOMATE A SMALL BUSINESS

by W. Gary Robertson



Automating a small business such as a doctor's office, accounting or legal

firm can be challenging. Budgets often are limited and technical personnel non-existent. Having a reserve of computer hardware ready to support new employees is uncommon.

As these businesses grow, existing systems become strained. While larger organizations may be well served by a minicomputer, mainframe, or server-based network, these often are beyond the scope of a smaller business.

System cost, ease of use, training, and maintenance are important considerations. Multiuser systems, particularly DOS-based ones, typically perform best in each of these categories.

Multiuser systems save money by allowing one computer to support multiple users through terminals attached to the CPU. They also avoid the hardware expense and maintenance inherent in server-based LANs. DOS-based multiuser systems require minimum retraining, and allow employees to use familiar applications.

The automation of Dr. Susan LeGrand's medical practice illustrates how a multiuser system can affordably and easily computerize a small business.

When Dr. LeGrand established her practice she didn't own a computer. Paperwork quickly became impossible to manage, so she purchased an 80386 computer for insurance filing, accounting, patient records, and maintaining a large hospital census.

As her practice grew, Dr. LeGrand hired an assistant for her office manager. Dr. LeGrand considered purchasing a second computer and a LAN, or purchasing a multiuser operating system that would allow an inexpensive terminal to be a second workstation. The multiuser system cost \$2,054 for the software, extra RAM and terminal, compared to \$3,326 for the computer, interface cards and software for the LAN.

Dr. LeGrand chose The Software Link's DOS-compatible multiuser operating system, PC-MOS.

"Conceptually, the multiuser approach seemed ideal," Dr. LeGrand commented, "and when it was the least expensive, the decision was easy."

The system was installed over a weekend, avoiding office hour downtime. "Everything locked and worked the same," Dr. LeGrand said. "And we could continue to use our existing software and communication program."

System administration and maintenance is handled remotely by the PC-MOS distributor, J.S. Walker & Co. of Charlotte, NC.

"Having two workstations has really improved productivity," Dr. LeGrand said. "And I can add up to three more workstations by simply installing RAM and terminals."

W. Gary Robertson is co-founder of The Software Link, Inc.

Circle 297 on Reader Service Card
(RESELLERS: 298)

All the power of The Software Link's PC-MOS operating system. All the benefits of both individual and networked PCs.

All in one high-performance, low-cost, multi-tasking system. With no terminals and no additional PCs — unless you want to optionally use your old XT's or AT's.

The UnTerminal™ UnNetwork.™

It's the ideal multiuser system for personal computer users.

UnTerminal monitor-keyboard workstations cost less than terminals. Less than text-only "intelligent I/O" solutions. Less than fiber-optic graphics solutions.

An independently operating UnTerminal workstation outperforms them all. With faster

UnNetwork.

Inexpensive monitor-keyboard workstations replace costly terminals and PCs on the UnTerminal™ UnNetwork.™ Run multiuser and popular PC programs at the same time — with no terminals or PCs — or use any XT's and AT's you happen to have.



The UnTerminal Video Network Adapter™ supports up to 4 Hercules-compatible workstations.



The UnTerminal Video Network Graphics Adapter™ supports up to two color graphics workstations — resolution up to 800 x 600.



The UnTerminal Video Connect Card makes an XT or AT into a multitasking, multiuser workstation.

screen refresh — text *and* graphics. Instant switching between single and multiuser screens. Running popular DOS applications. And making every user feel like the only user.

Just add PC-MOS, monitors & keyboards.

The Software Link's PC-MOS multiplies the power of your PC. Why pay extra just to get the boxes? You can run up to eight color or 16 monochrome UnTerminal workstations per system — and save thousands.

*Distributed by
The Software Link, Inc.*

For more information, call:
The Software Link, Inc. at (800) 451-LINK or (404) 448-5465.



Hercules compatible graphics using the UnTerminal (VNA).



Color graphics embedded in database using the UnTerminal (VGNA).



800 x 600 VGA graphics using the UnTerminal (VGNA).



Now XT's and AT's can be UnTerminals, too. Hotkey between local and host applications using the UnTerminal (VCCA).



The PC-MOS UnTerminal

PC-MOS MULTIUSER SYSTEMS WITHOUT TERMINALS

The Software Link, Inc., 3577 Parkway Lane, Norcross, GA 30092.
Phone: (800) 451-LINK or (404) 448-5465, FAX: (404) 263-6474, Telex: 4996147 SWLINK.

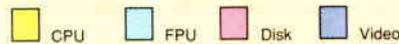
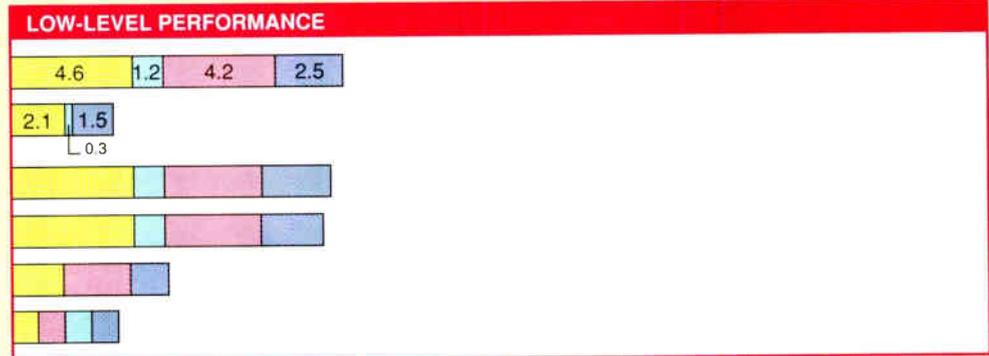
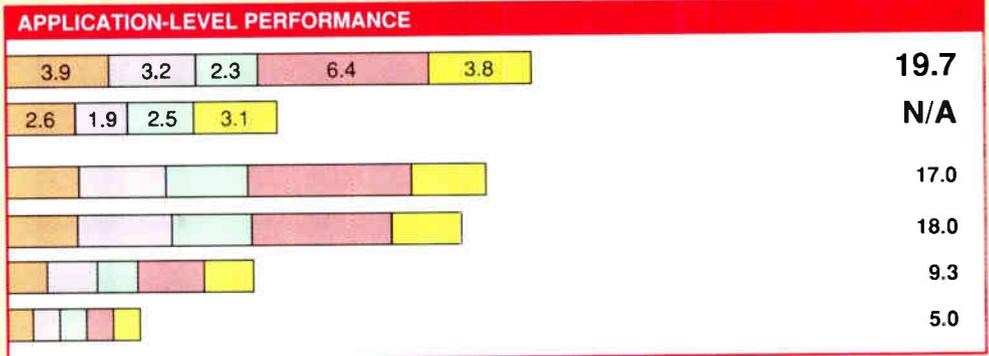
PC-MOS is a trademark of The Software Link, Inc. UnTerminal, UnNetwork, Video Network Adapter, Video Connect Card Adapter and Video Graphics Network Adapter are trademarks of Advance Micro Research, Inc.

Circle 299 on Reader Service Card (RESELLERS: 300)

World Radio History



MACINTOSH BENCHMARKS



CONVENTIONAL BENCHMARKS

	LINPACK (single)	Double LINPACK	Dhrystones
Dynamac SE/30	235	249	3708
Outbound	1096	2012	1744
Mac IIcx	237	250	3735
Mac SE/30	232	241	3754
Mac Portable	1154	2107	1633
Mac SE	2319	4229	805

The Outbound was unable to run the Scientific/Engineering tests. Also, the Outbound's RAM disk invalidates the low-level disk test results. The Mac Portable did not include an FPU, so it could not complete the FPU tests.

Except for the conventional benchmarks, all results are indexed; for each test, a Mac SE = 1, and higher numbers indicate faster performance. In the Dhrystone test, higher numbers indicate faster performance; in the LINPACK tests, lower numbers are better. The floating-point benchmarks use the SANE library. Comprehensive test results for all tested machines are available on request. For a full description of the Mac benchmarks, see "Introducing the New BYTE Benchmarks," June 1988 BYTE.

ed in 50 percent faster performance overall on the application tests. When docked to a Mac, however, the Outbound becomes an extension of the host Mac and takes a substantial performance hit. On the Mac Plus, CPU and video performance dropped by about 50 percent. But the Outbound/Mac Plus combination still was faster than the stand-alone Mac Plus.

The Dynamac

Dynamac is no newcomer to Mac users; its original Dynamac SE appeared well

before Apple's Mac Portable. The Dynamac SE/30 consists of a Mac SE/30 motherboard that Dynamac has put into a black plastic case. The orange 640- by 400-pixel gas-plasma display opens to reveal the keyboard in a typical clamshell laptop arrangement. But this is no laptop. The 18-pound system is nearly twice as heavy as the Outbound, runs only on AC power, and is far more powerful than the Mac Portable or the Outbound.

Like the Mac Portable, this is a no-compromise approach to lugging a Mac

around. You don't buy this machine as an adjunct to your desktop system; it becomes your desktop system.

The basic machine includes the Mac SE/30 motherboard with a Motorola 68030 CPU and a 68882 math coprocessor, 2 MB of RAM, a 40-MB hard disk drive, and a 3 1/2-inch 1.44-MB floppy disk drive for \$9995. My test machine included a 200-MB 16-millisecond Conner Peripherals hard disk drive and 8 MB of RAM, and it carries a hefty list price

continued

We developed a PostScript solution because the perfect printer is just a dream.



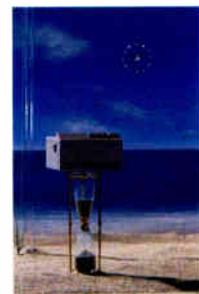
PacificPage brings the high quality output of an expensive PostScript printer within reach. Just plug the cartridge into a HP LaserJet Series II, IIP, IID* or III printer with 2 megabytes of additional memory.

The results are beautiful. PacificPage supports Adobe Type 1 fonts and Bitstream QEM fonts. And has 35 scalable resident fonts with Bitstream "rules" similar to Adobe's "hints." So, you'll get quality output with every character.

And you'll get it fast. Recent benchmarks show PacificPage IIP prints an average of 10% faster than Apple LaserWriter IINT with most applications. PacificPage with a IIP is also less expensive than a IINT.

Low price, high quality output and speed. It's a combination you can't afford to miss.

PacificPage can help make your dream of the perfect printer a reality. To learn more, call or write: Pacific Data Products, 9125 Rehco Road, San Diego, CA 92121, (619) 552-0880. Fax: (619) 552-0889.



PACIFIC
DATA PRODUCTS

*IID duplexing feature not supported in PostScript mode.
© Copyright 1990 Pacific Data Products Inc. PhoenixPage is a registered trademark of Phoenix Technologies Ltd. Copyright 1987, 1988 Phoenix Technologies Ltd. PacificPage and PacificPage P.E. are trademarks of Pacific Data Products, Inc. PostScript and Type 1 are registered trademarks of Adobe Systems Inc. Apple, Macintosh and LaserWriter IINT are registered trademarks of Apple Computer, Inc. IBM is a registered trademark of International Business Machines Corp. LaserJet Series II and III are registered trademarks of Hewlett-Packard. All other company and product names are trademarks of the company or manufacturer respectively.



Circle 215 on Reader Service Card (RESELLERS: 216)

World Radio History

of \$12,995—much more than a comparably equipped Mac SE/30. Other standard items include an Apple Desktop Bus (ADB) mouse, an internal 2400-bps fax/data modem, a Sharp Wizard electronic organizer, Mindshare software, a cable for downloading information to the Wizard, and a carrying case.

At the rear of the case are the power switch, interrupt and reset buttons, a small fan, and two RJ-11 connectors for the internal modem/fax board. Also lo-

cated at the rear are a SCSI port, two ADB ports, an external floppy disk drive port, two DIN-8 serial ports, and two DB-15 connectors for black-and-white and 8-bit Apple color monitors. Dynamac mounted the Apple SuperDrive floppy disk drive up front.

The gas-plasma screen has no controls for contrast or brightness, but both were fine. I found the display easy on the eyes after many hours of use. The integrated full-size keyboard doesn't detach and

lacks a numeric keypad. Dynamac expects that many users will add an external keyboard and monitor.

Not surprisingly, the BYTE benchmark tests show that the Dynamac performs similarly to the Mac SE/30 on the low-level CPU, FPU, and video tests. As with the Outbound, however, faster disk test results gave the Dynamac a decisive edge over its Mac rival.

The Dynamac's inability to operate away from AC power is its main drawback. But that's not a problem for me, and the ability to have a fully functioning Mac with me at all times causes me to think kindly about the weight. But at four times the cost of the Outbound, the Dynamac's power does not come cheap. Another potential drawback is that future hardware changes (like an add-on board that uses either the Processor Direct Slot or the NuBus slot) require returning the Dynamac to the manufacturer. Dynamac promises a 24-hour turnaround on repairs, however, and its three-year warranty includes overnight shipping both ways.

One for the Road

How much of a compromise you make on the road will be the key to what hardware you should choose. If you can do without the Mac environment on the road, relatively inexpensive PC-compatible laptops offer equivalent or better computing power in a smaller, lighter package.

I demand processing power beyond issues of weight, so although the Dynamac SE/30 weighs nearly as much as a Mac SE/30, it has the processing power I need. The Mac Portable, by contrast, is nearly as heavy, costs nearly as much, and uses the wimpy 68000 CPU. What you don't get are the Mac Portable's sharp active-matrix LCD and battery-powered operation (for a review of the Mac Portable, see "Hit the Road, Mac," February BYTE).

If you already have a Mac Plus or SE, the Outbound Laptop System greatly extends the usability of your existing hardware at a much lower cost than the Dynamac or the Mac Portable. Battery life is less than half that of a Mac Portable, and the display isn't as sharp, but the Outbound weighs substantially less, fits into a smaller space (crucial in airline cabin luggage compartments), and costs far less than Apple's \$4799 starting price for the Mac Portable. ■

Laurence H. Loeb is a BYTE consulting editor and is editor of the BIX Macintosh Exchange. You can reach him on BIX as "lloeb."



When all you have is a hammer,
everything looks like a nail.

It's always important to use the right tool for the job.

Quintus products, whether it's Quintus Prolog 3.0 for workstations—the embeddable Prolog—or Quintus DOS Prolog and MacProlog for PC's—give you the productivity you need with the flexibility to apply them exactly where they are needed. All this plus the tremendous functionality of Prolog itself. Prolog's declarative nature means that you can focus on the "what" rather than the "how."

Intergraph's family of RISC workstations and servers offers you a unique development platform that includes a comprehensive package of development tools—languages, support utilities, editors, graphics libraries, and much more. Each Intergraph tool is carefully designed for the development of powerful interactive graphics applications.

Quintus and Intergraph Productivity Tools—a combination you should definitely have in your toolbox.

Quintus 
An Intergraph Company.

Quintus Computer Systems, Inc.
1310 Villa Street
Mountain View, CA 94041
800/542-1283 • 415/965-7700
FAX: 415/965-0551

Quintus is a trademark of Quintus Computer Systems, Inc. Other brand names and product names are trademarks or registered trademarks of their respective owners. © 1990 Quintus Computer Systems, Inc. All rights reserved.

Intergraph Huntsville, AL 35894-0001 800/826-3515

Five lessons other companies have yet to learn about PostScript® printing.

1 *Genuine Adobe® PostScript®.* You need a true Adobe PostScript printer. The Silentwriter2 290 printer from NEC. Some companies emulate PostScript with clone interpreters or add-on cartridges. Others have limited font capabilities. But that's not the way to produce eye-popping newsletters, or 3D charts. We've known this since we introduced our first Silentwriter LC 890 printer back in 1987.

2 *MS-DOS® and Macintosh® Connectivity.* That's right, the 290 works with both Macintosh and PC-compatibles. And with its standard Centronics parallel, RS-232C, RS-422 and AppleTalk™ interfaces, the 290 is ideal for stand-alone or network environments.

3 *WYSIWYG Screen Fonts.* As in What-You-See-Is-What-You-Get. Our printer support kit included with every 290 we sell includes software that lets you see all of the printer's 35 scalable typefaces before you print them out. Also included are diskettes that allow you to install the fonts on any Macintosh or under Microsoft® Windows™ in the MS-DOS environment.



4 *Memory.* With a full 2 MB of standard memory, there's simply no more worry. Since now you have more than enough memory to print a full page of text and graphics (letter or legal size) without losing valuable data. Plus the optional user-installable 2 MB of additional memory satisfies your need to store downloadable fonts and overlays.

5 *Software.* The Silentwriter2 290 is the printer of choice for MS-DOS or Macintosh users working with hundreds of the most popular software packages. With an installed base of over 100,000 Silentwriters, our experience with printer software is hard to beat. Meaning you get more than just a printer, you get answers.

Since NEC began making PostScript® printers, we've learned how to stay ahead of the competition. Sure, other PostScript printers can do some of these things, but only NEC puts them all together in the Silentwriter® 2 290, the printer that goes to the head of the class. To find out more about the Silentwriter2 290, call us at 1-800-NEC-INFO. In Canada, 1-800-343-4418.

REVIEW

Open Desktop: Relief for the Unix-Wary



Open Desktop, as its name implies, uses a desktop metaphor to make Unix friendlier.

Unix may be the best-suited operating system for today's computers, but ironically, many believe it's still unsuitable for business use. Why? The leading complaint is that it's "unfriendly." If only someone could simplify Unix, make it as easy to use as DOS, or, better still, a Macintosh. Well, perhaps someone has.

Enter The Santa Cruz Operation, better known as SCO, with Open Desktop. Open Desktop seeks to do for Unix what DOS did for a PC—make it accessible to everyone. For just under \$1000, Open Desktop is truly everything you need to get Unix on your 386- or i486-based PC. It includes the SCO Unix System V operating system, Locus's XSight X Window System graphical user interface, IXI's X.Desktop graphical environment, Locus's Merge/386, Lachman Associates' TCP/IP and NFS, and the Ingres relational database manager. All this is crammed into a deceptively tiny box, and the documentation amounts to two tightly packed paperbound books. However,

SCO spreads the software across a whopping 43 5¼-inch floppy disks.

Breaking the Seal

I tested Open Desktop on a pair of systems. The first was a Dell System 325 (25-MHz 386) with 8 megabytes of memory and a 150-MB ESDI hard disk drive—my low-end machine, and probably typical of an individual Open Desktop user machine. The other system was an Altos System 5000 Power Server with a 25-MHz i486, 32 MB of memory, and an 840-MB SCSI hard disk drive; it was loaded with Altos's OEM server version of Open Desktop, and it is representative of the most capable platform for the software.

SCO's installation procedure is among the most manageable I've used, with one exception. After all the software is installed, an initialization script is executed for each selected subset. If something goes wrong during this process, you can't just rerun the scripts by hand; you've got to reload the disks.

When you're asked whether you want "C2 trusted security" or "relaxed defaults," consider your answer carefully. If you select the trusted option, your system will be transformed into a fortress, impervious to snoopers, hackers, and system administrators alike. Don't choose C2 security just to play with it. Even though SCO reduced the administration of security to a bunch of menus and forms, it's a big bunch. Unless you're working for the government or like to pretend you are, don't bother with C2.

The Fruits of Your Labor

Neatly separated into user's and system administrator's guides, the Open Desktop manuals are a study in minimalism. How did they get so small? Simple. SCO left out the reference manuals. You'll find no alphabetized list of commands in either volume. Instead, you are directed to browse the on-line manual pages and help facilities. Unix old-timers are used to asking computers for documentation, and newcomers will adapt quickly as well. It's a mighty convenient way to look things up.

I'll admit that SCO's new manuals took a bit of getting used to. They are both split into sections, covering the major components of Open Desktop. Each section covers only what SCO considers the important points, and the reader is sometimes directed to purchase optional documentation to fill in the rest. Except for the missing pieces, however, I thought SCO's documentation was well done. As it stands, I can pick up one of the books and zip immediately to the section that covers my topic of choice. It might instruct me to go out and buy additional manuals, but at least I know where to look.

Two parts of the manuals left me disappointed: The administrator's section on the SCO Unix mail program (MMDF) and the section on the database manager. There is no such thing as an easy Unix mailer, but MMDF still gets my prize for the most convoluted, most poorly conceived of the lot. At least for now, SCO has added a more common mailer, sendmail, but the documentation warns that it is unsupported and admonishes the user that it should be used only if unavoidable. The manual's description of the maze of configuration files needed to set up MMDF is so poor that even an MMDF expert would be left wondering which end is up. The only respite is a set of step-by-step instructions for configuring a typical system. If your system is

continued

INTRODUCING THE 4860[®] MOTHERBOARD. YOUR ULTIMATE BUILDING BLOCK.

The Dynamic Duo. The 4860 is an industry-first MotherBoard that packs the power of the Intel 80486 CPU with the Intel 80860 RISC processor (i486 + i860 = 4860). With it, you can build mainframe power into PC's for applications including CAD, LAN and desktop publishing. Equally impressive, our 4860 pumps up performance in your UNIX workstations.

A PC Revolution. In the PC environment, the 4860 is a 486-based MotherBoard which runs over 2 times faster than 386 computers. It's fully compatible with DOS, IBM's OS/2, Novell Netware and UNIX. What's more, Hauppauge's 4860 supports up to 64 MBytes of memory *without* a RAM expansion board!

RISC-Y Business. Thanks to the 4860's symmetrical architecture, both the i486 and the i860 processors can access the full range of memory, I/O system, and the 64-bit expansion bus. The result? Unprecedented dual processor performance.

You'll find that the i860 processor is ideal in graphics applications, performing up to 25 million floating-point operations per second. That's more than 10 times faster than the i486 processor alone! There's even an optional 64-bit frame

buffer card for ultra high-performance workstation graphics. **For UNIX Workstations, Too.** The 4860 board makes a great foundation for high-performance RISC workstations that run advanced UNIX applications. Many workstation vendors are choosing the i860 processor as a standardized vehicle for CAD and simulation systems, and the 4860 is perfectly compatible with these applications.

Technical Features: • 4 Megabytes of high speed RAM expandable to 64 MBytes shared between i486 and i860 processors • Socket for optional 128K static RAM cache module for the i486 • Full size PC/AT form factor • Eight EISA I/O slots • 64-bit expansion slot • 1 parallel, 2 serial ports.

The 4860 MotherBoard. Built with the world's highest performing microprocessors. So you can build the world's highest performing PC's and workstations.

Hauppauge Computer Works, Inc.
91 Cabot Court
Hauppauge, New York 11788
Toll Free: 1-800-443-6284
In New York: 516-434-1600
In Europe: (49) 2161-17063

Hauppauge!



Trademarks: IBM AT and OS/2; IBM, Intel 386, i486 and i860; Intel Corp. DOS and XENIX; Microsoft Corp. 4860 MotherBoard; Hauppauge Computer Works, Inc.

Circle 134 on Reader Service Card



Open Desktop 1.0.0

Company

The Santa Cruz Operation, Inc.
400 Encinal St.
Santa Cruz, CA 95061
(800) 726-8649

Hardware Needed

Intel 386 or i486-based PC with 6 MB of memory (8 MB is recommended) and up to 100 MB available on disk; mouse and graphics display required for X Window System operation

Price

\$995

Inquiry 883.

close enough to this example, you may survive. I didn't. The forbidden sendmail's standard configuration handles my setup perfectly, but I never did get MMDF to sit still for it.

As for the Ingres database, that offering is long on software and far too short on documentation. Running it for a few minutes left me feeling that it could do *anything*, but the documentation drops off just where things start getting interesting. Without reference pages, the powerful Structured Query Language and command interfaces are useless. I can understand SCO's motivation to keep the documentation set petite, but I wonder how many Open Desktop users will never bother to unlock the real power of Ingres. A thorough reading of the manuals would leave you thinking that Ingres is a \$99 toy filing program, instead of one of the most powerful DBMSes extant. Ingres, in large part, gives Open Desktop its style and its serious, professional flavor. I can't think of anyone who couldn't profit from its use.

The Grand Tour

You might figure that, with 43 disks, there must be some substance to Open Desktop. There's plenty. A good place to start is with the fabled desktop itself. The graphics are served up by Locus, which provided SCO with a capable port of MIT's X Window System. The OSF/Motif window manager (*mwm*) runs the window show, but atop it all sits X.Desktop.

X.Desktop is one of a few products that gives Unix a shot at being called friendly. The shallow view is that it provides a point-and-click interface to Unix, comparable to that of the Macintosh. Files become icons, and these icons interact predictably. Drag a file into the

Trashcan, and it is deleted. Drag a file into a folder icon (which represents a directory), and the file is moved there. You can rename files, check and change permissions, and launch applications without ever going near a Unix shell prompt.

This desktop manager is completely driven by a set of text files, each scripting the actions taken when you manipulate icons. IXI built a complex programming language into X.Desktop that makes it completely configurable. If you don't like the way the Trashcan icon acts, you can substitute your own behavior script. Entire kingdoms of icons can be added, and administrators can calm even the most timid user by adding new commands to the system in this way.

As mentioned, Ingres is an impressive database manager. Run from the Open Desktop command line and a full text-only screen (no XSight), Ingres's interface serves its purpose. Menus behave intuitively, and the program is easy to navigate once you get the hang of it.

The dark side of Ingres's interface is called WindowView. I have only one word for it—horrid. The premise is this: You can take a good text-based application, paste some simple mouse sensitivity into it, and have a good X application. If the premise sounds flaky, its implementation is worse. So, you see a menu, and you click the mouse button on an item to make it happen, right? Wrong. You click on the item and then click on the keyword Go in the bottom line of the window. Worse, you lose the ability to use the keyboard with the menus. A single click works on the horizontal menus across the bottom of the window (where the magic Go appears), and this menu includes everything in the fancy (useless) boxed menu. Two or three pixels below lies the window-resize bar, and you'd better get used to pressing that by accident. But don't judge Ingres by its half-baked, pseudographical interface. It's a beefy database manager that just needs the screen to itself.

The overall quality of Ingres comes with a price: It is memory- and disk-hungry. Even when you're only running your own private databases on your isolated system, Ingres behaves as a client/server application. It takes several daemons (background processes) just to support one Ingres session, and some of these background programs span nearly 2 MB. Running Ingres on the Dell System with 8 MB of memory caused the system to go swap-happy. Nothing failed, and the slowed performance was still acceptable, but the disk went wild while the operating system scrambled to

stoke Ingres's furnace with more memory. (The Altos, with 32 MB, ran without swapping.) According to SCO, a special package, the Open Desktop Server Upgrade, will let you set up a centralized Ingres database server, bringing down the memory and disk requirements at each desk. However, the upgrade was not shipping at the time of this review.

Getting Down to DOS

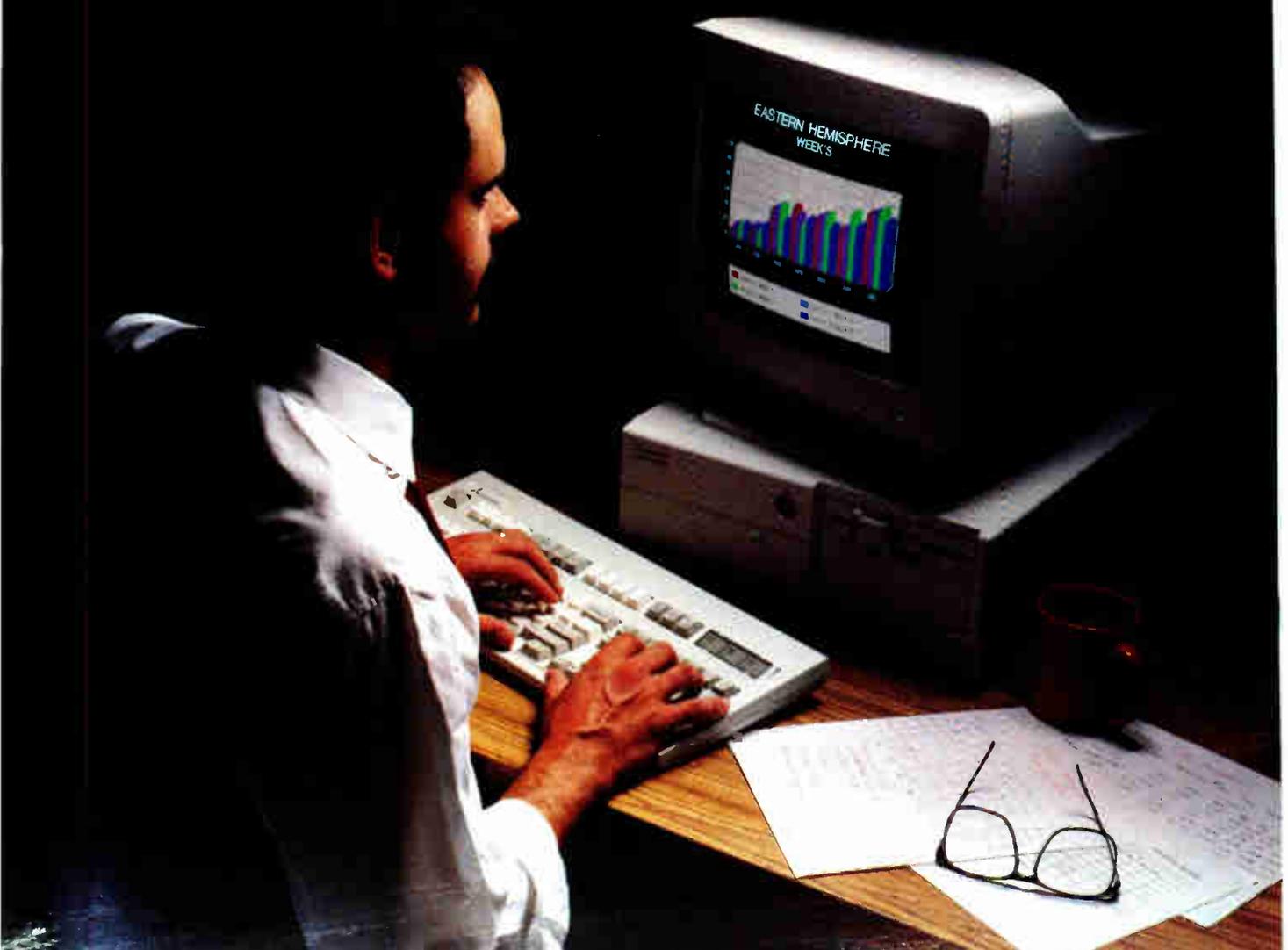
If you double-click on the DOS icon, a Merge/386 window appears, containing a C> prompt that makes a DOS user feel right at home. To simulate a color DOS display, Merge takes over all the colors (16 in the case of VGA), resulting in a strange color shift when the DOS window is selected. This is normal and even desirable. I was able to install many applications that use color text and have them behave predictably in the DOS window. The window is also capable of displaying CGA graphics, an interesting feat considering that memory-mapped graphics have to be converted to X instructions. CGA graphics works well, and an application can talk to the window as though it were a CGA display. It also supports 40-column text, 640- by 200-pixel graphics, and all the other CGA modes. When you change modes, the window changes size automatically to match the screen size of the mode.

Merge runs under the virtual 8086 built into the 386 and i486, so you can't run protected-mode programs or anything written specifically for the newer Intel processors. This is something of a handicap, since there is a lot of software now that just assumes you've got at least a 286. Still, Merge had to work with what Intel gave it, and it does work. For the mainstream DOS productivity applications, it performs admirably. A single session on the Dell System runs at roughly the same speed as that of an IBM AT. The Altos performed much better, of course.

For those times when your native display is the only way to go, you can ask Merge to turn over the entire screen to DOS. A hot-key sequence brings up a menu, and clicking on Zoom makes the switch—in my case, to VGA. I was able to run everything that talks to real VGA with reasonable performance.

Could you run Merge all the time? Absolutely. I found it provided faithful emulation and excellent stability. A fringe benefit is that, since Merge runs as a client of Unix, you can run DOS programs that crash. In most cases, Merge just resets itself, and you're back in business.

continued



If You're Driven by Success, Make Sure It's a Quality Drive.

To be successful in today's business environment, you need drive, determination and commitment. You also need the right products supporting you—keeping things running smoothly, on track and on schedule. Products that consistently meet operating specifications, and provide the dependability you can rely on. Products such as Mitsubishi disk drives.

Just like you, Mitsubishi Electronics is also driven by success. We manufacture the latest in memory storage technology, and offer one of the broadest ranges of flexible drives in the industry today. Whatever your memory requirements, Mitsubishi has the drive you need—from 720 KB and 1.44 MB 3.5" models to 360 KB and 1.2 MB 5.25" models, with a variety of mounting and bezel configurations.

As one of the largest suppliers of flexible disk drives in the world, Mitsubishi® continues to earn its reputation for product quality and design innovation.

Mitsubishi also manufactures rigid disk drives that have the same incomparable dependability as the flexible drives. Every 5.25" rigid drive supports the high-density mode of the newer (RLL) controllers, with up to 65 MB formatted memory, as well as the standard-density mode of the (MFM) controllers used in today's most popular systems, with up to 42 MB formatted memory.

So when you're looking for reliable, high capacity disk drives, look to Mitsubishi. We'll make sure you get a quality drive.

For the authorized Mitsubishi reseller nearest you, call 1-800-556-1234, ext. 54 in the U.S. and Canada (in California 1-800-441-2345, ext. 54).



**MITSUBISHI
ELECTRONICS**

Mitsubishi Electronics America, Inc., Information Systems Division, 991 Knox Street, Torrance, CA 90502.
Mitsubishi Electric Sales Canada, Inc., 8885 Woodbine Avenue, Ontario L3R 5G1.

© 1989 Mitsubishi Electronics America, Inc. Mitsubishi is a registered trademark of Mitsubishi Electric Corp., Tokyo. Image courtesy of Software Publishing Corp.

Circle 186 on Reader Service Card (RESELLERS: 187)

In no case have I seen it crash Unix or otherwise affect other processes.

Ordinarily, Merge uses the Unix file system to store application data. To a DOS program, Unix files are made to look like DOS files. Filenames that don't fit the eight-plus-three DOS naming conventions are squashed in a nonintuitive way. There was no right way to handle this problem, so any solution that simply makes the files available is passable. You can also use the real DOS partition on

your hard disk drive. Another plus is that you can map Unix networked disk drives into Merge's DOS as well.

Stringing the Nets

Open Desktop includes a boatload of networking solutions: TCP/IP (the Unix standard), Sun's NFS, and Microsoft's LAN Manager. The LAN Manager module operates as a client only, and while SCO will sell the server portion, I recommend sticking with NFS.

Getting your new workstation attached to an existing Unix network isn't automatic, but it's pretty easy. I dropped a Western Digital Ethernet adapter into the Dell System and told Open Desktop about it during the installation. You'll be asked for the network address of your system, but you won't be able to see other systems until you add them to your /etc/hosts file.

As part of a Unix network, an Open Desktop system is mostly a good citizen. In the BYTE Lab, the Dell System was asked to swap files with our Unix server (a Swan 386/33 running Interactive's 386/ix 2.0.2) and an Opus Personal Mainframe (a 25-MHz 88000-based system). My first attempt to copy files through NFS to the 386/ix system crashed it and jumbled its hard disk—everything was lost. The problem was Interactive's, and installing its latest release (version 2.2) fixed everything. The Opus got along famously from the start with Open Desktop, except that it complained periodically about a protocol screwup when I used rep (remote copy). In my home lab, where the Altos resides, I've encountered absolutely no problems shipping data, X images, and shared files across the network. Altos did a bit of work on Open Desktop's networking facilities, and it seems to show.

An Open Closing Statement

Open Desktop wants to be the shrink-wrapped Unix for the 1990s. It is packaged to run on just about any 386 or i486-based system and truly can be pulled off a shelf and run out of the box. SCO's price, \$995, is very attractive considering all that's thrown in.

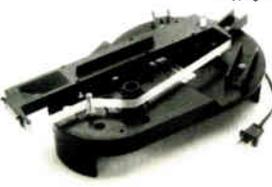
Open Desktop is the only Unix system I can truly recommend to new Unix users. You might need some experienced help during the first couple of days, but once you've gotten that push, you'll be hooked. Also, SCO's technical-support department is responsive—every call I placed got me a prompt and accurate answer.

SCO's coup is that it has built a Unix system you can use without taking the time to understand it in depth. Thirty minutes after installing it, you can run your favorite DOS applications in an X window under Unix. You can progress from there to learning about Unix, Ingres, X.Desktop, and the rest. But the real work can come first; there will be plenty of time to explore. ■

Tom Yager is a technical editor for the BYTE Lab. He can be reached on BIX as "tyager."

Never buy another ribbon!

Over 150,000 sold



Shipping \$5.00

Universal Cartridge (includes one adapter)75.00

Multicolor Adapter (specify printer).....40.00

Epson only MacInker mod. 271EP45.00

Imagewriter only MacInker™ mod. 234IM.....45.00

Universal Spool MacInker75.00

Heat Transfer Adapter25.00

Extra Ink Bottle, black3.00 pint18.50

Colored Ink Bottle4.00 extra reservoir5.50

All models delivered complete with bottle of ink, ink meter, reservoir, reservoir cover. Go color !! Single & multicolor, standard and heat transfer cartridges available: red, green, blue, brown, purple, yellow, orange, white, silver and gold. Indelible and OCR ink cartridges available.

Universal Cartridge unit shown with Epson cartridge **\$75.00**

Over 24,000 printers supported. Better than new print quality. Extended printhead life thanks to lubricated ink. Average cartridge can be re-inked 60-100 times at 5cents/re-inking. Multicolor adapters re-ink multiband cartridges. Documented customer savings of up to \$30,000/year. Detailed free catalog.

MacBond II Auto-Ribbon Welder

Make your own ribbons! MacBond II splices and bonds in seconds ribbons of any size and inked in any ink and color. First real alternative to ribbon bonding machines costing thousands of \$\$\$.

We have a complete range of bulk ribbons, color and multicolor, heat transfer etc. for your application.



Shipping \$9.00

\$299.00 !!

Modems

4800 b throughput, full duplex. 9600, 4800, 2400, 1200 bps. CCIT V.22bis, V.22, Bell 212A & 103J modes • Auto speed selection • MNP cl. 5 error correction • Synch & asynchronous modes

• Cable and software included (PC or MAC) • 2 year warranty

9600 baud mnp cl 5 v.32599.00 **LightSpeed 2400LE (MNP cl 5).....169.00**

LightFax 9624 faxmodem399.00 **Ring-On Remote Power Center.....199.00**

LightSpeed 9624E is a V.32, mnp 5, 9600 b modem. LightFax 9624 is a full featured group III, 9600 b fax & 2400 b modem combined, shipped with software & cable for PC or MAC (specify). Ring-On is a power center which senses an incoming call to turn on computer & modem.



Shipping \$7.00

2400b MNP cl 5 **\$169.00 !!**

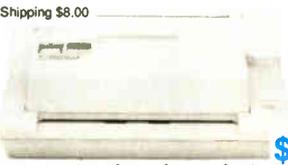
Full Page Hand Scanner !

Now you can have all the advantages of a handy scanner in a FULL PAGE SCANNER, for half the price of a desktop scanner. Includes 10 sheet document reader for sheet fed use. Scanner detaches for hand held use on photos, books etc. Compatible with most OCR software, a very high quality (100 to 400 dpi) option for Optical Character Recognition. Comes complete with scanner, sheet feeder, interface card, and free LightPaint software. Includes a 1 year warranty. Order part #400 P.

Shipping \$8.00

New

\$599.00!!



Computer Friends, Inc.
14250 NW Science Park Dr.
Portland OR 97229

Order Toll Free 1-800-547-3303

In Oregon (503)626-2291

fax (503)643-5379 telex 4949559 CF

Satisfaction or 30 day refund - Immediate shipment - Major credit cards - PO's from National Accounts

Opening Database Servers To The Whole World

ORACLE Server. Nonstop data sharing among PCs, Macs, minis, and mainframes.

Imagine the frustration of being in an airplane that can only take off and land at the same airport. SQL Server suffers that same problem. It limits users to a single server running just OS/2 and Named Pipes.

ORACLE[®] Server is different. As an open server, it works with virtually any network, any operating system, application or database system.

So ORACLE can act as an information hub to share data across an organization's PCs, Macs,

minis and mainframes.

ORACLE Server works with existing Novell, 3Com, and IBM LANs as well as Lotus 1-2-3 and dBASE applications.

It even allows access to corporate data stored in other vendors' software such as RMS on DEC minis and DB2 on IBM mainframes.

And only Oracle provides a set of integrated tools for portable application development,

office automation and CASE. It also has interfaces to the most popular programming languages.

All this is backed by the largest service and support organization of any software company in the world.

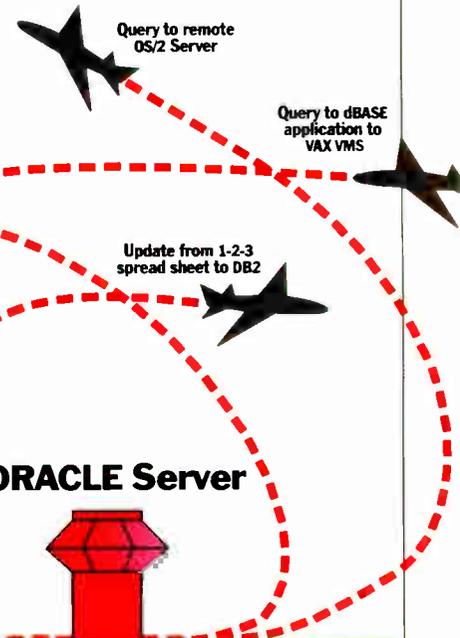
Call 1-800-ORACLE1 ext. 4993

**Call
1-800-ORACLE1
ext. 4993
and sign up for the
Client/Server
Forum
in your area.**

to buy ORACLE Server for OS/2 for \$3699 and get six months of free upgrades and phone support.

Or you can try the 3-user Developers Version for \$1299.

Because no one wants to be all hooked up with no place to go.



ORACLE Server

- Supports virtually all operating systems: OS/2, VINES, UNIX, Netware 386, VMS, MVS.
- Supports virtually every vendor's Network: Novell's SPX/IPX, NetBIOS, Named Pipes.
- Allows access to other vendor's databases: DB2, SQL/DS, RMS.
- Multiple user interfaces including dBASE and 1-2-3.
- Complete set of programming tools.
- Supports multiple programming languages: C, COBOL, FORTRAN, PL/1, Ada.

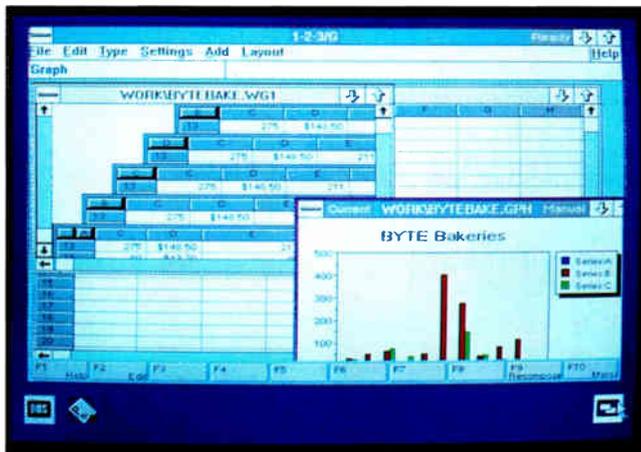
ORACLE[®]

Compatibility • Portability • Connectivity

©1990 Oracle Corporation. ORACLE is a registered trademark of Oracle Corporation. All trade names referenced are the service mark, trademark, or registered trademark of the respective manufacturer. Call 1-800-ORACLE1 for hardware and software requirements.

REVIEW

G Is for Graphics



With the PM windowed interface, you can keep a number of worksheets on the desktop. Note the three-dimensional structure and the third scroll bar for scrolling across pages. The graph in the window displays spreadsheet changes interactively.

Why in the world would we need another Lotus 1-2-3 for OS/2? Lotus already offers 1-2-3 release 3.0 for OS/2, but now there's 1-2-3/G as well. As with release 3.0, much of 1-2-3/G's impressive power stems from the underlying features of OS/2, but its real draw is its graphical interface. If you buy into the GUI revolution, Lotus finally has something for you.

Of course, a graphical interface delivers more than just a pretty face. Some of the spreadsheet's features are more readily tapped and are more powerful using a mouse. Although release 3.0 works like a champ under OS/2, it still uses the old character-based interface, which fits awkwardly in the Presentation Manager environment. Lotus 1-2-3/G

gives you the same windowed environment of PM while retaining keystroke compatibility with the original 1-2-3.

The Graphical Advantage

The 1-2-3/G graphical interface is inviting and responsive. I'm not completely sold on the advantages of using a mouse for spreadsheet work, but mouse or no mouse, you can't help but appreciate having multiple windows on the desktop. Moving data or linking data from one sheet to another is much easier when you can view and access both sheets at the same time. You simply open a file in its own window. You can then resize it, minimize it, cut and paste to other windows, and interact naturally with other PM applications on the desktop.

The page-preview features of 1-2-3/G, while nice to have, are awkward and inflexible. So, I fired up PageMaker OS/2 in its own window and pasted 1-2-3/G's spreadsheets and graphs into PageMaker. I could then place the spreadsheet elements anywhere on the page by simply clicking and dragging, printing the document, minimizing PageMaker, and returning to my spreadsheet work. When I needed PageMaker again, it waited a click away. Once you've got your windows effectively placed, you can save the whole bundle in a single desktop file.

The PM interface also provides Dynamic Data Exchange, which lets you link your spreadsheet data to other PM applications. For example, you could paste a spreadsheet to a word processor and link it so that whenever you change the spreadsheet numbers, the word pro-

cessor document is automatically updated. Unfortunately, the potential of DDE—like that of OS/2, in general—suffers from a lack of OS/2 applications.

Of course, 1-2-3/G also boasts true three-dimensional operation, but, ironically, that very capability makes its graphical perks less useful. True 3-D places all your related worksheets in a single structure. You could, for example, put each of your monthly sheets on separate pages of your 3-D spreadsheet. Your annual totals could also reside within the single structure. The monthly totals could be summed by referencing them as a range cutting through the 12 pages. Under this scheme, autonomous windows are not such a big win.

Then again, the program makes moving around in a 3-D spreadsheet easier by adding a third scroll bar. In addition to the scroll bars that let you move down rows or over columns, the third scroll bar moves you through multiple pages. I found this useful only when I had to flip through a lot of pages. Otherwise, I turned a page by pressing Alt-PageUp or Alt-PageDown.

Predictably, the graphing tool improves under a graphical interface. The graph comes up in its own window and menu bar. You can move objects, such as the title or a legend, by clicking and dragging them. You can also add markers or annotations and move them about just as easily. By strategically overlapping your graph window and spreadsheet window, you can see how changes to your data affect your graph. There's a full range of graph types available, and 1-2-3/G can map your color bars or pie slices to black-and-white patterns. So you can keep your on-screen graphs as solid colors and print them as monochrome patterns without reconfiguring graph options.

The Performance Trade-Off

Release 3.0 wins hands down when it comes to questions of performance (see the figure). Using our standard spreadsheet benchmarks (for details, see "Not Just for Numbers Anymore," February BYTE), release 3.0 again showed its exceptional speed. This performance advantage becomes significant when spreadsheets become big and complex.

I also ran into some disturbing problems with 1-2-3/G, mostly related to the Undo feature. When I was working with large files and would load a spreadsheet into a window and then try to retrieve a different spreadsheet into the active window (an operation that should throw the first spreadsheet away), I hit the dreaded

continued

Lotus 1-2-3/G

Company

Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
(617) 577-8500

Hardware Needed

IBM AT or compatible (386-based PCs recommended); 4 MB of RAM; hard disk drive

Software Needed

OS/2 1.1 or higher

Price

\$695

Inquiry 887.



CERTIFIED 4X4 POWER

The IIT Advanced Math Coprocessor is the only Math Coprocessor with the power of 4X4.

The Future is Now – Ask for the Math Coprocessor with Certified 4X4 Power

See what EVOLUTION COMPUTING and SCHROFF DEVELOPMENT say about the power of 4X4:

- “Evolution Computing agrees with IIT – The future is now. The ability of FastCAD[®] 3D/FastCAD Render Man and all IIT math coprocessors to support matrix transformations provides the user with unparalleled speed and performance.”
— EVOLUTION COMPUTING
- “SilverScreen will benefit greatly from the coprocessor’s ability to move matrix transformation onto the chip itself,” says Jeff Howe, Schroff Manager of R&D. “We did not have to change any of SilverScreen’s code to be able to run with any of the IIT math coprocessors. With the implementation of the 4X4 instruction set by the IIT products, SilverScreen now offers the user the ultimate in 3-D performance! Workstation functionality is now available at the DOS level.”
— SCHROFF DEVELOPMENT

The Most Advanced Math Coprocessor

The 4X4 matrix transformation instruction is an exceptionally powerful addition to a floating point processor when working with three-dimensional CAD. Plug in the IIT Advanced Math Coprocessor for remarkably increased productivity.

Warranted Compatibility

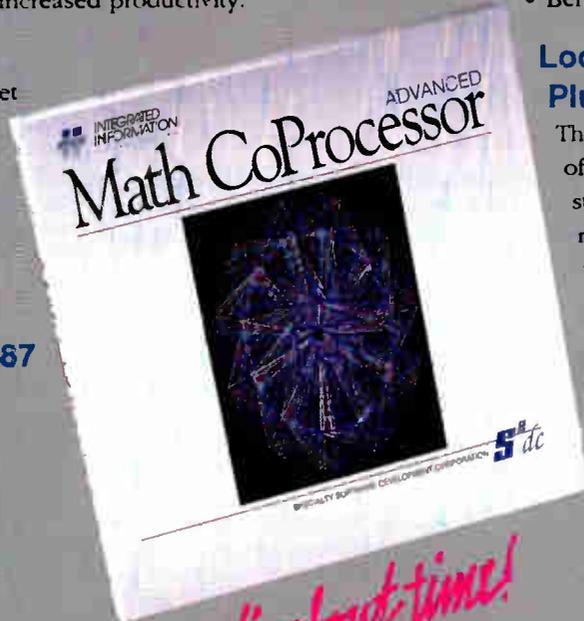
- Software and socket compatible
- Backed by one of the strongest 5-year limited warranties in the industry/Made in USA
- Benchmark software included

IIT Sets New Standards

- Built-in 4X4 matrix instruction set
- Advanced CMOS technology for higher reliability
- Fewer cycles to execute existing instructions
- 3C87 instruction set in the 2C87
- Twenty-four additional 80-bit numeric registers

Full Line of 2C87 and 3C87 Math Coprocessors

- Completely compatible with existing 287 and 387 sockets



Look for the 4X4 Symbol – Plug in the Power

These software innovators are some of many developers to incorporate the strength of 4X4, the most powerful number-crunching tool available. Call your local dealer and ask for the IIT Advanced Math Coprocessor, the one with the power of 4X4. Or call Specialty Software Development Corp. at (512) 327-8608 for the name of the dealer nearest you.

S²dc

Marketed by:
SPECIALTY SOFTWARE DEVELOPMENT CORP.
1001 Capital of Texas Highway So., Bldg. I
Austin, Texas 78746 • 512/327-8608

Circle 270 on Reader Service Card

IIT, IIT-2C87 and IIT-3C87 are trademarks of Integrated Information Technology, Inc. Intel is a registered trademark, and 286 and 387 are trademarks of Intel Corporation.

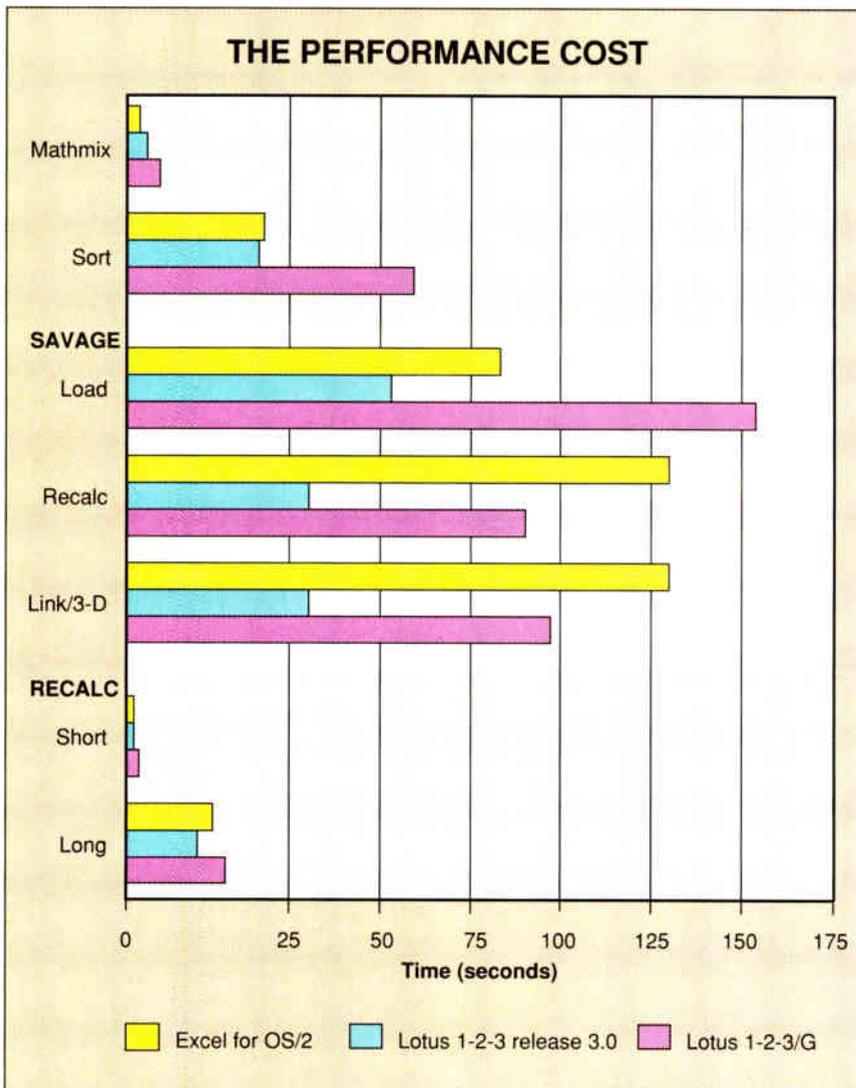


Figure 1: Lotus 1-2-3/G pays a performance penalty for its graphical interface, as it is significantly slower than its sibling, 1-2-3 release 3.0. Shorter bars indicate better performance. (For a complete explanation of the spreadsheet benchmarks, see "Not Just for Numbers Anymore," February BYTE.)

memory barrier. It was disconcerting, given that I was working on a Compaq 386/20 with 6 megabytes of real memory and another 4 MB of swap space on disk.

The memory problems did not occur under release 3.0, nor did they occur with the Undo feature disabled. The trouble, then, was obvious: 1-2-3/G was retaining the discarded spreadsheet file in memory so the Undo option could get it back. That's understandable, even desirable, and easily disabled.

You can blame it, though, for not handling memory limitations gracefully. I got a message that Undo was being disabled, closely followed by a memory warning. I clicked the OK button, at which point the program sometimes

froze. I could still access the Task Manager and shut down 1-2-3/G, but by killing the task, I would lose other files on the desktop. At other times, 1-2-3/G would load an empty worksheet with the same filename as the worksheet it failed to retrieve.

There is one big advantage for 1-2-3/G that goes beyond the graphical interface. Lotus calls it the Solver, and that's just what it is. You can easily set up complex models and what-if scenarios. You specify adjustable cells (such as the price you charge for an item), constraint cells (such as the number of items in your inventory), and a cell to maximize (such as profits). The Solver then returns many solutions for the defined problem.

For testing purposes, I set up BYTE Bakeries as a model. The worksheet listed a variety of pastries and, for each pastry, reported the cost to make them, the selling price, and the number made. I selected the number-made entry for each pastry (the adjustable cells) and entered a series of simple logical formulas that set maximum and minimum values for each of the number-made entries (the constraint cells). I was also constrained by the total cost of all pastries, representing the limit of my current resources. I then asked Solver to optimize the profits entry. Solver returned several possible solutions so I could decide which mix of pastries would maximize my profits.

In the same way, you could pick the optimal mix of stock investments for a portfolio. The Solver surpasses the simple what-if capabilities of most spreadsheets. If you do a lot of spreadsheet modeling and what-if calculations, the Solver alone could justify the switch to 1-2-3/G.

Finding the Right Fit

It sounds strange to call a Lotus spreadsheet a niche product, but 1-2-3/G may fill the bill. I would recommend it for specific situations. If you have dedicated Lotus users along with users just learning spreadsheets, 1-2-3/G offers a middle ground. The old users can still employ the slash key, while new users should feel less intimidated by the point-and-click interface. In fact, if you're sold on the PM interface, 1-2-3/G could be the perfect vehicle for weaning your 1-2-3 junkies off the keyboard and onto the mouse.

Users who include their spreadsheets in other applications will also benefit with 1-2-3/G. Pasting to PageMaker or linking to a database is smoother under the graphical interface. Finally, users who have modeling chores that require the sophistication of the Solver can justify the 1-2-3/G investment.

However, if you're a single user who is already productive with the old Lotus interface, there's not much incentive for going to a graphical interface just for the sake of having one. You'll find release 3.0 less frustrating and more stable. Those who spend the bulk of their day within the Lotus environment will be more productive under release 3.0. In fact, that is 1-2-3/G's biggest drawback: It's hard to upstage a program as good as Lotus 1-2-3 release 3.0. ■

Stanford Diehl is a testing editor/engineer for the BYTE Lab. He can be reached on BIX as "sdiehl."

REVIEW

9600-bps Modem Brings Apple Networks Closer Together



Shiva's NetModem V.32 offers 9600-bps communications as a shared network device or as an internetwork router, thanks to its built-in AppleTalk connector (top).

Advances in LAN technology have made shared computer resources a fact of life in many companies. Shiva promises similar rewards for far-flung Apple networks with its NetModem V.32, which places wide-area-network (WAN) technology into the hands of small businesses. Thanks to a built-in

AppleTalk connector, the NetModem V.32 can connect AppleTalk networks or allow traveling employees full dial-in access to company Macs and peripherals. It also offers a major performance improvement over its predecessor, the NetModem 2400.

The NetModem V.32's foundation is a 9600-bps V.32 modem. The V.32 protocol allows the modem to communicate dependably with other V.32 modems at full speed over ordinary phone lines. But once you pull the new NetModem out of its box, you'll see that it is not an ordinary modem. In back, it offers three connectors: phone, power, and AppleTalk.

The significance of the AppleTalk connector may not be immediately apparent, but it is the key to the NetModem V.32's power. It enables the NetModem to take advantage of the AppleTalk networking protocols included in every Mac. Thus, the device can become a shared modem available to every Mac on a network, and it can serve as a remote router (or half-bridge). As a router, it can connect two remote AppleTalk networks to form one internetwork, allowing each node to transparently share all the resources of both remote networks, whether they are 1 mile or 1000 miles away.

Just Add AppleTalk

Installing the NetModem is as easy as adding any other device to an AppleTalk network. Each Mac that will use the NetModem to dial out needs the NetModem software installed on its start-up disk.

Shiva's Internet Manager application examines, sets up, manages, and performs troubleshooting on AppleTalk internetworks. I found it to be handy when configuring the NetModem. You can also use it for Shiva's innovative method of updating NetModem V.32 firmware: Instead of requiring you to replace ROM chips, the NetModem V.32 can simply download an image file from disk into its battery-backed-up RAM.

In general, using the NetModem V.32 as a dial-out modem is identical to using its slower cousin, the NetModem 2400. Through the standard Chooser desk accessory (DA), you can select any NetModem connected to the network. If the NetModem is busy, the software records your request; it then notifies you when the device becomes available. If you have several NetModems on your network, you can even select a pool of NetModems, so that if one is busy, another in your pool can be used.

Once a NetModem has been selected and the connection to your Mac is established, using the NetModem V.32 is much like using any high-speed modem. It uses the standard Hayes AT command set and responds in much the same way as a dedicated modem. A small display appears in the menu bar and mimics the display lights normally found on the front of a modem. Even the sounds from the modem are transmitted over the network to your internal speaker.

Remote-Routing Power

But the NetModem V.32's real power lies in its remote-routing capabilities in an internetwork. For this, you need two remote AppleTalk networks, each with a NetModem V.32 (or one with a NetModem V.32 and one with a Shiva TeleBridge or EtherGate). To create the internetwork, a user in one network initiates the call; the NetModem in the other remote network answers and automatically forms the connection.

The software that controls the initiation of the connection is accessed through a standard Control Panel DA. A Dial Out window lets you set up miniature scripts for the various remote networks you will be calling. These scripts include phone numbers, connect speeds, and access limitations.

The Internet Manager application con-
continued

NetModem V.32



Company

Shiva Corp.
155 Second St.
Cambridge, MA 02141
(617) 864-8500

Hardware Needed

Macintosh-family computers or related peripherals attached to a LocalTalk network; LocalTalk connectors and cabling; a dedicated phone line (when used as an internetwork router)

Price

\$1999 each (two are required for internetwork routing)

Inquiry 855.

TRANSFER TIMES

The NetModem V.32 outshined the baseline 2400-bps modem in direct transfers. More significantly, the NetModem's times as a 9600-bps router for LocalTalk transfers were close to those for direct transfers. At 9600 bps, the NetModem averaged one transmission error per 70K bytes transferred. Dial-in access gave comparable times. Creating moderate to heavy intranetwork traffic during testing, in the form of large file transfers between various nodes on one network, did not significantly affect internetwork performance.

File size (bytes)	Direct modem-to-modem transfers		LocalTalk transfer
	2400-bps modem	NetModem V.32, 9600 bps	NetModem V.32 as a router*
10K	0:44	0:12	0:21
25K	1:48	0:29	0:37
50K	3:35	1:02	1:08
100K	7:10	2:08	2:12
200K	N/A	4:05	4:29
500K	N/A	10:12	10:16

* Routing benchmarks measure transfers between a simple four-Macintosh network and a complex 20-Macintosh network connected through remote routing. Transfers in both directions yielded comparable times. All transfers were made using ZMODEM and MacBinary II. Times are in minutes:seconds. N/A = Not applicable.

NetModem V.32s to connect my AppleTalk network in California to a friend's AppleTalk network in Tennessee. We accessed each other's file servers and printers and sent E-mail transparently.

Dial-in access is the single-user equivalent of remote routing, with two differences. First, the Mac initiating the call can use any modem to make the connection. Second, only single users can be connected, not networks. The dial-in access software that Shiva ships works via the Control Panel as seamlessly as the remote-routing software. For \$99, the company also sells software that allows PCs the same dial-in capabilities.

The slower NetModem 2400 also offered this ability, but it used a DA called Async AppleTalk and suffered from irritating slowness and occasional crashes. Shiva has done a good job reengineering dial-in access in the NetModem V.32. Also, I think a speedier 9600-bps modem is much more suitable for this use.

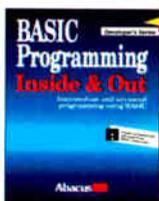
figures the NetModem V.32 to limit access to particular AppleTalk zones (if your network has them) and specifies separate passwords for dialing in, dialing

out, or making configuration changes. Once connected, people on both networks can use resources on the entire internetwork. To test remote access, I used

A Sense of WANDer
In tests using two remote networks, the NetModem V.32's performance was *continued*

Computing Know How

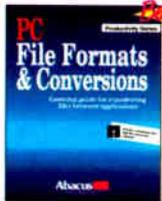
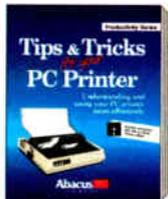
From these bestselling books



BASIC Programming Inside & Out
The standard reference for all professional GW-BASIC, BASIC, QuickBASIC and Turbo BASIC programmers. Includes demo programs and routines you can easily adapt for your own programs. Describes sound, graphics, using ML, BASIC compilers, database management, create a help screen editor with pulldown menus. 600 page book with companion disk containing 360K of BASIC source code.
ISBN 1-55755-084-0. **\$34.95**

Tips & Tricks for your PC Printer

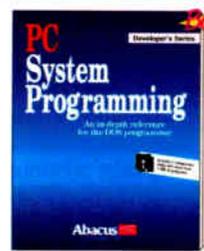
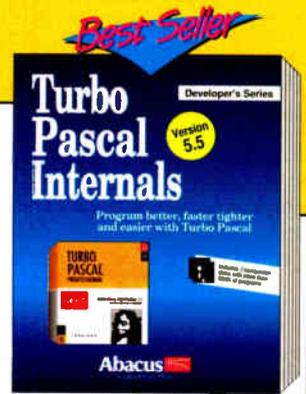
Takes the hassle out of working with PC printers. Learn how to setup and connect your printer. Learn to use the many features built into the popular printers, but rarely used because they're so difficult to understand. The companion disk has several practical printer utilities: online printer HELP, printer control aid, printer font editor and more. 400 page book with companion disk.
ISBN 1-55755-075-1. **\$34.95**



PC File Formats and Conversions
is for every PC user who needs to exchange data between different application programs. Details the file formats for major software applications. Use IMPORT/EXPORT functions in many applications. Includes conversion program on the Companion diskette. 280 page book with companion diskette.
ISBN 1-55755-059-X **\$34.95**

Turbo Pascal Internals

Gives you "know how" to program faster, easier, tighter and better. Find out how to use Turbo for system programming tasks-writing TSRs, performing multi-tasking, using SAA windowing, implementing expanded and extended memory. Learn how Turbo generates machine code, handles the mouse, scans the keyboard, uses UNITS and OOPS, performs fast screen display and more. This book/disk combination includes more than 800K of source code on two diskettes. 750 pages with 2 diskettes.
ISBN 1-55755-080-8 **\$49.95**



PC System Programming
An encyclopedia of PC technical and programming knowledge. Features parallel working examples written in Pascal, C, assembly and BASIC. Explains memory layout, DOS operations, using extended, expanded memory, writing device drivers, hard disks, PC ports, mouse drivers, fundamentals of BIOS, graphics and sound, TSR programs, complete appendices. 920 pages with 2 disks - over 1 meg of programs in compressed format. A Best Seller.
ISBN 1-55755-036-0 **\$59.95**



Dept. B9, 5370 52nd Street SE, Grand Rapids, MI 49512

Orders: 1-800-451-4319 • Phone: (616) 698-0330 • Fax: (616) 698-0325

In US and Canada add \$4.00 postage & handling. Foreign orders add \$12.00 postage per book. We accept Visa, Mastercard or American Express. Call or write for your free catalog of other PC books.

Using 16 Ports Is Easier Than Ever



You told us what you're looking for from your multiuser communication controller. We listened and gave you exactly what you asked for. The ULTRA 16 and ULTRA 8 — designed to make your life easier.

Now you can have...

- ▲ A Powerful 80286 Processor
- ▲ Streams Drivers
- ▲ Field Upgradable From 8 To 16 Ports
- ▲ New "Quick Connect" Cabling
- ▲ A Universal Interface Box and "Dual Lock" Mounting
- ▲ Easy To Install Software Drivers For SCO XENIX System V, SCO UNIX System V, AT&T System V, Interactive 386/ix, Sun OS, IBM OS 2 and IBM AIX

- ▲ Transparent Print
- ▲ Easy To Use Documentation

When you need a basic multiuser communication controller, give our HOSTESS SERIES a try. Count on our people to give you the support and extra effort you deserve and have come to expect from us since 1982.

**Call Us Toll Free
800-9-CONTROL**



Control Corporation

A Control Systems Company
2675 Patton Road
P.O. Box 64750
St. Paul, Minnesota 55164
(612) 631-7654 • (800) 926-6876

The ULTRA SERIES logo, CONTROL ULTRA SERIES, ULTRA 8, ULTRA 16, Universal Interface Box, CONTROL HOSTESS SERIES, and the CONTROL logo are trademarks of CONTROL CORPORATION. Product names mentioned herein may be trademarks and/or registered trademarks of their respective companies. © CONTROL CORPORATION. All rights reserved.

Circle 71 on Reader Service Card

World Radio History

excellent. Direct modem-to-modem transfers as a shared network modem ran as efficiently as those of a dedicated modem (see the table). Occasional transmission errors at 9600 bps indicate these speeds push the limits of ordinary phone lines, but the V.32 protocol did a good job at maintaining the connection's integrity.

In remote-routing applications, the NetModem V.32 proved itself a reliable performer in networking environments ranging from my relatively simple Macintosh development network of TOPS file servers and E-mail, to a complex network at a local graphic arts company, consisting of two AppleShare file servers, 20 Macintoshes, Apple LaserWriters, and a Linotronic L300 ImageSetter.

The NetModem V.32 had an overall "feel" that was excellent across the board. There were short delays while choosing printers or file servers from the Chooser, for instance, but nothing troublesome. And although file transfers were slower than with a direct connection to an AppleTalk network, printing operations were surprisingly quick, adding only about 20 seconds to the 1½ minutes it took to print a sample five-page text document or a MacDraw graphic.

However, there were some problems when communicating with on-line services such as BIX. The NetModem V.32 tended to lose control at random times. The resulting garbage could only be terminated by cycling the power on the NetModem. Shiva is aware of this problem (cycling the power is the company's workaround), and it expects to release a fix in the form of a new image file soon.

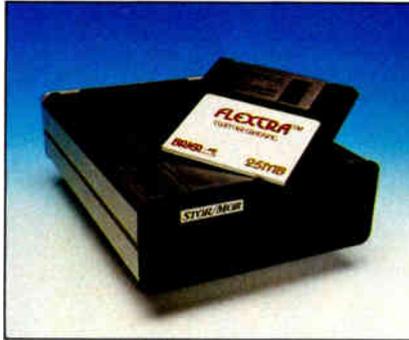
The Shiva technical-support people took a thorough report of the garbage bug and promised to pass it on to the engineers, but I did not hear back from them until I contacted Shiva and identified myself as a reviewer. This is a shame, because my previous experience with Shiva's support has been generally positive.

Even at \$1999 each, the Shiva NetModem V.32 gives you a sense of awe at how well it works. Internetworking between remote users or AppleTalk networks is easy to establish and easy to get used to. Combining those features with the ability to share a high-speed modem among many users makes this an attractive investment for businesses in search of the advantages of WAN technology. ■

Christopher R. Gibson is president of Cloud Ten, a Macintosh development firm located in San Luis Obispo, California, and is a moderator of the BIX Macintosh Exchange. He can be reached on BIX as "cgibson."

REVIEW

New Floppy Drive Puts 20-MB Disk in Your Pocket



The Stor/Mor Subsystem uses a SCSI controller to bring 20-MB floppy disk storage capacity to PCs and PS/2s.

While some computer technologies forge ahead at breakneck speeds, floppy disk drive storage usually progresses at a leisurely pace. Capacities grew from 180K bytes to 1.44 megabytes only in incremental jumps. Now they are beginning to leapfrog, thanks to the 20-MB floppy disk drives hitting the market.

I tested one of the first: Q/Cor's Stor/Mor drive, which uses 3½-inch floppy disks that only look like the standard disks. Based on the Flexora system developed by Brier Technology (San Jose, CA), the Stor/Mor drive uses Twin Tier Tracking (T²) technology (see the figure).

As the name implies, two layers of magnetic material reside on special floppy disks that cost a hefty \$25 each. The entire upper layer is free for data storage. The lower layer, which is permanently formatted at the factory, contains positioning (servo) information for the read/write heads. This low-frequency magnetic homing signal sends a continuous message to the read/write head. The embedded positioning information enables the head to track more tightly and accurately than in traditional floppy disk drives. This allows for a density of 777 tracks per inch, versus about 135 tracks in traditional floppy disk drives. In addition, most drives store data uniformly throughout the disk surface. But the Stor/Mor takes advantage of the longer sectors near the disk's outer edge by packing more data there than is possible in the shorter, inner sectors.

The Stor/Mor comes in both an in-

Stor/Mor Subsystem

Company

Q/Cor
One Meca Way
Norcross, GA 30093
(404) 923-6666

Hardware Needed

IBM XT, AT, PS/2, or compatible

Price

External version as tested: \$895

Internal version: \$795

Micro Channel architecture subsystem: \$995

Inquiry 882.



ternal version that fits in a standard 3½-inch floppy disk drive space and an external version. It uses a SCSI controller and is available with both AT and Micro Channel SCSI controller boards.

Installation Woes

Getting the external version of the Stor/Mor to work in my AT clone wasn't a "plug and play" proposition. The SCSI host-adaptor board requires you to set address and interrupt-level jumpers. Because my system already has other boards in place, I had to do some fiddling to get everything right.

I then had to install a device driver in my CONFIG.SYS file and reboot. Problem solved? Not quite. My system, which has a 64-MB hard disk drive partitioned into logical drives C and D, wouldn't recognize the Stor/Mor. Eventually, I realized that the second physical hard disk drive (the Stor/Mor) became drive D. But I still kept getting an "I/O error" message on my screen.

I ended up spending several hours fooling with my CONFIG.SYS and AUTOEXEC.BAT files, painstakingly removing individual TSR programs and device drivers. The culprit turned out to be a disk-caching utility, which somehow clashed with the Stor/Mor driver. Once I removed the utility, I was able to boot from the Stor/Mor drive.

After an extensive talk with the Q/Cor people, they admitted that they have to revise the driver for the Stor/Mor to avoid these conflicts.

continued

Another page in printer history.



BUBBLE JET

Introducing the first printer that is both a desktop and a portable and prints with letter-quality precision on plain paper: The Canon BJ-10e Bubble Jet.™

On a desk, with its optional 30-sheet paper feeder, it's an ideal personal printer. As a single-sheet portable with its optional rechargeable battery pack, it weighs a remarkable 4.6 pounds and prints on a variety of paper. Moreover, the BJ-10e emulates the IBM® Proprinter™ X24E, so you can use a wide range of applications software.

How fast is it? It prints 83 characters per second and won't slow down when printing in bold or various type sizes. It even handles complicated graphics such as the scanned-in image printed here. And, it's so quiet it can be used in the middle of the night with someone asleep just a few feet away.

Plus you never have to worry about maintenance because it uses an economical pop-in BJ cartridge, containing the print head and ink supply, which prints approximately 700,000 characters (HQ mode). But best of all, the BJ-10e works everywhere you could possibly need it, fitting neatly into a briefcase.

The BJ-10e Bubble Jet. What other printers print on a desk, it prints anywhere.

The document displayed in the BJ-10e is actual output using the UltraScript™ pc software BJ-130e™ printer driver.

Canon® is a registered trademark and BJ-130e and Bubble Jet are trademarks of Canon Inc.
IBM® is a registered trademark and Proprinter is a trademark of International Business Machines Corp.
UltraScript is a trademark of QMS.



Canon
BUBBLE JET PRINTER
BJ-10e

Working To Improve Your Image.™

For a history-making demonstration, visit your
Canon dealer or call 1 (800) 848-4123.

Circle 58 on Reader Service Card

World Radio History

See Your Data *



MapInfo software can find, display and analyze your data geographically. See your prospects, customers, facilities—anything in your database. Find addresses by street, ZIP code, city, etc. (We can even supply the maps. *)



Any point or region on the map can have a complete record of data behind it. See your actual dBASE data in a window to view, edit, and print. Draw your own boundary lines. Add titles and legends for high quality presentations.



Perform analyses on your data to sum, average, or count your database records by location. Color sales territories by volume of orders. ZIP codes by numbers of leads, countries by your demographic data.

From street-level to worldwide, MapInfo can merge your databases with maps. Play visual "what if" with your data. See patterns, trends, and opportunities you never knew existed. If you need to map your data, MapInfo can do it.

*MapInfo now has "TIGER," the most up-to-date and comprehensive library of street maps available on the PC. Prices vary. MapInfo comes with a map of the world and the U.S. with all ZIP code locations. Runs on IBM PCs or compatibles with 640K RAM, a hard drive, and graphics.

MapInfo Corp.

Changing The Way The World Looks At Information™

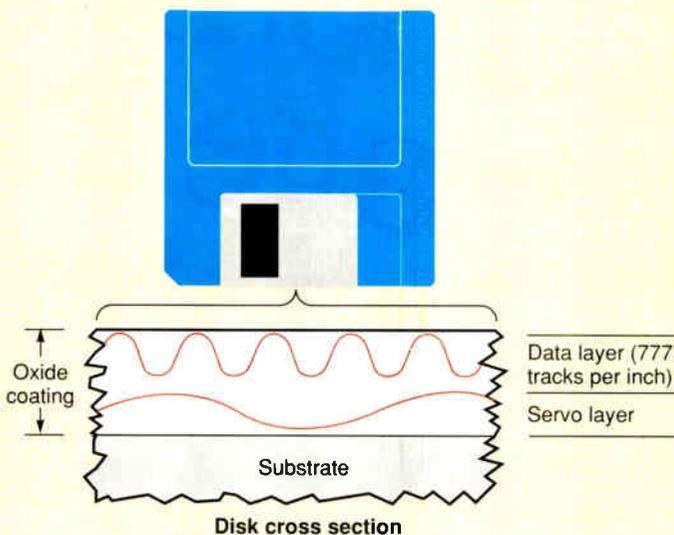
200 Broadway, Troy NY 12180
To order, call 1-518-274-8673
or 1-800-FASTMAP Toll free.

MapInfo is a trademark of MapInfo Corp. dBASE is a trademark of Ashton-Tate

REVIEW

NEW FLOPPY DRIVE PUTS 20-MB DISK IN YOUR POCKET

PACKING 20 MEGABYTES



The oxide coating on the Stor/Mor's floppy media is divided into two layers. The bottom, or servo, layer contains an embedded homing signal that guides read/write heads. Accurate head positioning in part allows the drive to densely pack data in the upper layer into 777 tracks per inch.

Special Formatting

Not surprisingly, the Stor/Mor drive comes with its own formatting utility. Because the positioning information is permanently encoded on the disks, the actual formatting is very fast—under a minute for the 20-MB storage space. In addition, the format utility allows you to partition the floppy disk into two logical drives in any combination that adds up to 20 MB.

If you use the Stor/Mor as your boot drive, the formatting utility also gives you the option of putting DOS files on the disk. But I ran into an annoying anomaly when using this option: Stor/Mor won't take system files off an existing hard disk. It insists that you have a bootable disk in your floppy disk drive A. Of course, if Stor/Mor is your only "hard" drive, that's where the files would have to be. But I would have liked to have had a choice.

The Stor/Mor drive is only usable with Brier's special disks. It currently won't read or write to 720K-byte or 1.44-MB disks. However, Q/Cor promises to have a version of the drive that will handle those formats later this year.

Speed Is Relative

The Stor/Mor is faster than a standard floppy disk drive, but slower than a hard disk drive. I would have expected that,

except that Q/Cor's marketing literature claims an average access time of 35 milliseconds, which is comparable to a standard hard disk drive. I found that to be a bit optimistic; most of the time, actual access time is three to four times that figure.

Packing more and more data onto 3½-inch floppy disks isn't a trivial undertaking. After what seems like years of fits and starts, many manufacturers are coming out with competing—and incompatible—subsystems. Stor/Mor is intriguing technology, but considering my installation problems, I get an uneasy feeling that it isn't quite there yet. It's a useful alternative to a standard hard disk drive for hard disk backups or for carrying large amounts of data in a portable package. For security, you can lock the disk away at night.

But for these capabilities, \$895 is a considerable price to pay. In fact, for that, I could buy both a 40-MB hard disk drive and a 40-MB tape backup system and have money left over. Of course, the Stor/Mor is new technology, and new technology is usually expensive. But until its price falls considerably, I'll stay with my current storage technology. ■

Stan Miaszkowski is a consulting editor for BYTE. He can be reached on BIX as "stanm."

Printer Sharing Solutions



SL 10 Ports from \$495

Any Combination of Ten Printers or PCs: All ports can be set as input or output; automatic serial-to-parallel conversion; automatic switching and queuing of jobs

115,200 bps: Our software allows your PC to send data serially several times faster than normal 9,600 bps.

Pop-up Menu via Hotkeys: Keyboard selection of printers and many other control functions

Simple Installation: Just plug in your cables and run the menu-driven installation software

User Upgradable Memory: From 256KB to 4MB buffer



Save by Sharing Resources: The SL enables everyone to share lasers, printers, plotters, and modems. Greater access by more users reduces unproductive idle time and the need to purchase additional expensive peripherals. All users can simultaneously send print data and quickly release their PCs to continue working.

BUFFALO

45 Day Money Back Guarantee

CALL TODAY (800) 345-2356

Fax (503) 585-4505

Buffalo Products, Inc. 2805 19th St. SE, Salem, OR 97302-1520



HWP 5 Ports from \$275

All ports are parallel and user configurable as either 3 inputs to 2 outputs with a pop-up menu, or 4 inputs to 1 output as a buffered auto-switch; memory is user upgradable from 256KB to 4MB buffer

AS-41 5 Ports \$200

4 parallel inputs to 1 parallel output, automatic switch with no buffer; use the AS-31 for up to 3 inputs to 1 output, \$175

CE 2 Ports from \$175

Printer buffer with 1 parallel input to 1 parallel output, from 256KB to 4MB buffer

SPPS Converter \$100

Combination serial-to-parallel, or parallel-to-serial interface converter in a single unit, no power supply needed, serial transfers to 115,200 bps, DIP switch configurable

RCJ Toshiba Memory Module

Memory expansion module for the Toshiba T1000SE or T1000XE laptop (notebook) computer, 1MB - \$299, 2MB - \$549

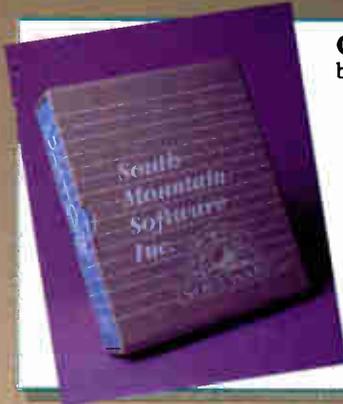
Cables & Adapters

High quality, 24 gauge shielded cables, parallel or serial; modular cable adapters

Circle 399 on Reader Service Card

World Radio History

Professional developers require



GUIDO

by South Mountain Soft.

GUIDO is a powerful library of C functions which enables you to easily add graphical user interface objects to your application. Available objects include menus, windows, data entry, radio buttons, user definable objects and more. An event driven, object oriented windowing environment is also provided. GUIDO does not require any other graphics library and includes support for Borland Turbo C, Microsoft C and Quick C.
LIST: \$249 PS Price: \$229
LIST: \$499 (w/so.) PS Price: \$459
FastFacts 42-050



SentinelScout

by Rainbow Technologies

The SentinelScout is a hardware key that attaches externally to the parallel port of an IBM PC or compatible to enable execution of authorized program copies. It does not interfere with printer operation, hard disk installs or backup copies. Featuring a fixed-response security system unique to each device, the economical SentinelScout offers a level of execution control perfect for lower-cost programs.
LIST: \$295 (kit of 10 keys)
PS Price: \$265
FastFacts 1313-001

386 DEVELOPMENT TOOLS

	Cost
386 Max Professional	\$119
386:ASMLINK by Phartap	485
DESQview 386	189
FoxBASE+/386	479
Instant C	769
Metaware High C - 386/486	875
NDP Fortran - 386	549
NDP C - 386	545
QEMM - 386	89
VM/386	229
WATCOM C8.0 386 Prof.	1155
WATCOM C8.0 386 Stand.	795

ProtoFinish by Genesis	279
Show Partner F/X	279
Visible Analyst	585

COBOL

MS COBOL V3.0	639
Realia COBOL	859

COMMUNICATIONS ADD-ONS

C Asynch Manager 3.0	155
Essential COMM by S. Mtn.	259
Greenleaf Comm Library	329
QuickComm	129

DBASE

Clipper 5.0	550
dBASE IV	499
dbFAST/PLUS	325
dbFAST/Windows	329
dbMAN V	275
dbXL	209
FoxPro	495
FoxBASE + - V2.1	279
QuickSilver	399

DBMS

Cause Professional	719
CLARION Prof. Dev. V2.1	549
dbFast/Windows	329
D the data language	359
Magic PC	349
Paradox V3.0	479
R:BASE 3.1	499

DBMS TOOLS & LIBRARIES

AdComm for Clipper	279
Artful.Lib	200
Buzzwords dAnalyst	269
CLEAR + for dBASE	179
dBase BlackBox	65
dBASE Online	129
BRIEF w/DBRIEF	Call
dBX/dBport	579
dGE 4.0	279
dQUERY	179
dSalvage	89
FLIPPER	179
FUNCKY.LIB	179
Genifer - Code Generator	269
Net Lib	229
Pro Clip	125
R&R Relational Reportwriter	139
R&R Code Generator	129

AI-LANGUAGES

ARITY Combination Package	989
LISPC	269
PC Scheme LISP	85
TransLISP PLUS w/source	179
PDC Prolog Compiler	119

ASSEMBLERS

MS MASM	105
Turbo Assembler/Debugger	109
Visible Computer:80286	85

BASIC & ADD-ONS

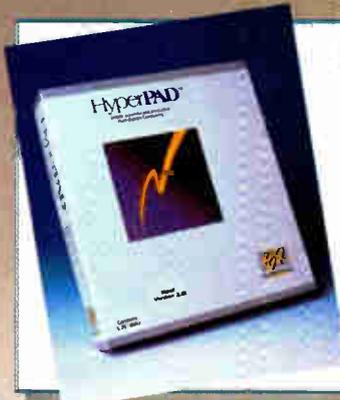
BAS-C Commercial	439
dB/LIB Database Library	125
MS QuickBASIC V4.5	69
ProBas Prog. by Hammerly	Call
ProRef by Hammerly	Call
QBase	139
QuickPak Prof./PDS	179

C LANGUAGE COMPILERS

Lattice C - 6.0 Compiler	189
Microsoft C 6.0	349
Microsoft QuickC	69
Turbo C	109
WATCOM C8.0/286 Prof.	429
WATCOM C8.0/286 Stand.	359

CASE & PROTOTYPERS

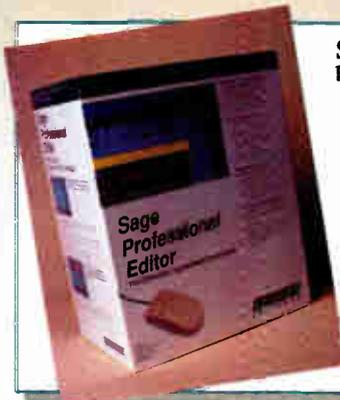
Case: W	695
Case: PM (for C or C++)	1469
Dan Bricklin Demo II	185
EasyCase Plus	209
EasyFlow	135
Instant Replay III	139
Instant Windows	895
Matrix Layout	179
MetaDesign by Meta Software	295
Pro-C w/Workbench Combo	349



HyperPAD

by Brightbill-Roberts

HyperPAD is an object-oriented application generator. HyperPAD gives DOS users the same capabilities as Tool Book, HyperCard and others, without the overhead. Use HyperPAD to create customized menuing systems for hard disks or Local Area Networks, computer based training systems, help systems tutorials, flat-file databases, hypertext information systems, front-ends and much more.
LIST: \$150 PS Price: \$129
FastFacts 1104-006



Sage Prof. Editor

by Sage

The Sage Professional Editor is designed to create the applications of the 90's. It's highly configurable and has an advanced windowed user interface with integrated mouse support, on-line help and menu-driven commands. Has emulations for Brief, Vi, EMACS/Epsilon and WordStar, and a virtual memory system for large files. Includes MS-DOS, OS/2 and Dual Mode versions on 3.5" and 5.25" diskettes.
LIST: \$295 PS Price: \$249
FastFacts 111-060



ProtoFinish

by Genesis Data Systems

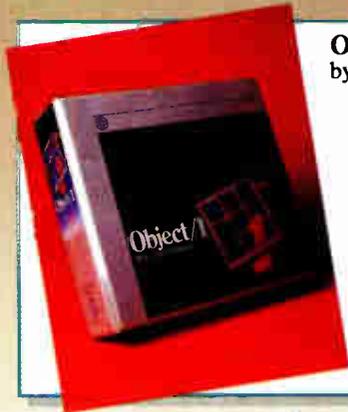
ProtoFinish creates program prototypes, demos and tutorials. Contains screen design module for creating ASCII-based screens, memory-resident utility for capturing ASCII and CGA-VGA graphics screens, 4th-generation language with interactive/self-running capabilities for accurately simulating your program's look and feel, royalty-free run-time utility, and assembly language routines for incorporating screens in C, PASCAL, BASIC, and Clipper code.
LIST: \$300 PS Price: \$279
FastFacts 1496-001

THE PROGRAMMER'S SHOP 1-800-421-8006

more than just products...



OPTune
by Gazelle
Got a case of "hard-disk slowdown?" Get OPTune, the fastest, most complete set of performance-enhancing utilities available. It features unmatched file defragmentation, low-level non-destructive interleave adjustment, and in depth media testing. OPTune will, quite simply, keep your disk spinning faster and longer than any other "so-called" optimizer... guaranteed.
LIST: \$100 PS Price: \$89
FastFacts 726-003



Object/1
by mdb, Inc.
Object/1 is more than just another application development tool. It's designed specifically for graphical environments like Presentation Manager and Windows 3.0 to provide a comprehensive development environment. It features a Forms Painter which allows you to build and edit graphical forms which link to a variety of back-end database servers. Object/1 is a rich object-oriented programming tool which has more than 250 classes and 3000 methods.
LIST: \$995 PS Price: \$895
FastFacts 1506-003



BLAST
by Communications Research
BLAST puts powerful data transfer, remote control, scripting, terminal emulation, datacompression, and other communications magic into one product for PC, Unix, Xenix, VAX, Macintosh, and even mainframe communications... all with the same look, feel, menu interface, protocol, and script language! Easy for developers to link into existing applications for automated, 100% error-free data transfer and fast, reliable remote control.
LIST: \$295 PS Price: \$235
FastFacts 1674-001



WATCOM C 8.0/386 Prof.
by WATCOM
WATCOM C 8.0/386 is 100% ANSI C optimizing compiler/runtime library for Intel's 80386 architecture, generating applications for 32-bit protect mode. Features include: protected mode version of the compiler; VIDEO full-screen source-level debugger; MS library-& source-compatibility; execution profiler; high performance linker; graphics library; supports MetaWare High C 386 runtime calling conventions; SAA compatible.
LIST: \$1295 PS Price: \$1155
FastFacts 1044-004

Scrimmage	139	FORTRAN	
SilverComm Library	179	FOR_C w/source	789
SilverPaint	100	Lahey FORTRAN F77L	549
Steve Straley's Toolkit	149	Lahey Personal FORTRAN	Call
Tom Rettig's Library	85	MS Fortran Opt. Compiler	309
UI Developer's Release	479	RM/FORTRAN	499

DEBUGGERS/ DISASSEMBLERS

DASM	225	GENERAL ADD-ONS	
Dis Doc	119	C Tools Plus - V6.01	98
Periscope IV	Call	C Utility Library	199
RE:Source by Genesoft	119	Greenleaf Functions	209
SoftProbe 86/TX	345	Greenleaf SuperFunctions	239
Sourcer 486 w/BIOS pre-proc.	129	Opt-Tech Sort	119
Trapper	189	Turbo C Tools by Blais	109
Zortech C Debugger	Call		

DEVELOPMENT TOOLS

ASMFLOW	89	GRAPHIC ADD-ONS	
CLEAR+ for C	169	Code Master II	269
Codan	349	Essential Graphics v3.0	349
Buzzwords dAnalyst	269	GraphiC	319
The Documenter	245	GSS Graphics Dev't Toolkit	525
INSIDE!	119	Halo	279
MKS Lex & Yacc	199	HSC Sunscan	289
MKS RCS	175	LaserControl	139
Poly Doc-SU	179	Matrix Synergy Toolkit 3.0	349
PC-Lint	115	MetaWINDOWS	209
Plink/LTO	619	MetaWINDOW/PLUS	289
PolyMake	135	PCX Programmer's Toolkit	229
PVCS Professional	659	Sunshow Adv. Image Toolkit	239
.RTLINK - by Pocket Soft	279		
RTLINK Plus	419	HARDWARE	
Source Print	97	ALL Chargecard	399
TLIB 5.0 Version Control	125	Capital Equipment Corp.	
Zortech C++ Tools	Call	OS/RAM32 0M	225
		OS/RAM8 0M	299
		OS/RAM4 0M	179
		DigiCHANNEL COM/8i	875
		DigiCHANNEL MC/8i	949
		DPT	
		SmartCache ST506	1099
		SmartCache RLL	1099
		SmartCache ESDI	1099
		Disk Mirroring Module	685
		Emerson UPS	
		Model 10 UPS	169
		Model 20 UPS	319
		Model 40 UPS	699
		AccuCard	209
		AccuSaver	69
		EtherCard Plus	239
		EtherCard Plus/A	349
		Erasable Optical Drive	Call
		IIT Adv. Math Coprocessors	
		3C87-25	450
		3C87-33	559
		2C87-20	329
		2C87-12	279
		Intel Math Coprocessors	
		80387-25	555
		80387-33	675
		80287-10	309
		J T Fax 9600	595
		KickStart I	125
		KickStart II	350
		KickStart III	539
		LANStor LAN150S	1995
		LaserStor WORM Drive	3295
		Personal Modem 2400	199
		QX/12K Modem	699
		QX/V.32c Modem	1349
		Seagate 5T-125-1 20M	299

EDITORS

BRIEF	Call		
Cheetah	199		
Epsilon	169		
KEDIT	139		
QEdit TSR	89		
RimStar PM:Editor	190		
Sage Professional Editor	249		
SPF/PC - V2.1	199		
Vedit +	139		

EXPERT SYSTEMS

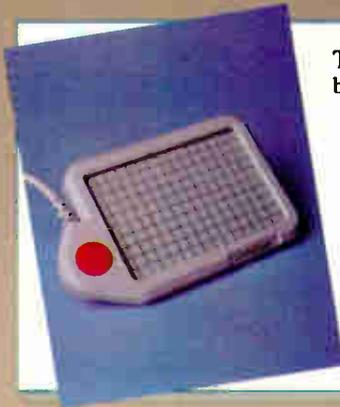
Exsys Professional	695		
KnowledgePro Windows	589		
Logic Gem by Sterling Castle	89		
Personal Consultant Plus	1999		
VP-Expert	219		

FILE ADD-ONS

Accsys for Paradox w/source	739		
Btrieve V5.0	199		
CBTREE	179		
C-Data Manager w/source	499		
c-tree by Faircom - source	329		
CodeBASE 4	279		
C-TRIEVE	189		
CQL - w/ source	359		
db_FILE/RETRIEVE - SU	229		
UNIX or XENIX - MU	569		
Faircom Toolbox Prof.	889		
Faircom Toolbox Special	539		
WKS Library	149		
XQL	649		

THE PROGRAMMER'S SHOP 1-800-421-8006

The Programmer's Shop is



The UnMouse by MicroTouch

Why use a mouse to point when you have your finger! The UnMouse is a compact, touch-sensitive, state-of-the-art pointing device providing cursor control, graphic input, and function key selection. Just touch the glass tablet with your finger or the stylus. Use it in absolute mode with touch points mapping directly to the screen, or in relative mode, similar to a mouse.
LIST: \$235 PS Price: \$219
FastFacts 2918-002



InstaPlan by Micro Planning International

Your business has projects going on all the time. Some need coordination, have important deadlines and limited budgets. To make these projects succeed you need realistic plans. InstaPlan highlights resource conflicts and problem areas ahead of time. InstaPlan utilizes the outline approach to planning, has clear screen views, on screen help and highly presentable charts to ensure you manage your projects not your software.
LIST: \$99 PS Price: \$99
FastFacts 1657-001

Seagate 5T-4096-1 80M	639	HEADROOM	89
Seagate 5T-251-1 40M	339	Hijaak	139
SentinelScout (kit of 10 keys)	265	LapLink III	129
SpeedStor AT 300S	2695	Link & Locate ++ - ROM MSC	349
Smartmodem 2400	459	Math Advantage	475
The Shadow SVGA1024K	319	Norton Utilities Advanced	109
VGA WONDER 256	279	PAGINATE by AccuMatics	89
VGA WONDER 512K	359	pcANYWHERE III	129

NETWORKS

dBXL/LAN	519
Btrieve Network Version	479
Netware SQL	519
Netware C Interface	239

OBJECT-ORIENTED/C++

Actor	639
C_talk/Views	419
Intek C++ 80386	469
Smalltalk/V	85
Smalltalk/V-286	185
Smalltalk/V PM	469
Turbo C ++	159
Turbo C ++ Prof.	259
Zinc Interface Library	179
Zortech C ++	Call
Zortech C++ Debugger	Call
Zortech C ++ Dev. Edition	Call

OS/MS WINDOWS-SUPPORT

C-Trieve/Windows	329
DESOview	109
Graphics Server SDK	479
MKS Toolkit	229
MS Windows 3.0	69
MS Windows SDK	319
OS/286 or 386	459
OS/2 PM Toolkit	369

OTHER LANGUAGES

Modula-2 Dev. System	229
RPG II Dev. Systems	1469
TopSpeed Modula-2	189
StonyBrookProf. Modula-2	249

OTHER PRODUCTS

BALER	399
Carbon Copy Plus	159
COTERM/220	219
Dan Bricklin's PageGarden	89
The Duplicator Toolkit-Pro 3.0	119
File Shuttle	109
Flow Charting II Plus	179

Link & Locate ++ - ROM MSC	349
Math Advantage	475
Norton Utilities Advanced	109
PAGINATE by AccuMatics	89
pcANYWHERE III	129
PC Tools Deluxe 6.0	109
PC-KWIK Power Pak	119
Remote2	139
SpinRite II	Call
Systat & Sysgraph Combo	749
TimeSheet Prof.	135

TURBO PASCAL

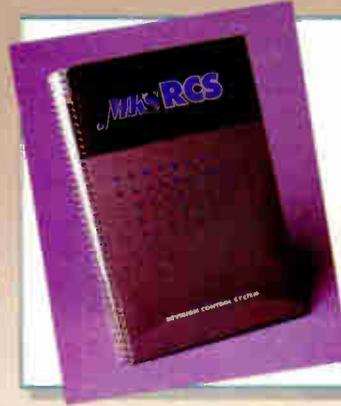
graphics-Menu	139
MetaWare Pascal 386/486	839
Turbo ASYNCH PLUS	139
Turbo Pascal 5.5 by Borland	109
Turbo POWER TOOLS PLUS	109
Turbo Professional	98
Turbo Programmer	269

TEXT SCREEN ADD-ONS

AEWINDOWS	459
C Communications Toolkit	119
C Worthy w/forms	Call
Greenleaf DataWindows	339
HI-SCREEN XL Professional	289
JAM by JYACC	199
MEWEL Window System	149
POWER SCREEN by Blaise	103
Vitamin C - source, menus	169
VC Screen - painter	119
Vermont Views Obj. + source	899

UNIX/XENIX

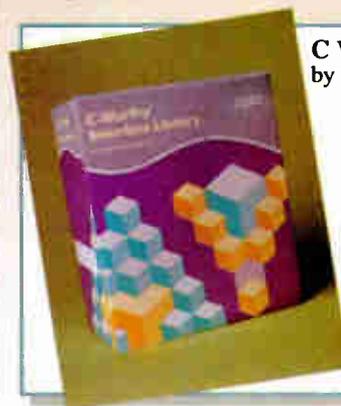
ESIX Systems	
ESIX/V 386 Dev. (2 user)	569
ESIX/V 386 Dev. untd	769
Interactive Systems	
Architect Wrkstn Platform	1199
Architect Wrkstn Developer	1850
Santa Cruz Operations	
Unix Operating Sys.	799
Unix Developer Sys.	895
VP/ix 286	449
VP/ix 386	429
XENIX 286 Dev. Sys.	599
XENIX 386 Dev. Sys.	689
Recital Standard SU	699
WordTech Quicksilver Diamnd	839



MKS RCS by Mortice Kern Systems

MKS RCS maintains a complete history of changes to a file and recalls any revision instantly. MKS RCS has all the features you'll ever need in a revision control system - binary file support, compression of log files, SCCS to RCS conversions, full locking capabilities, unlimited branching and merging - at a price you can afford.
LIST: \$189 PS Price: \$175
FastFacts 469-002

See our ad on page 83.



C Worthy w/Form & ARCH by Solution Systems

Create a clear, high quality user interface with minimal overhead to your code. Benefit from 400 tight, ready-to-use functions for Windows, Menus, Text Editing, Message System, Mouse Support, Help and much more. cWARCHITECT is included to let you interactively design and test forms without coding. Best of all it's flexible to your needs, providing high level functions for immediate results, yet power and functionality for the long-term.
LIST: \$399 PS Price: \$359
FastFacts 732-095



Multi-Edit by American Cybernetics

EASIER, FASTER & BETTER THAN EVER!
Multi-Edit has always been your best text editing value. Now version 5.0 adds: Windows/SAAs-style interface, seamless Mouse Support, expanded online help & manuals (LOTS of useful examples), full EMS support, plus hundreds of new features!
Inexpensive - NOT CHEAP!
You've gotta see this!
FREE DEMO
LIST: \$99 PS Price: \$95
FastFacts 1067-001

THE PROGRAMMER'S SHOP 1-800-421-8006

your source for solutions!

TCAT & S-TCAT by Software Research, Inc.

TCAT
Let's start with TCAT, our Test Coverage Analysis Tool. TCAT uses your source code to make your test suites more complete than ever before. TCAT measures test thoroughness in terms of logical branches, instead of statement coverage that common profilers use. With TCAT, you work on reports that are 8 to 10 times more concise and 3 times more accurate.

FastFacts 1126-011

LIST: \$4,100

PS Price: \$3,995 *Software Research, Inc.* **PS Price: \$2,775**

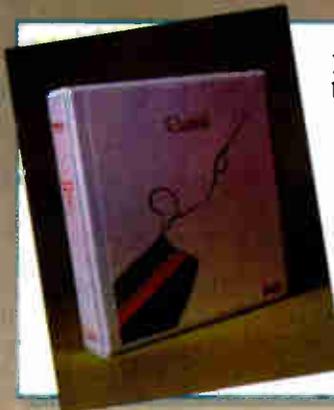


S-TCAT

When you finish unit testing with TCAT, move on to system level testing with S-TCAT, and verify that your executive or "driver" programs combine the lower level modules correctly. With S-TCAT, you can double the detection of module interface errors, which often make up over 50% of total system errors.

FastFacts 1126-012

LIST: \$2,850 (Unlx)



Recital

by Recital Corporation, Inc.

Yes, it runs your dBASE, FoxBASE and Clipper applications on UNIX, XENIX and AIX (also VAX/VMS and ULTRIX). But that's only the beginning of Recital. It's a complete relational database and 4GL for developer and end-user alike. It's also got a powerful data dictionary. SQL interface and over 350 additional commands.

LIST: \$995 PS Price: \$699

FastFacts 2039-001

WENDIN - DOS PLUS by Wendin

Replicating functionality built deep within MS-DOS was key to the birth of WENDIN-DOS PLUS. Commented Microsoft C and Assembler source code builds into an OS/2 like, stand-alone host operating system which retains MS-DOS compatibility! Multiuser! Multitasking! Windows Developer's Kit! Full Source Code!

LIST: \$249 PS Price: \$199

FastFacts 305-012

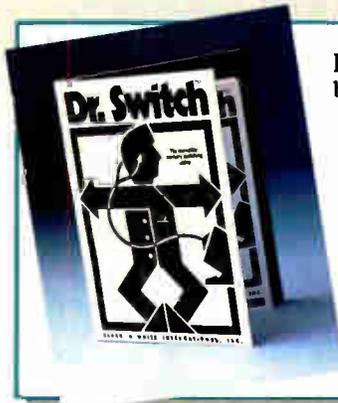


Dr. Switch-ASE by Black & White Int'l, Inc.

Dr. Switch-ASE turns any size Dbase application into a RAM resident (TSR) program that occupies only 16-20K of RAM; Supports Clipper, dBASE III PLUS, dBASE IV, FoxBASE + and FoxPro. Dr. Switch-ASE includes Cut, Paste, Timer, Alarm and Macro functions. It supports Expanded and Extended memory and is fully network compatible.

LIST: \$100 PS Price: \$95

FastFacts 1178-006

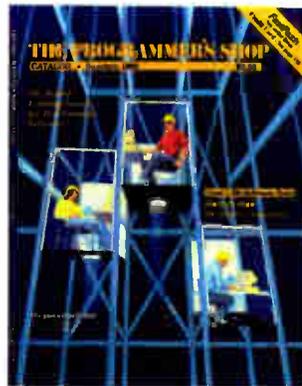


FREE Catalog!

THE PROGRAMMER'S SHOP CATALOG is the definitive source book for serious software development professionals.

Over 1,700 development products listed, including:

- applications
- books/training
- communications
- hardware
- LANs
- languages
- libraries
- operating systems
- tools
- UNIX/XENIX
- utilities



**Call today for this
valuable guide to
programming productivity.**

What is FastFacts?

You now have access to literature on any of our products via FAX machine. **FREE!**

1. Call 617-740-0025 from your FAX machine's phone.
2. Follow the voice computer's instructions and enter your product's code number (listed in each product box or in our catalog).
3. Hang up the phone and await your instant print out of product literature.

Call 617-740-0025 from any fax phone!

THE PROGRAMMER'S SHOP

800-421-8006 National Accounts **800-446-1185**



5 Pond Park Road, Hingham, MA 02043 • Canada 800-446-3846 • Mass. 617-740-2510 • FAX: 617-749-2018
Credit card orders processed *only* when product is shipped. All prices subject to change. Int'l. prices will vary.

BY990

REVIEW

Strictly for Personal Information

Personal Information Managers (PIMs) have had a tough time in the world. There's a passel of them on the market, but they don't sell very well. And like Rodney Dangerfield, they don't get no respect. It's a shame, because a PIM can be a very useful tool.

If you're normally a neatnik, an organized person who loves lists and timeline wall charts and loose-leaf notebooks with lots of schedulers, list pages, and dividers, a PIM can automate much of the drudge work that you now do manually. It can let you put more effort into the content and less into the structuring of your work.

If you're one of us organizational slob, wallowing at a desk stacked with notes scribbled on old Moon Pie wrappers and coffee-stained file cards, with Post-it notes almost obscuring your terminal screen, a PIM can be even more valuable. It lets you move the mess—as a mess—into your computer in ways that allow you to actually find things later.

Naturally, no single information-management program could very well serve masters as diverse as neatniks and slob. And that may be the heart of the PIMs' problem: People look at one or two PIMs and assume they all are about the same. It's not so.

Talking about a PIM is a lot like talking about California. Describing San Francisco really doesn't say much about San Diego, let alone Merced or Madeline. The discussion needs focus to make any sense, and the focus needs to deal with the listener's interests.

The specific functions that are combined variously to make a PIM are calendars, auto-dialers, telephone books and logs (records of conversations), to-do lists, prioritized to-do lists, tickler files, smart date-handling, and reports (see the table). There's also the ability to sort, filter, and interrelate your information and look at it in different ways. Some of the PIMs add to their utility by letting you run them as TSR programs.

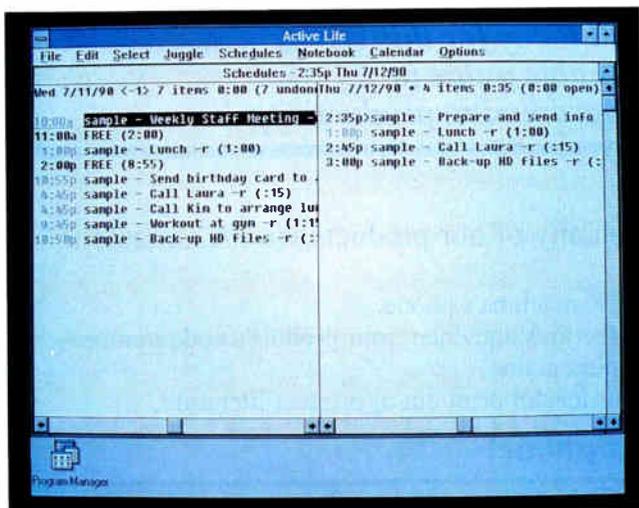
To bring some focus to a discussion of PIMs, I've divided them into two general classes: free-form and structured. There are wide variations within these classes, but they describe the essence of how PIMs work.

Lotus Agenda, for example, is a free-form PIM. Agenda seems to have been designed to send would-be users back to tossing scraps of paper into a shoe box as an information-management technique. And it has to be one of the most difficult-to-learn programs that have ever been written. It is work, hard work, and a lot

of it, to learn. But once you've figured it out, Agenda is indeed a powerful, flexible tool for managing many sorts of textual information. (For a review of Agenda, see "The Database Redefined," December 1988 BYTE.)

IBM Current, on the other hand, is a structured PIM. Current is a Microsoft Windows-based program. It would be a standout if it weren't for its limited record capacity (a category can have no more than 4000 items in it) and its field-size limit. The only required—and non-removable—field in Current's records is limited to 25 characters for people and project names, and 16 characters for calendar, expense, task, and to-do entries. In all other respects, Current is a do-everything program that works well and is a pleasure to use. (For a review of Current, see "Jack of All Trades," March BYTE.)

The free-form programs reviewed here are askSam, Info Select, and MemoryMate. The structured ones are Active Life, Instant Recall, PackRat, and Who-What-When. (Incidentally, what is sold now as Instant Recall is not the same Instant Recall that was distributed as shareware several years ago. That program has been transformed into MemoryMate.)



Active Life

Active Life's smart calendar shows you at a glance, in bold type, your appointments and the time you have free. In light type, it suggests times to accomplish your tasks.

on the same calendar. The rationale for this is that tasks take time and affect any schedule.

Most PIMs make you go back and forth from tasks and calendar views to see where you've committed your time. By displaying both tasks and appointments together, Active Life gives you a much clearer idea of what your time commitments are. This, I think, is an eminently sensible approach.

Active Life allows automatic repetitive scheduling (e.g., a meeting held at the same time daily, weekly, or monthly), alarms, and easy juggling of appointment schedules with a mouse or a keyboard. The program also automatically archives each day's records after all tasks are marked as done.

Active Life enhances the regular Windows card file for its notebook (the notebook is not available in the PM version). When combined with the telephone dialer, it becomes the communication module. Multiple notebooks are

Active Life is the only shareware product of the group. It's available for Microsoft's OS/2 Presentation Manager (PM), Windows 3.0, Windows/286, or Windows/386, and in a run-time Win-

dows version for DOS.

The heart of Active Life is its smart calendar. Unlike many of the PIMs, Active Life does not differentiate between tasks and appointments; it displays both

supported, which helps in organizing textual information. You can create telephone books in the notebook as they are in Windows, and existing Windows card files and ASCII text files and databases can be imported directly to a notebook.

Data searches are done with simple text strings. Its reporting capability is limited to printing your daily schedule and a two-month calendar.

While Active Life doesn't have all the features of some of the other PIMs I

looked at, it allows thorough control of your activities. And because it closely follows the Windows standard, it is a breeze to learn. In addition, because it is shareware, you can try it out before you buy it.



askSam

askSam can easily deal with big chunks of data, and its main menu, as shown here, gives you plenty of options for managing and updating the information files.

programs can also use.

Within a file, you can find information using sophisticated full-text search procedures, including variable word proximity (e.g., "locate only records in which search string 1 is in x relation to search string 2"). This feature allows you to easily find the notes on, say, the times you talked with Harry about the Acme Building project. It handles dates with a moderate degree of intelligence: Dates entered without a year are treated as being in the current year; months can be names with the minimum nonambiguous string (e.g., N for November, JA for January, and JUN for June); days within the current Sunday to Saturday cycle can be entered as SU, MO, TU, and so on. Multiple Boolean operators in a single-search command are supported. A hot key calls up an auto-dialer that can seek out telephone numbers on the screen.

askSam has no calendar/scheduler or telephone book as such, but it is possible to program them. The telephone book requires nothing more than a text file of the appropriate information and simple string searches. A very smart calendar/scheduler could be made using askSam's calendar command and saved macros to build ad hoc daily, weekly, monthly, or whatever views of text files containing the necessary information.

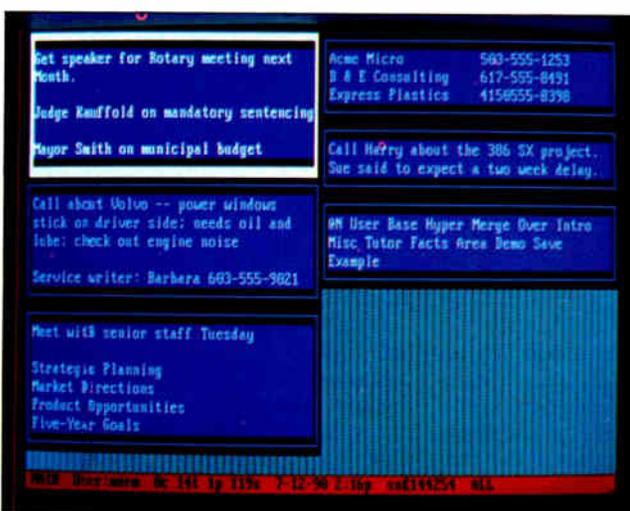
Handling large volumes of text is askSam's real strength. If your information comes primarily in big chunks, then you should give serious consideration to this program.

As with Agenda, askSam's learning curve is fairly steep. Although many basic operations are menu-driven, the more complex operations require programming in a language that is not simple. For example, here's a fragment of sort-request code:

```
{ELSE}@JOURNAL
{LONG JN}{VO}
```

```
{IF COUNT}IS[=0
PG[
]{ELSE}
IS[PG[
]{END}
```

You can enter information manually or by importing ASCII files. Records can link to external graphical files, and some hypertext capability is built in. You can also store data in a totally free format or a traditional fielded format. Its powerful reporting capability (using language like the sort fragment above) can generate printed ASCII files that other



Info Select

Info Select emulates a desktop littered with several notes. As you browse from one note to another, the brightly framed "active window" moves to the screen location of the note you select.

If you are an inveterate scribbler of memos to yourself or a slave to Post-it notes, check out Info Select. This is Tornado Notes grown up. The concept is the same—manipulating electronic stacks of paper on your virtual desktop—and you can use it as a TSR program.

Data entry is totally free-form, with only kludges available to impose some structure. For example, you prefix dates in tickler-file entries with a ** string. A tickler command will search an entire stack for any entries with ** followed by the current or earlier date and will put what it finds in a new window. It's not elegant, but it works.

The program will also create a "linear calendar"—a year's worth of dates,

continued

PIM FUNCTIONS COMPARED

Each PIM uses a combination of functions to help you manage your information (●=yes; ○=no).

Name	Price	Minimum DOS version required	Minimum RAM (bytes)	Hard disk required	Calendar	Auto-dial	Telephone/address book	To-do lists	Priority manager	Tickler	Smart dates	Alarms
Active Life 1.1	\$149 ¹	2.0	512K	●	●	●	●	○	○	○	●	●
askSam 4.2	\$295	2.0	256K	○	○	●	*	*	○	○	○	○
Info Select	\$99.95	2.0	256K	○	*	●	*	*	○	●	○	○
Instant Recall 1.2	\$99.95	2.1 ²	512K	○ ³	●	●	●	●	●	○	●	●
MemoryMate 3.04R	\$69.95	2.0	256K	○	○	○	*	*	○	●	○	○
PackRat 2.0	\$395	3.0	215K	●	●	●	●	●	●	●	●	●
Who-What-When 2.0	\$295	2.11	640K	●	●	●	●	●	●	●	●	●

* Free-form PIM; you can add structure to create the function.
¹ Distributed as shareware and available on BIX.
² DOS 3.0 or higher for memory-resident operation.
³ 720K-byte or 1.2K-byte floppy disk drive required.

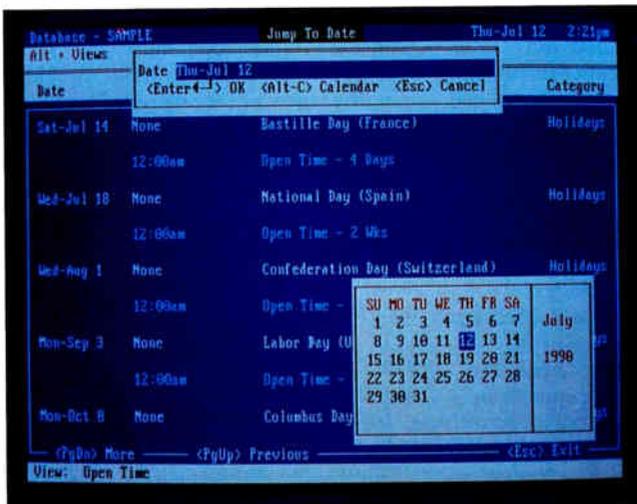
listed one under the other—that can form the basis of a scheduling calendar. Again, it's pretty primitive, but it works. You're on your own as far as telephone books go. This is no problem, since all you need to do is create lists of names and telephone numbers in any way you want. You can search on any part of the list, and an auto-dialer will place the call. The auto-dialer can seek out a telephone in any text on the screen, not just in something formatted as a telephone book.

To enter information into Info Select,

you just open a window and start typing. You can also import ASCII text and simple database files. When you're done, press Escape twice to get out of the editor. Your note will be at the top of the current stack. To find information from the stack, you issue the get command and type the string you want to locate. When you press Return, Info Select creates a temporary substack of all the windows containing that string. You can then browse the stack with the up- and down-arrow keys. Report writing is

limited, but it is adequate for memos and other nondemanding uses.

The only thing I don't like about Info Select is its default screen display, which emulates a desktop littered with many notes. As you browse from window to window, the brightly framed "active window" jumps around the screen as you change windows, rather than being anchored in one position. This makes scanning text a bit like following PacMan through its maze. Fortunately, you can change the default.



Instant Recall

Instant Recall's biggest strengths are its date handling and its pop-up calendar, which make it easy to refer to past or future dates without leaving the program.

and search and replace. You can use the clipboard for traditional cut-and-paste work. Conversion utilities are included to import ASCII, SideKick, Tornado, and MemoryMate files. You can search text using simple Boolean operators.

Dates are handled well. For example, the program knows how to convert "next Wednesday" to the proper month and date. Time handling is equally smart, including recognition of noon and midnight. Entries are checked for time conflicts. You can enter recurring events automatically. A pop-up calendar makes it easy to determine past and future dates without leaving the program or referring to paper. And you can use a timer to track and record time spent on individual projects.

Instant Recall supports schedules and task lists for as many as 64 individuals organized in up to 14 groups. You can organize and view the information by text, category, priority, person assigned, date, or combinations of these categories.

continued

Instant Recall is a very business-like program. Its command set is consistent. Its screens are clean and unambiguous. You can issue commands using an Alt-character key combination or with a mouse and pull-down menus. Instant Recall's structure is rigid but useful. You

can enter information as a note (up to about 30 pages long), a task, a schedule item, or a people (name and address) entry. An auto-dialer can call the telephone numbers in the people entries. It can run as a TSR program.

The built-in editor allows block moves

GET A JUMP ON THE COMPETITION.



Staring at your computer screen waiting for a laser to start printing eats up a lot of time.

Especially if you're using a desktop publishing program, or mixing fonts and graphics.

In fact, for all of the work you do, the true measure of laser performance is *processing time*. And compared to how painfully slow most lasers are, the new MT906 from Mannesmann Tally moves at lightning speed.

In some cases, it delivers your first page literally hundreds of times faster.

PCL Output: Ventura Publisher "Scoop"



PostScripts Output: Pagemakers, Times Roman Fonts



Seconds 60 75 90 105 120 135 150 165 180 195 210 225

This graph shows specific examples of typical time savings you can expect. It also makes our point abundantly clear. If you want to jump ahead of your competition, a lot depends on making every second count.

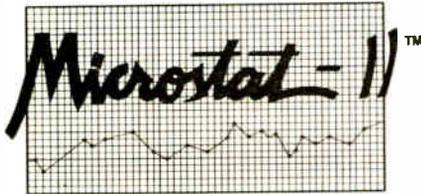
For more information about the super performing MT906, take a minute to call us toll free at **1-800-843-1347** Ext. 407

**MANNESMANN
TALLY**

Circle 167 on Reader Service Card
(RESELLERS: 168)

Dual bin sheet feeder optional. IBM, HP Series II, HP Series III, LaserWriter, Pacific Page, PageMaker, PostScript, and Ventura are registered trademarks. Mannesmann Tally, 8301 S. 180th St., Kent, WA 98032.

NEW



RELEASE

You're going to appreciate the enhancements we've made to Microstat-II, Rel. 2.5 from the new pop-up calculator with built-in statistical functions to the rewritten user's manual. Of course, we've kept those features that we're famous for:

EASE OF USE

No command language to learn and no expensive training costs. What takes 88 keystrokes on other packages can be done with four keystrokes using Microstat-II.

"... using Microstat-II is a breeze."
PC Magazine

COVERAGE

It's all there; from descriptive statistics to multivariate analysis, including discriminant, principal components, and cluster analyses plus a dozen nonparametric tests.

"... more tools at less than half the competition's price."
Reviewer Responses, InfoWorld

SPEED AND ACCURACY

Microstat-II runs up to eight times faster than other packages without compromising accuracy.

"... one of the fastest IBM PC statistical packages we have tested."
InfoWorld

"Results are unusually accurate."
Computer Language

To find out how Microstat-II, Release 2.5 can simplify your statistical workload, call or write today.

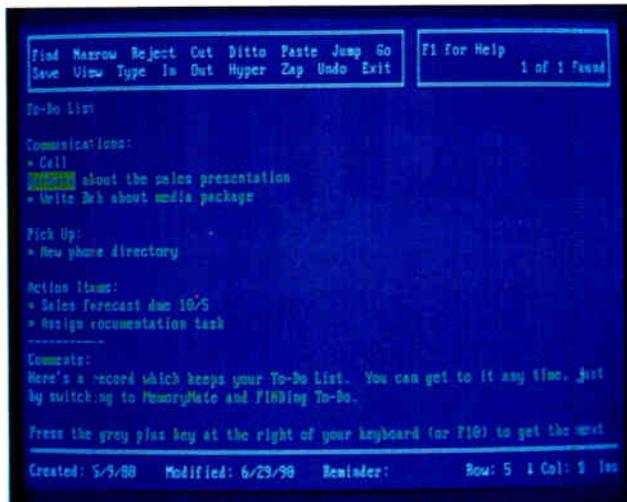
Ecosoft Inc.

8295 Indy Court • Indianapolis, IN 46214
1-800-952-0472 (Orders)
(317) 271-5551 (Info.)
(317) 271-5561 (FAX)



REVIEW

STRICTLY FOR PERSONAL INFORMATION



MemoryMate

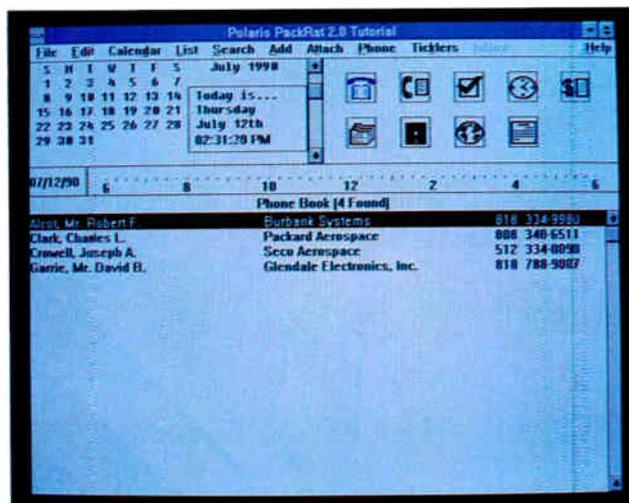
MemoryMate can help organize your scraps of diverse information in ways that make sense to you, as shown here. For people who keep lots of bits and pieces of information, MemoryMate is hard to beat.

MemoryMate is probably the best information manager available for people who hate to organize themselves. It's not fancy. It doesn't have spiffy graphics. It doesn't beep at you to remind you of that 3:30 meeting. But you can take that mess you call a desk, stuff it into MemoryMate, and voilà! You're organized.

MemoryMate, which can run as a TSR program, indexes every word you put in it. You just type in the information or import it as an ASCII file from some other source. When you want to locate something, you issue the Find command and the string you are looking for. The string

can be a word, text with wild cards, a date in the text, the date the material was entered or last revised, or a range of dates. You can use Boolean operators in the search string, too. You can also tell the program to display a memo on a specific date, and the memo will pop up automatically on that date.

However, what's important is that once you enter data, you can retrieve it with simple keyword searches, not special coding. If you're one of those people who have to deal with scraps of diverse information that comes in at random times in random ways, MemoryMate is hard to beat.



PackRat

PackRat takes full advantage of the Microsoft Windows environment to give you menus and icons that you can select that help make learning this big, complex program easier.

PackRat is a full-featured Microsoft Windows-based PIM. It was also the first major PIM written for Windows—long before IBM Current was released. It's a highly structured program. If you use PackRat, you must do things Pack-

Rat's way. Whether you like that way or not is a question of style, not of capability. PackRat is a very good program that does what it says it does, easily and reliably.

continued

We turn work into a Celebration!



- MODEL 9800**
- Programs 8 parts at a time
 - Programs up to 4 megabit parts, including single chip processors
 - Operates serial to 56Kbps or stand alone
 - Ultra fast communication software included



- MODEL 9000**
- Fastest programmer on the market
 - Quick & Intelligent programming algorithms
 - Programs up to 4 megabit parts, including single chip processors
 - Programs largest variety of chips including Prom replacements, Eproms and EEPROMs
 - Communication software included



- ROMX-2XL EPROM EMULATOR**
- Emulates 2716-27010 eproms
 - 256K to 1024K memory available
 - Battery backed up, auto emulate on power-up
 - Low-cost, pays for itself on first project
 - Free 19.2K serial communication software

QUALITY PRODUCTS MADE IN THE U.S.A.

PCSS-91W INTELLIGENT SERIAL COPROCESSOR

- Compatible with PCSS-8I
- Up to 768K of Dynamemory™
- Utilities provided to download and execute 8086 code on the board
- DOS, SCO™, XENIX® drivers

PCSS-8I INTELLIGENT SERIAL COPROCESSOR

- On board 15MHz processor handles serial communications
- 32K of Dynamemory™ included
- Reduces host processor overhead
- DOS, SCO™, XENIX® drivers

PCSS-8X SERIAL BOARD

- Eight RS232 ports per card (optional 4 port)
- All eight ports 100% DOS compatible
- 32 ports may be added to a PC
- Optional RS422 to 4000 ft.
- Interrupt driven BIOS enhancement software included

MCSS-91M INTELLIGENT SERIAL COPROCESSOR

- For Micro-Channel™ computers
- Up to one megabyte of Dynamemory™
- 9 serial channels per card

MCSS-8TX SERIAL BOARD

- 8 DOS compatible COM ports for Micro-Channel™ computers
- BIOS enhancement software included

MODEL 2020

- Low cost controller board
- RS232/485/422
- Stackable option boards

MODEL 2010 SINGLE BOARD COMPUTER

- 2010B: 8052AH - Basic V1.1 solid state EEPROM disk system
- 2010M: Machine language with built-in assembler/disassembler
- 64KByte RAM, 40 bit programmable I/O lines
- RS232 and expansion interface

PCSS-8TX SERIAL BOARD

- Compact half sized version of the PCSS-8X with RJ-11 jacks
- Order PCSS-8TH for SCO™, XENIX®

MODEL PC-64

- 64 bit digital I/O board
- Each bit programmable as either input or output

GTEK® INC.

Development Hardware & Software
P.O. Box 2310, Bay St. Louis, MS 39521-2310
Order Toll Free 1-800-282-GTEK (4835)
Fax: 1-601-467-0935
MS & Technical Support 1-601-467-8048

STEK-Registered Trademark of GTEK, Inc., Dynamemory-Trademark of BTEK, Inc. - All other trademarks are property of their respective companies.

Circle 132 on Reader Service Card (RESELLERS: 133)

World Radio History

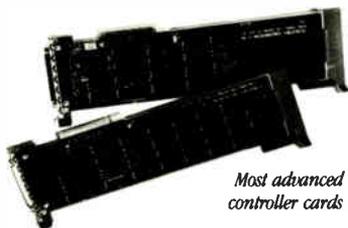
Nine Track Tape... One Track Mind.

If you can't get your mind off 9 Track Tape... there's good reason.



It's *still* the number one choice in the entire world for exchanging information between computer systems.

Using a 9 Track-Tape drive, you literally turn your PC into a mainframe.



Most advanced controller cards

We not *only* sell more 9 Track Tape drive systems than anyone else... we're known as *problem solvers*. People who develop and nurture solutions for other people. Give us a call today and let us solve your next conversion problem.

GSA# GS00K89AGS6390

FLAGSTAFF ENGINEERING
Helping people read
a world of information

1120 Kaibab (602) 779-3341
Flagstaff, AZ 86001 FAX 602-779-5998

REVIEW

STRICTLY FOR PERSONAL INFORMATION

PackRat can maintain a detailed telephone book and log information about conversations. In addition, it supports a keyword-indexed card file, with each card capable of containing 32K bytes of information. PackRat also maintains a prioritized task list, a calendar, lists of disk files, and expense records; it sorts, filters, and displays information from multiple areas (called facilities) in a

single report; and it can construct relationships among information in various facilities.

It's easy to begin using PackRat. The program's close adherence to Windows conventions is a decided plus in learning the program. However, learning to tap the full potential of PackRat requires a fair amount of application on your part. It's a big, complex program.



Who-What-When

Who-What-When is primarily a task manager, but it also helps you keep track of a large number of people. And any of those people can be easily assigned to one or more particular tasks.

Who-What-When is clearly meant to be used by managers of projects involving many people. In addition to the usual personal calendar, it automatically creates and maintains calendars for every person and project entered into the program. These other calendars are updated automatically when you delegate tasks or set milestones for projects in your personal calendar.

Although Who-What-When operates in the foreground only, it includes a TSR alarm that can pop up over other programs. It has a built-in printing format for 5½- by 8½-inch pages; these pages fit

in standard binders for paper-based personal organizers. You must supply the needed compressed-character codes for your printer.

Three programmable hot keys allow you to substitute, on the fly, your own word processor, spreadsheet, and telecommunications package for the built-in memo writer, calculator, and auto-dialer. Who-What-When also allows an unlimited number of milestones to be associated with a project, making tight controls much easier. In fact, you could say that Who-What-When is a project manager for very small projects.

Free-Form or Structured?

In deciding on whether a free-form or structured PIM best fits your needs, you should consider this: Free-form PIMs are probably better suited to people who take a more relaxed view of organizing their lives. Because such PIMs are free-form, there is no structure to figure out before you enter something—you just load the program and start typing. You can add varying amounts of structure to any of them if you want to, and you probably will. Totally free-form data

has its limitations.

Ease of use is a strong point of free-form PIMs. There are exceptions, however. For example, askSam is relatively easy to get started with if you have any experience at all with computerized databases. But becoming skilled with askSam takes time and effort, because its powerful query language is also complex.

There is no consistent design metaphor for free-form PIMs. The askSam program can support records with formal

continued

Exciting news from ACM, the society for computing and information processing...

You Could Win This Powerful AT&T 6386/25 WorkGroup System With Just A Phone Call



Call 1-800-835-2246, Ext. 80,
to enter the ACM Sweepstakes now
or mail the coupon below



GRAND PRIZE—You Get A Computer With The Works (suggested list price of the package is \$17,118* as of 7/90).

The winner receives an AT&T 6386/25 WorkGroup System (WGS) which is a 25MHz 80386 computer for intensive stand-alone or networked applications. "The Works" includes a full software package comprised of the UNIX® System V and MS-DOS® operating systems, C programming language development environment, AT&T's Simul-Task software to permit both operating systems to work together, and the OPEN LOOK® Graphical User Interface. Also included is a math co-processor, 8MB RAM, 16-color Super VGA monitor and card, AT&T 305 B keyboard, 3-button mouse, 80MB hard drive and 3.5" floppy disk drive. It even includes an AT&T 593 laser printer that is HP LaserJet II compatible and a C.P.U. floor stand.

SECOND PRIZE—You Get The Printer (suggested list price is \$1,695* as of 7/90).

This AT&T 593 laser printer operates at 300 d.p.i. for text and graphics printing, offers font downloading and macro storage, can be expanded to 4.5MB to accommodate demanding graphics applications and is HP LaserJet II compatible.

THIRD PRIZE—You Get This Modem (suggested list price is \$695* as of 7/90).



The AT&T 2224-CEO is a 2400 b.p.s., full duplex modem which stores up to 10 numbers for automatic dialing and is Hayes® compatible.

No purchase necessary. Sweepstakes open to U.S. and Canadian residents who are 21 years of age or older as of 1/31/91, and whose paid employment involves information technology. Void in the Province of Quebec and where prohibited by law. For full rules, send a stamped, self-addressed (#10) envelope to: ACM Sweepstakes Rules, 11 West 42nd St., New York, NY 10036. Limit one request per outer mailing envelope. Requests must be received by January 10, 1991. Sweepstakes ends January 31, 1991.

* ACM reserves the right to substitute alternate prizes of equal or greater value. Prices shown reflect current suggested list prices as of 7/90, and are subject to change.

UNIX and OPEN LOOK are registered trademarks of UNIX System Laboratories, Inc., in the U.S. and other countries; MS-DOS is a registered trademark of Microsoft Corporation; Hayes is a registered trademark of Hayes Microcomputer Products, Inc.; LaserJet is a trademark of Hewlett-Packard Corporation.



Association for Computing Machinery
the society for computing and information processing
11 West 42nd Street • New York, NY 10036

ACM SWEEPSTAKES ENTRY FORM

Please return by January 31, 1991. **NO PURCHASE NECESSARY TO ENTER. LIMIT ONE ENTRY PER PERSON.**

I want to win. Please check as many as apply:

- Please enter me in the sweepstakes.
 I'd also like to join ACM at the regular dues rate of \$71 (includes a subscription to *Communications of the ACM*).
Payment method: My check payable to ACM is enclosed.
 Charge my VISA® MasterCard® American Express®

Card # _____

Expiration Date _____

Signature _____

- Send information on ACM membership.
 I am already an ACM member.

Name _____

Title _____

Company Name _____

Address _____

City _____

State _____

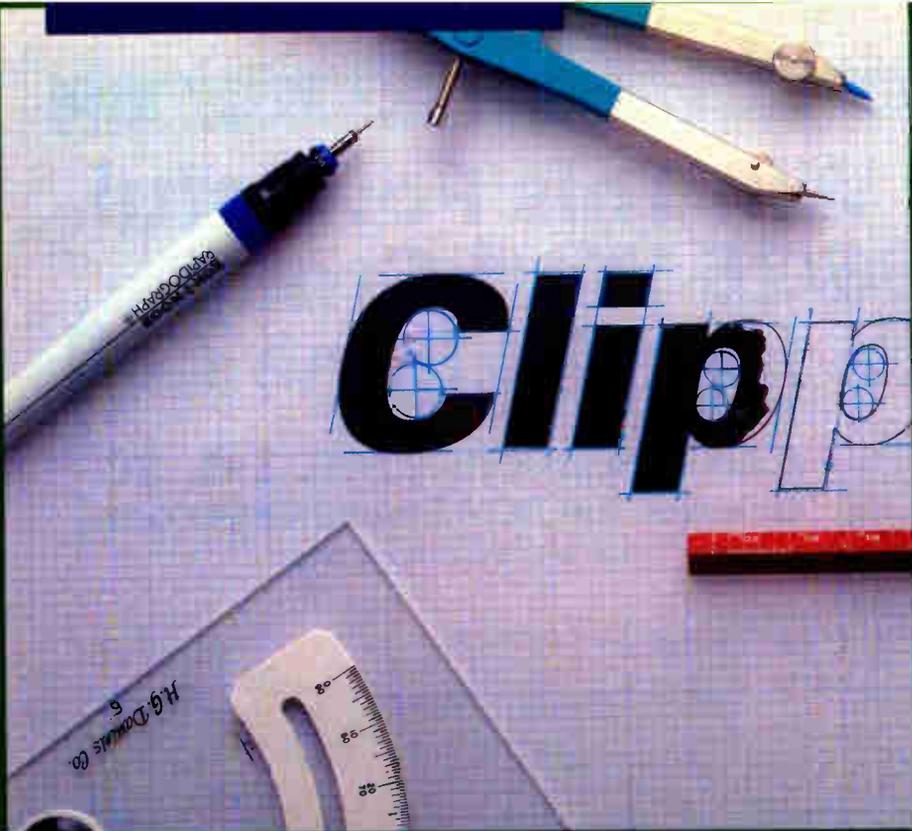
Zip _____

()
Daytime Phone _____

Mail this coupon to:
ACM SWEEPSTAKES
Association for Computing Machinery
P.O. Box 12114, Church Street Station
New York, NY 10257

M90BYTE

Circle 11 on Reader Service Card



Your Left Brain Needs Clipper.

Organization is everything in business. The left side of your brain knows this. It wants order. Economy. Precision. All reasons your left brain appreciates Clipper 5.0, the premier application development system for PCs.

An open architecture programming system, Clipper provides a flexible environment for developing precisely the application you need, not a messy approximation. Its user-definable commands and functions let you configure the Clipper language for your exact requirements. Its compiler generates .EXE files for rapid execution and cost-free distribution. Its new linker even lets you build and run applications larger than available memory! And its elegant network support yields high performance on even the largest systems.

So, if you're charged with coaxing order out of chaos for your business, put Clipper in your programming arsenal today. It has exactly the programming power you need!

Clipper 5.0

The Application Development Standard

213/390-7923

 Nantucket

Circle 194 on Reader Service Card

COMPANY INFORMATION

askSam Systems
(askSam 4.2)
P.O. Box 1428
Perry, FL 32347
(800) 327-5726
Inquiry 889.

Broderbund Software, Inc.
(MemoryMate 3.04R)
17 Paul Dr.
San Rafael, CA 94903
(415) 492-3500
Inquiry 890.

Chronologic Corp.
(Instant Recall 1.2)
5151 North Oracle, Suite 210
Tucson, AZ 85704
(602) 293-3100
Inquiry 891.

Chronos Software, Inc.
(Who-What-When 2.0)
555 De Haro St., Suite 240
San Francisco, CA 94107
(415) 626-4244
Inquiry 892.

Micro Logic Corp.
(Info Select)
P.O. Box 174
Hackensack, NJ 07602
(800) 342-5930
Inquiry 893.

ISoft Corp.
(Active Life 1.1)
P.O. Box 1320
Middletown, CA 95461
(800) 326-4391
Inquiry 894.

Polaris Software
(PackRat 2.0)
613 West Valley Pkwy., Suite 323
Escondido, CA 92025
(619) 743-7800
Inquiry 895.

fields as well as unstructured text. You can use complex Boolean searches and simple string searches to locate information. (Agenda uses data structures that are vaguely like fields, to which you can attach extended notes. In addition, Agenda can sort material automatically by keywords and dates and do simple string searches.)

Info Select is a hard-core scraps-of-paper system—its default screens even look like a littered desktop. It finds specific information using string searches.

MemoryMate mimics scraps of paper, too, but keeps them neatly out of sight until you call for them with simple Boolean searches. It supports forms with pseudofields (fields not as strongly typed as in a traditional database manager like dBASE IV or Paradox).

The structured PIMs offer diversity in their individual look and feel, too. The Microsoft Windows- and OS/2-based programs Active Life and PackRat, not surprisingly, are more graphical. But even character-based, structured PIMs, such as Instant Recall and Who-What-When, have their own personality.

An area in which the structured PIMs stand out is calendars and related tickler files. Much of what you do in your daily life is done repeatedly in predictable patterns: staff meetings on alternate Tuesdays at 10:30 a.m., semi-annual staff performance evaluations, and a mortgage payment that is due on the 23rd of each month. Each of the structured PIMs here lets you enter such information once and specify how it should be repeated. Then you can forget about any future data entry for those events. It's wonderful.

With such variety and richness of functions available, choosing a PIM for day-in and day-out use is tough. I have weaseled in my own life and use three different ones: MemoryMate, Current, and Agenda. I wish a single program would combine the features I want.

For me, MemoryMate is a sort of super notebook in which I quickly scribble down random thoughts and bits of information. Current is my daily-use PIM, functioning as an electronic Day-Timer, tickler file, people finder, and telephone book. Agenda is my tool for dealing with the large volumes of information I get electronically from on-line services and databases and for managing large-scale, long-term projects. If I were forced to depend on only one, it would be MemoryMate, because of its ease of use, flexibility, and TSR capability.

What you need in the way of a PIM truly depends on what you do. A PIM is a personal program. Don't look at just one or two and decide they aren't for you. Try a whole bunch of them. One is almost certainly what you have been looking for for a long time. ■

George Bond is a consultant in communications—electronic, traditional print, and person-to-person. He has more than 20 years' editorial and management experience with major information companies and is cofounder of BIX. You can reach him on BIX as "gbond."



Your Right Brain Wants It!

While your left brain duly notes the benefits of Clipper programming, the right half is wild about how you get them! Imagine a programming environment with no limits. The language can be easily extended with your own routines and you can even integrate code from other languages, like C and Assembler. You're always free to configure Clipper to suit your own programming style.

Hey, let's say you want to read and write data stored on larger platforms or in other PC formats. It's no problem since Clipper 5.0 sports a replaceable database driver, even allowing multiple drivers to be used concurrently in the same application. And SQL queries will be a breeze, using familiar Clipper code. There's no end to the possibilities you can pursue with Clipper!

Clipper's open architecture system will fire your imagination with unparalleled freedom. It's an unlimited palette of pigments for a developer's mind. So, if you're ready to let your imagination inspire your applications, indulge yourself with Clipper 5.0. It has everything you need with anything you'd want.

Clipper 5.0

The Application Development Standard

213/390-7923

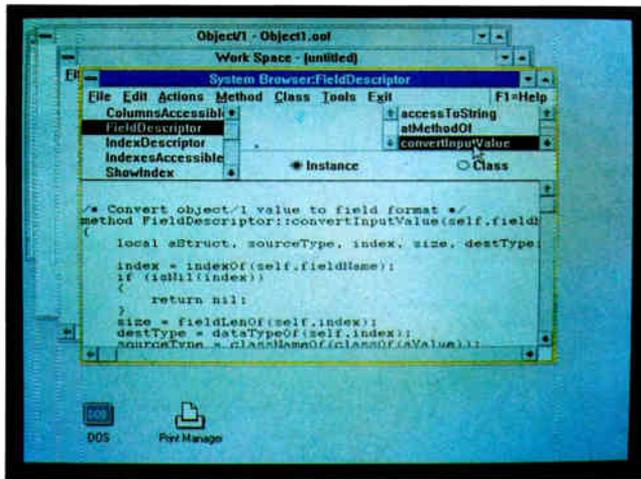
 nantucket®

Circle 195 on Reader Service Card

Nantucket Corporation, 12555 West Jefferson Boulevard, Los Angeles, CA 90066. 213/390-7923 FAX: 213/397-5469 TELEX: 650-2174125. Nantucket, the Nantucket logo and Clipper are registered trademarks of Nantucket Corporation. Other brand and product names are used for identification purposes only and may be trademarks or registered trademarks of their respective holders. Entire contents copyright © 1990 Nantucket Corporation.

REVIEW

Speaking OS/2's Native Language



Object/1 is a pure object-oriented environment for programming under OS/2's PM. Its appearance is Smalltalk-like, with the object browser, source code editor, and interface builder integrated into the total package.

Graphical user interfaces, including OS/2's Presentation Manager, create object-oriented environments for users. Each mouse-sensitive region, be it an arrow on a scroll bar or an icon, is an object in the truest sense. Yet most PM programs are still being written in languages, such as C, that have no innate understanding of objects. As a result, programmers have to translate their designs to a non-object-oriented approach.

Object/1, a PM application development system from MDBS, is at the forefront of OS/2 software technology in several ways. The C++-like programming language is fully object-oriented. The forms painter tool for designing PM screens builds interfaces that require a

minimum of procedural code to manage. Object/1 includes a relational database manager (called TBL), plus a tool for laying out the design of your relational tables. The source code browser understands the object-oriented terminology and mechanisms of methods, classes, instances, and inheritance. You can also use Object/1 to develop Systems Application Architecture-compliant user interfaces.

The Rundown

I tested Object/1 using a 12-MHz AT clone running OS/2 Standard Edition 1.2 with 4 megabytes of memory and a Microsoft Mouse. Object/1 requires a minimum of 4 MB of RAM. If you choose to load the demonstration and tutorial files, it takes up about 4 MB of hard disk space.

The core of Object/1 is a 140K-byte kernel/interpreter program. This kernel runs an application-specific image file of compiled classes and methods. The default 780K-byte image file that is supplied with Object/1 provides the development environment in which you create applications. Each application that you develop consists of the application image file, any data files you need to distribute, and a copy of the kernel/interpreter program file.

The Object/1 development environment is comprehensive. It includes a set of browsers (object-oriented editors) for viewing and modifying classes and their methods. In addition to the screen and database design tools, the environment includes a debugger, tools for tracing the hierarchy of class and method relation-

ships, a useful tutorial, and the source code (1.4 MB worth) for the built-in classes. Getting the class source code is equivalent to getting library source code when you buy a C compiler—a definite advantage, even if you only use it for reference.

The Object/1 documentation consists of a 130-page tutorial and a 790-page reference manual. The reference manual is broken down into sections: operations guide, developer's guide, TBL database interface, MDDBS IV database interface, Structured Query Language (SQL) Server database interface, class reference (the largest section), and a TBL reference.

Although the tutorial warns that it is not a comprehensive introduction to object-oriented programming, I put it to the test by asking a C programmer friend to run through it and give me his comments. When he finished, he and I both agreed that this first introduction to OOP was more than adequate and that he was ready for more advanced, real-world programming.

In the class reference section, each class is described in terms of its superclass, its subclasses, its stability (likelihood of changing in later releases), and its methods. The methods (functions) of a class are shown as either class methods (those that you can use to create a new instance) or instance methods (those that you can use to manipulate an existing instance). The library of methods you get with Object/1 encompasses just about everything you might want to do under OS/2 and PM.

The class reference section is useful, but I found the descriptions of most methods too terse. To Object/1's credit, though, the supplied source code is an easy-to-use adjunct to the class reference. You can arrange and view the source files by hierarchical category or in simple alphabetical order. I also found the library source code to be well commented and modular.

The Language of OOP

The Object/1 language is more like Smalltalk than like C++. Even so, programmers familiar with either C or C++ will find the transition to Object/1 syntax and semantics an easy one. The most difficult aspect of the adjustment for a traditional C programmer is the lack of procedural (non-OOP) facilities. While C++ adds OOP to an existing procedural language and lets you drop back to old-style C coding practices, Object/1 is a pure OOP environment. For example, it discourages global variables. And it does

continued



Object/1 version 1.0

Company

MDBS, Inc.
1834 Walden Office Sq., Suite 250
Schaumburg, IL 60173
(708) 303-6300

Hardware Needed

IBM AT, PS/2, or compatible with a hard disk drive and 4 MB of RAM; a mouse and a VGA display are recommended

Software Needed

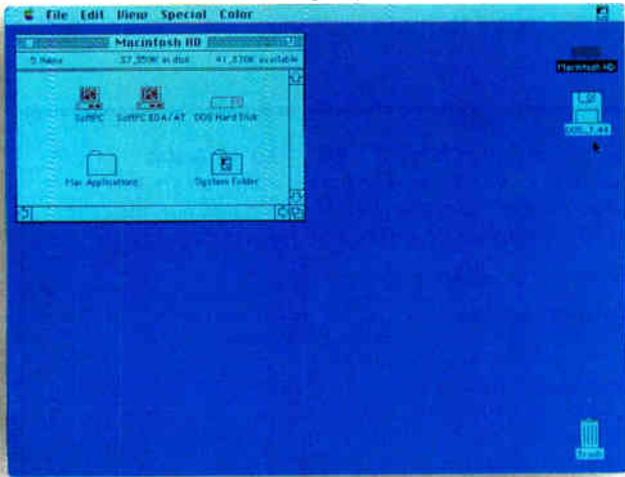
OS/2 1.1 or higher

Price

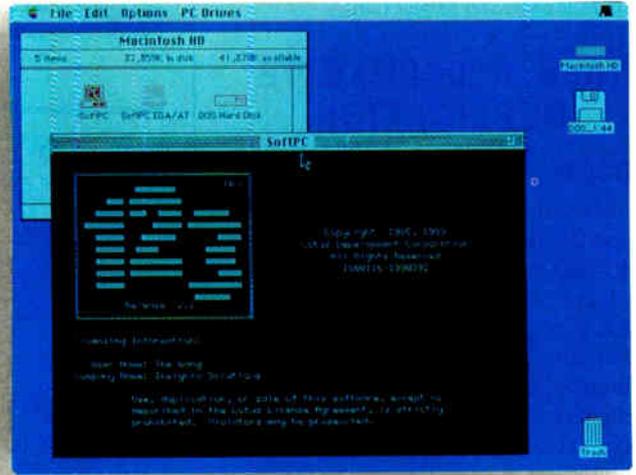
\$995

Inquiry 887.

The floppy disk icon "DOS-1.44M" is actually an MS-DOS® disk, brought to you by AccessPC™



Shown: Lotus® 1-2-3® release 2.2, running in SoftPC® with EGA/AT Option Module™



Click, It's A MAC.

Click Click, It's A MAC And A PC.

Load SoftPC, click twice, and you've got a window wide open to the entire MS-DOS world. Everything a Mac can do plus everything a PC can do, in one machine.

Whether you're a Macintosh user who needs access to PC software and data, or a PC user who wants to go Macintosh without losing PC compatibility, you can have it all with Insignia's best-selling software solutions.

SoftPC is a software emulation precise enough to run the toughest PC applications—Norton Utilities, Lotus 1-2-3, Harvard Graphics, AutoCad, even custom development programs. You get *complete* XT or AT compatibility for the SE/30, Macintosh II family and the Macintosh Portable.

Add an EGA/AT Option Module, and get vibrant EGA color compatibility, LIM expanded memory and math coprocessor support.

New AccessPC lets you use PC and PS/2 disks just like Mac disks. Now you can move and view PC file and disk icons—even in locked or full disks!—format DOS disks, launch Mac applications and much more.

For more information and the name of a SoftPC dealer near you, call Insignia at 800-848-7677 (U.S. only) or 408-522-7600 (outside U.S.).

Insignia™



Insignia Solutions, Inc. 254 San Geronimo Way, Sunnyvale, CA 94086. Fax: 408-733-9541. We give a SoftPC (retail \$399) or AccessPC program (retail \$129) away to a caller selected at random. SoftPC is a registered trademark and AccessPC is a trademark of Insignia Solutions, Inc. Other product names are trademarks or registered trademarks of their respective owners.

Circle 147 on Reader Service Card

TAPE AND DISKETTE DUPLICATION

CD2000 - DUPLICATOR

- Simultaneous Tape Duplication
- QIC, DEC, IBM, HP and 1/2" tapes
- Also Exabyte, DAT and Optical
- Versatile, Cost Efficient
- Upgrade to High Capacity Systems



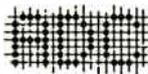
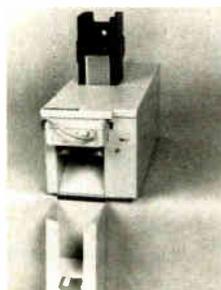
LLP - LOADER, LABELER, PRINTER

- 3.5" Diskette Duplication
- Loads, Labels and Prints Custom Labels
- Easy to Operate, Unattended
- Wrap around or flat labels
- Serialized or Single Copies with Serialized Labels



RDH 3.5 LC - ROBOTIC DISK HANDLER DUPLICATOR

- Solution for 3.5" Diskettes, IBM or Macintosh
- High Volume
- Low Cost



**APPLIED DATA
COMMUNICATIONS**

14272 Chambers Road
Tustin, CA 92680-6998
(714) 731-9000
Fax (714) 838-7172

US - 1 (800) 221-5486
In Calif. - 1 (800) 334-5486
European Inquiries: ADC GmbH
Mainhausen, West Germany
Phone 0 61 82-2 10 04
Fax 0 61 82-39 22

Distributors Welcome

DEC is a trademark of Digital Equipment Corporation.
HP is a trademark of Hewlett Packard. IBM is a trademark of International Business Machines. Exabyte is a trademark of Exabyte Corporation. Macintosh is a trademark of Apple Computer.

Listing 1: Bound to a graphical button labeled "Add," this method is activated every time you click on the button. The button itself was created interactively with the forms painter. Creating the PM button and handling the associated action would have been more complex and time-consuming in C.

```
/* Add the current information to the contact/company database. */  
  
method SalesLeads :: add (self, mp2, mp2)  
{  
    local hPointer;  
  
    /* Show an hourglass for the mouse cursor */  
    hPointer = setPointer (systemPointer(SPTR_WAIT));  
  
    /* add the record */  
    addRecord (table, fillFromScreen(self));  
  
    /* Reset the mouse cursor */  
    setPointer (hPointer);  
    return nil;  
}
```

not provide the means to code methods that are not associated with a particular class. Why? It's easy in C++ to fall into the bad habit of coding global variables and non-OOP functions, even though you intended at the outset to stay within the bounds of good object-oriented style. Bad habits come back to haunt you during the testing and maintenance phases. Most bugs and time-consuming work-arounds are attributable to the non-OOP code. These pitfalls are not present in Object/1.

However, if you find pure OOP too restricting, Object/1 has an escape mechanism. You can easily interface to Object/1 code with dynamic link libraries. By supplying some functions in a DLL (you will need a separate C compiler to build it), you can, if you wish, develop a portion of your application in a procedural fashion.

Listing 1 is an example of Object/1 code. It is an `_add_` method that is automatically invoked when the user clicks on the Add button. This automatic invocation is established in the forms painter. The `_add_` method sends an `_addRecord_` message to a relational table stored in the `_table_` instance variable.

Designing and Using Forms

Besides letting you place push buttons, list boxes, dialog boxes, menus, entry fields, and other PM objects exactly where you want them, the forms painter uses your design to generate Object/1 source code that implements the screen you have laid out.

When a window control is activated at run time, the generated code makes the control behave predictably (e.g., list boxes know how to scroll, text editors know how to accept input, and push buttons can be pressed).

Controls pass data to your application through methods. Object/1 generates a source code template for each method; you then edit the generated source code to make it perform the specific task you want. For example, you might place a push button on the screen, label it "Add," associate it with a method called `_add_`, and then write the code given in the listing. At run time, when the user of your software clicks on the Add button, the method you have coded is automatically invoked.

Much of the productivity gain you realize under Object/1 is achieved in the forms painter.

Databases, Data Exchange, and Browsers

TBL consists of a library of methods for defining and manipulating data tables. Through them, you can create new tables and records and perform other traditional DBMS tasks. Record retrieval via multi-field indexes is supported, as well as field-at-a-time updating. TBL provides record-locking and network error-trapping mechanisms so you can write multi-user applications that run on an OS/2-based LAN.

TBLDesigner is an Object/1 tool for designing your application's relational tables. You open TBLDesigner, a PM window like the rest of Object/1, by selecting Tools and then TBLDesigner from one of the Object/1 browser windows. As you define a field, you can specify the field name, a field description, access codes (for field-level security), field length, and data type. The data type can be one of the following: logic (Boolean), integer, numeric (float/double), or string. In addition, you can specify that one or more of the fields be an

continued



SHARP PRESENTS THE CASE FOR A VGA 286 NOTEBOOK COMPUTER.

VGA DISPLAY.

The first in a notebook computer. It's bright, paper-white, with a crisp 640 x 480 resolution and 16 shades of gray.

TRUE NOTEBOOK SIZE.

8.5" x 11" x 1.4",
4.3 lbs.



12Mhz 286.

Runs the latest software with exhilarating efficiency. And it's fully expandable.

20MB HARD DISK.

With a speedy
23ms access time.

THE PC-6220.

About the only thing you don't get with the Sharp PC-6220 is another piece of luggage to carry. It's a mere 8½" x 11" and weighs only 4.3 lbs., yet has the kind of power you need. To run Windows™. To do desktop publishing. To have instant access to your programs and files.

Find out how you can put a serious computer in your briefcase. Without taking everything out of it. Call 1-800-BE-SHARP.

SHARP
FROM SHARP MINDS
COME SHARP PRODUCTS™

index into the table you design.

Object/1 library routines for accessing MDBS IV and SQL Server databases are also supplied.

The Dynamic Data Exchange protocol consists of interprocess messages and guidelines that OS/2 PM applications can use to share data. Object/1 provides methods (in compiled and source code form) that you can use to signal other DDE-conforming applications.

Methods are also provided for the ac-

tual sharing of data. The classes related to DDE are the DDE class, DDE client class, and DDE server class. Some of the methods in these classes are `_buildDDE_`, `_getFormat_`, `_postDataResponse_`, `_execute_`, and `_postData_`. It's fairly easy to use these DDE methods to, for example, import and export data to and from such DDE-conforming PM applications as Microsoft Excel.

Object/1 uses the concept of a browser for the editing and inspection of source

code. Fully integrated within the Object/1 environment, a browser can be used to collect a set of system-supplied and programmer-written methods into a project (application). A list of methods is displayed in a list box; you can see the source code for a method by simply selecting the method's name. You can elect to sort the contents of the list box alphabetically for easy searching or by class hierarchy.

The system browser is augmented by the heritage browser, the implementors tool, and the senders tool. You use the heritage browser to see the class name, the associated methods for the current class, and the superclasses for that class. The implementors tool displays the classes that contain a given method. You use the senders tool to see which methods use another given method.

Help for PM

The inspector tool is a debugging aid that lets you view the instance variables of an object. The debugger tool is activated when the notifier tool displays a run-time error message, which in Object/1 can often be that a class receives an unrecognized message. A list box of message events is displayed; as you select an item, the source code of the method is shown along with the variables associated with the method. Selecting a variable displays its current value. You use the breakpoint tool to set breakpoints in a method. When a breakpoint is reached, a breakpoint dialog box appears, and you see the sequence of messages that have been sent, along with the source code of the methods and the values of variables associated with those methods.

I found the debugging aids supplied with Object/1 to be some of the friendliest and most helpful I have ever seen. Even when a run-time error occurred as the result of a coding error on my part, I could easily see the history of message events and the values of variables at the point of error. I could quickly figure out what I had done wrong.

If you have developed PM applications in C before, you know how time-consuming and error-prone it is to set up and manage a PM window and all its objects. The Object/1 environment relieves you of much of the dirty work and lets you concentrate on the application itself. It is also an interesting, useful implementation of OOP. ■

Barry Nance is the author of Network Programming in C and works in the R&D department of PRC, Inc. (Hartford, CT). He can be reached on BIX as "barryn."

PC T_EX

Makes Your Best Work Look Its Best.

For professional publishing and the power to produce high-quality technical documents, scientific notation, mathematical formulas, and tables, rely on PC T_EX to make your work look its best.

And with Personal T_EX's Fontware Interface package, you have access to the complete library of Bitstream Fontware, for type selection and quality previously available only to professional typographers.

The next step beyond standard desktop publishing, PC T_EX is the difference between average and expert. With PC T_EX you'll get professional typesetting at amateur prices.

PC MAGAZINE wrote: "(With PC T_EX)... you can achieve incredible precision in formatting text, especially mathematical expressions."

INFOWORLD said: "... No non-T_EX-based program has such typographical aesthetics... enormously flexible..."

New PC T_EX 3.0, with double the page-building capacity, is now available. For 386 computers, there's PC T_EX/386 and Big PC T_EX/386.

For a product catalog and free demo diskette, call

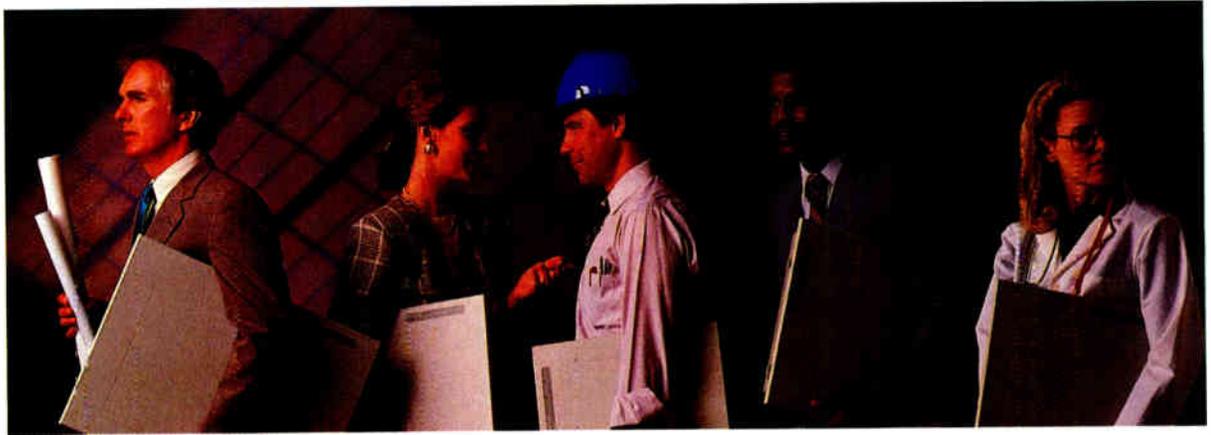
415/388-8853. See the best for yourself.



12 Madrona Avenue
Mill Valley, CA 94941

PC T_EX is a registered TM of Personal T_EX, Inc. T_EX is an American Mathematical Society TM. Bitstream and Fontware are trademarks of Bitstream Inc. Site licenses available to qualified organizations. Inquire about PTI distributorships. This ad was typeset using PC T_EX and Bitstream fonts.

Finally. An input device based on your input.



Introducing SummaSketch® II.

New Limited
Lifetime Warranty

The new SummaSketch II tablets were created with one thing in mind—you, the people who use tablets every day. You said you wanted a complete plug and play package, so we're giving you the works—both in PC and Macintosh® SE and II versions. A 12" x 12" or 18" x 12" graphics tablet with a 4-button cursor and 2-button stylus, or 16-button cursor for the PC.

The PC version includes interface cables for the IBM® PC, AT, PS/2 and compatibles. A utilities diskette with test and reset software, an Autodesk® Device Interface™ driver, Universal Mouse Emulator™ and a Microsoft® Windows driver. And an offer for

a free tablet template (US and Canada only) worth over \$245.

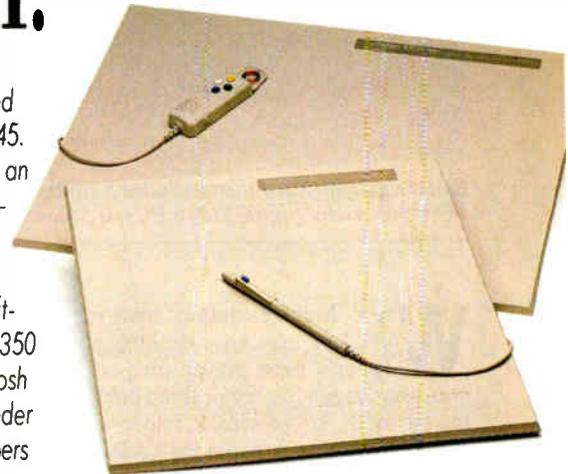
The Macintosh version has an Apple® Desktop Bus™ interface device to connect the tablet to the computer.

You'll also get the most software compatibility with over 350 PC programs and all Macintosh SE and II software written under the Apple Software Developers guidelines.

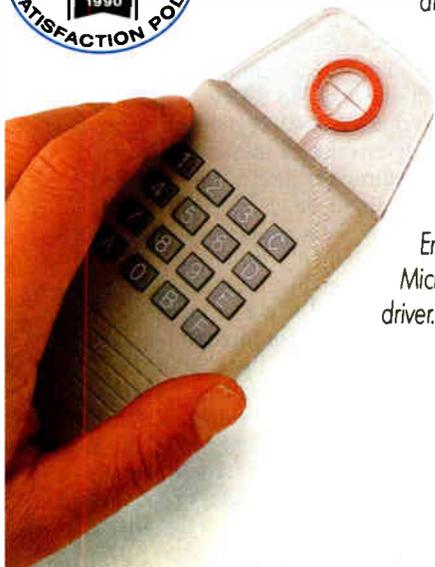
SummaSketch II tablets have a standard accuracy measurement of ± 0.015 inches, selectable resolution of up to 1,016 lines per inch and high proximity so you can trace from documents up to 1/2" thick. Add in convenience features such as a power/proximity light, on-off switch, wedge shape design for easy use, lightweight construction for portability—and it's easy to see why SummaSketch is the industry standard and the

obvious choice of today's computer professionals.

Best of all, you get all of these benefits at an affordable price. And that's why our new SummaSketch II is the easiest buying decision you have to make. Find out more about SummaSketch II today. For literature and the name of a local dealer call 1-800-888-2028, Ext. 304. For technical information call 203-881-5400.



November 28, 1989
SummaSketch II



Summagraphics™

Every decision should be this easy.™

© 1990 Summagraphics Corporation.
Seymour, CT 06483 • All rights reserved.

For IBM/Compatible information circle 277; For Macintosh information circle 278; For Dealer inquiries circle 279 on Reader Service Card.

World Radio History

REVIEW

Dual-Page Duel: Two High-Resolution Monitors Square Off



Radius's 21-inch monitor includes a controller-based VGA chip and supports either PCs or Macs.



Cornerstone's DualPage PC offers 1600- by 1280-pixel resolution and an upgrade path to 4 or 16 gray scales.

While high-resolution, two-page displays may be a desktop publisher's most prayed-for peripheral, they're not just for desktop publishing anymore. Large-screen, paper-white monitors are also a staple for CAD, and they're making inroads in other areas. Spreadsheet users can increase productivity with a monitor that shows significantly more cells. Multitasking applications, such as Windows 3.0, make use of large-screen displays, too.

The bottom line is that high-resolution monitors, like Radius's new TPD/21 and Cornerstone Technology's DualPage PC, are becoming mainstream items in the PC market. With one or two caveats, both of these monitors perform up to specifications (see the table).

Two-Page Basics

Both of the reviewed monitors come with a dedicated 16-bit controller (which can also be used in an 8-bit slot). Each also has a tilt/swivel stand, plus video and AC inputs. Spartan controls consist of an on/off switch, an LED power-on light, and brightness and contrast knobs; I would also have liked to have vertical and horizontal size and positioning controls. Depending on which controller card you buy, the Radius TPD/21 runs with Macs

or PCs, so it includes an A/B switch that alters the image size to conform to Mac or PC standards.

When they're the only monitor on a system, both products can display virtually any low-resolution software program in Hercules 720- by 348-pixel mode. But to see applications like AutoCAD and PageMaker in high resolution, you'll need proprietary drivers supplied by Cornerstone or Radius. Among the programs that both monitors support are Aldus PageMaker, Autodesk AutoCAD, GEM/3, Lotus 1-2-3, Microsoft Windows (at press time, both vendors had announced plans to ship Windows 3.0 drivers), Microsoft Word, WordPerfect, Xerox Ventura Publisher, and ZSoft Publisher's Paintbrush. I tested the monitors with Windows, PageMaker, 1-2-3, Ventura Publisher, and others, and encountered no problems with the drivers of either unit.

Radius's Contrasts

The Radius TPD/21 is a study in pluses and minuses. Its 21-inch screen is bigger than most in this product area—ostensibly a plus. But its top resolution of 1280 by 960 pixels is in the low end of the high-resolution spectrum.

In addition, the TPD/21 is effectively

a monochrome monitor. Although it can display 16 shades of gray in the VGA mode, it is limited to black and white in the higher resolutions for which it was designed. Look for future incarnations to offer PC users gray-scale capabilities, as Radius currently does in the Mac market. But the TPD/21 offers an important plus for users of PCs and Macs: It works with both computers (the PC interface card costs \$795; the Macintosh interface card costs \$595).

I found the TPD/21 easy to install, despite its lack of a centralized installation utility. The documentation is clearly written and easy to follow. One drawback is that the TPD/21 driver disk separates driver utilities into subdirectories. Each subdirectory has its own README file that tells you how to install its particular driver. This requires you to root around more than with the installation utilities offered by most other display manufacturers. But it's more flexible—you don't have to run through the whole program to tweak the installation later.

One of the TPD/21's best features is its controller-based Paradise VGA chip and standard display connector. This allows you to attach a multiscanning monitor. With both monitors plugged into the board, the system automatically switches



back and forth from color VGA on the smaller monitor (when you access non-high-resolution programs) to the large screen (when you enter high-resolution software). You can rig up two monitors on the Cornerstone DualPage PC, but the Radius method is much easier to install and use.

The TPD/21's 1280- by 960-pixel resolution offers large, dark characters and shapes that have a clean, angular look. There's something evocative of the Macintosh look and feel in its overall color and patterning. That's not surprising, considering its heritage. Along with its 19-inch TPD/19 brandmate, the TPD/21 is the first Radius product for the PC.

The company's long association with Apple computers doesn't seem to have caused quirks for PC users. The only PC problem I found was in the BNC video connector: It's too big for the slots of the IBM XT and many AT-class computers. I couldn't get the BNC connector close enough to the card to be turned down and seated properly. Even so, the video quality was not affected, and the connector wasn't so loose that it ever fell off.

DualPage Gray Shades

The Cornerstone DualPage PC is a class act with some significant performance advantages. It offers a fairly high 1600-by 1280-pixel resolution. Also, while the monitor tested for this review was black and white, 4 or 16 gray shades are available optionally from Cornerstone. And for \$875, you can upgrade your display adapter to provide 16 gray shades later on. Few programs or monitor drivers take full advantage of gray-scale capabilities, with Xerox's Ventura Publisher being a notable exception on the DualPage. You can expect this to change as the number of Windows 3.0 applications and drivers increases. Gray-scale capabilities are particularly important for desktop publishers who regularly scan photographs.

Besides accessibility to gray shades, DualPage provides a centralized and efficient driver installation program. But in general, installation is not as easy as with the Radius monitor. If you normally use a color monitor, you must use your system's setup program to default to monochrome. This may also involve a DIP-switch change. The documentation, while technically correct, is aimed at the 16-shade product, so some specific information, such as noting differences in program menus, is missing.

Images have a neater, trimmer, more finely rounded appearance on the DualPage than on the TPD/21. The only

TPD/21

Company
Radius, Inc.
1710 Fortune Dr.
San Jose, CA 95131
(408) 434-1010

Hardware Needed

IBM AT or XT/AT compatible (the interface card is too large to fit into an IBM XT case)

Price

As reviewed (includes display, \$1795, and TPD/PC interface card): \$2590

Inquiry 852.

drawback was that characters were sometimes not as dark as I would have liked.

Eyeball and Time Tests

Both monitors displayed some distortion. On the DualPage, the image area was not perfectly square, so images drooped downward slightly along the top left corner a couple of inches from the vertical edge. A similar flaw appeared on the TPD/21 screen, except that the distortion area was in the lower right corner. I've yet to see any monitor that doesn't have some distortion of this type, and neither flaw was particularly noticeable.

I determined screen-response times with scroll tests using PageMaker documents. I used a three-page document with text in several faces and fonts, Encapsulated PostScript art, and a TIFF photo. My test system was a 33-MHz 386 AT-class machine. I measured the time it took to scroll horizontally across a PageMaker fit-in-window-size two-page spread. In the one-page test, I started scrolling from the center position to the

DualPage PC

Company
Cornerstone Technology, Inc.
1990 Concourse Dr.
San Jose, CA 95131
(408) 435-8900

Hardware Needed

IBM AT or compatible

Price

\$2495

Inquiry 853.

right edge of the right page. The two-page test started from the left edge of the left page and ended at the right edge of the right page. The screen-update test involved resizing a block of text in the upper left corner of the left page.

Both monitors completed the single-page horizontal scroll in 3.1 seconds. The DualPage performed two-page scrolls in under 7.4 seconds, while the TPD/21 pulled it off in just under 7 seconds. The two monitors tied at 7.8 seconds in redrawing a two-page screen after a type-size change.

Image size is the true measure of screen size. The 19-inch DualPage displayed a 17¾-inch image area; the TPD/21 spanned 19½ inches, which is roughly comparable considering their tube sizes. Even so, when it comes to showing two full pages on the screen, the two monitors are roughly equal. In PageMaker's actual-size page mode, I counted 13 horizontal PageMaker screen inches of a two-page spread on the DualPage.

continued

FEATURES

Although the Radius TPD/21's two-page screen is larger, the Cornerstone DualPage PC surpasses it in resolution and gray-scale capability.

Product	Screen size (inches)	Maximum resolution (pixels)	Refresh rate (Hz)	Video bandwidth (MHz)	Gray levels
Radius TPD/21	21	1280 × 960 (1152 × 882 on Mac)	65 (71 on Mac)	100	Black and white in high resolution; 16 shades in VGA mode
Cornerstone DualPage PC	19	1600 × 1280	67	200	Black and white (can be upgraded to 4 or 16 gray shades in high resolution)

while the TPD/21 showed only ½ inch more. When you consider that you might have as much as 2 inches of gutter between the two pages, you really need about 15 PageMaker inches to see the full width of a standard spread.

You might expect that from Radius's 21-inch monitor, but you won't get it. The reason is that the controller is exactly the same as the one used for Radius's 19-inch monitor, for which it was developed. So, rather than getting more of the page on the screen, you're seeing what the 19-inch monitor would show you, only about 10 percent larger.

For some applications, such as spreadsheets, this may be a boon. But for desktop publishing, it can be frustrating. This is generally not true on the DualPage. On the DualPage screen, an 8½-inch-wide page measured 8¾ inches—an acceptable margin of error. Although the Radius 19-inch monitor wasn't tested for this review, it should have a similar margin of error, so desktop publishers concerned about accurate sizes should investigate the smaller model.

Both products performed admirably in showing side-by-side pages in PageMaker's fit-in-window mode. Times Roman text appeared legible to 9 points on the TPD/21; on the higher-resolution DualPage, I read Times Roman as small as 7 points. At actual size, I could read down to 6 points on the DualPage, and to 7 points on the TPD/21.

Customer service and technical support at both companies were prompt and accurate. Even when I gave the technical-support representatives a hard time by deliberately "misunderstanding" their instructions, they remained calm, polite, helpful, and knowledgeable.

The Winner Is . . . ?

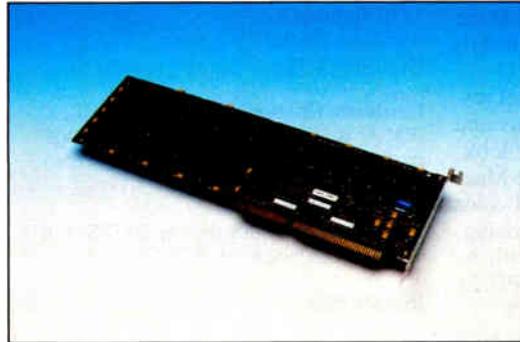
In the end, there's no clear-cut winner. If gray-scale capability and high resolution are paramount on your list, the Cornerstone DualPage is your choice. However, if you run PCs and Macs side by side and can live without higher resolution and a sure gray-scale upgrade path, opt for the Radius TPD/21.

If you're not interested in gray shades and do not use a Mac, the decision becomes largely one of personal preference. All other things being equal, I would give the nod to the DualPage for its higher resolution. ■

J. Scot Finnie is a freelance editor, writer, and consultant based in Ridgefield, Connecticut, who specializes in computer topics. He can be reached on BIX c/o "editors."

REVIEW

Flashdisk: Not Your Father's RAM Disk



Sixty-four Intel Flash chips make up the Flashdisk's memory. Similar to EEPROMs, the CMOS chips can be electrically erased and reprogrammed 10,000 times.

When I first received Digipro's Flashdisk board, I assumed it was just a very large (8-megabyte) RAM disk card. Wrong.

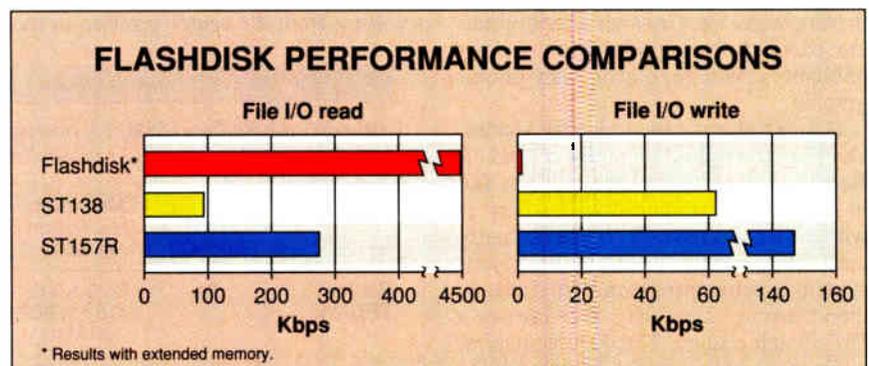
Flashdisk is a nonvolatile memory storage device that fits into a full-length 16-bit slot. It emulates a hard disk drive while also offering long-term data storage: The memory chips are guaranteed to hold data for up to 10 years. This makes it ideal for read-intensive applications where files are seldom, if ever, changed. Digipro recommends Flashdisk for storing large database files, compilers, graphical user interfaces, network-control software, and CAD libraries. In addition, you can use the board to store process-control software so that even if a computer shuts down due to loss of power or hard disk failure, your control program is safe. You can configure the Flashdisk board to become your boot drive. You can even transfer large volumes of data in solid-state form by just

moving Flashdisk from one computer to another.

Faster Than an EEPROM

The Flashdisk memory is composed of 64 1024K-byte (128K-byte by 8-bit) Intel 28F010 Flash Memory chips. These CMOS chips are electrically erasable and reprogrammable devices. They function similarly to EEPROM (electrically erasable programmable ROM). But because of their CMOS construction, Flash chips offer much faster performance than do EEPROMs. Flash chips require 1 second for electrical erasure and 2 seconds for reprogramming, and they have an access time of 135 nanoseconds for high-performance reads. (A typical hard disk drive requires up to 85 milliseconds for a read operation.) According to Intel, you can erase and reprogram Flash chips a minimum of 10,000 times.

But saving files on the Flashdisk is a lengthy procedure, with the Digipro TSR



Flashdisk showed markedly different results when performing file I/O reads and writes under the BYTE DOS Benchmarks (version 2.0). Here, the BYTE Lab compares performance against the Seagate ST138 and ST157R hard disk drives. All tests were conducted with a 6-MHz AT clone; higher numbers indicate better performance.



Flashdisk

Company

Digipro, Inc.
102 Lowry St.
Huntsville, AL 35805
(800) 662-6802
(205) 536-2047

Hardware Needed

IBM PC or compatible with an available
16-bit expansion slot

Price

Base model with 2 MB of RAM: \$1199
As tested with 8 MB of RAM: \$3349

Inquiry 881.

software often displaying the message "Writing FLASH Buffer," while the Flash memory chips play catch-up with the rest of the computer. And once a file has been deleted, it is gone for good—it cannot be recovered with any utility program.

Installation is quite simple: You just insert the board into any 16-bit slot. Flashdisk comes with several software utilities and drivers. Among them are programs that format Flashdisk, a TSR program that automatically saves files to Flashdisk, and a program that restores the Flashdisk file access table if it's lost due to a faulty write operation. Device drivers include one that sets the I/O port and memory addresses and another that enables use of extended memory.

Also, there is FLASH.EXE, which installs or removes the TSR software that allows reads and writes to Flashdisk. Flashdisk requires 256K bytes of RAM for its buffer. FLASH.EXE can configure the board to use main system, extended, or expanded memory. You can use multiple Flashdisks in one computer.

An Odd Hard Disk Drive

The board behaves like an odd hard disk drive. The characteristics of the Flash chips mean that a write operation takes a long time, while a read operation is very quick. I ran some of BYTE's hard disk benchmark programs to compare Flashdisk's read and write speeds to those of

hard disk drives. As the figure shows, the read times for Flashdisk are very fast, from over 15 to almost 50 times faster than the mechanical drives on the same or faster computers. The file I/O write times are very slow, with Flashdisk barely keeping pace at 1.63 kilobits per second. Digipro describes the Flashdisk as a ROWS (read often, write seldom) drive.

To test reliability of the data stored, I filled the Flashdisk with 8 MB of files and then removed the board. Whenever I reinstalled the board, all the files were intact.

With its base price of \$1199, Flashdisk is an expensive storage device that I don't expect every computer user can justify. But for those who work with large database files, CAD libraries, and network-control software, its reliability comes at a reasonable cost, especially when compared to the price of uninterruptible power supplies and redundant hard disk drives that provide a similar degree of data security. ■

Stanley J. Wszola is a testing editor/engineer for the BYTE Lab. He can be reached on BIX as "stan."



PUT YOUR
CUSTOMER SERVICE CENTER
ON BIX

■ BIX is more than just a great on-line information service. It's a community made up of thousands of the most serious computer users in the world; people like your customers, who are always on the look-out for the latest innovations and information regarding both hardware and software. Now you can set up shop in this electronic neighborhood with your own BIX *Technical Support Conference*. That way, you can give your customers all the product information and technical support they need. Use it to post updates or fixes for your customers to download at any time. If your company doesn't operate an 800 number, a BIX conference is an inexpensive alternative. Or it can back up an existing 800 line. And when you establish a BIX conference you'll enhance your product's value because you'll be able to offer your customers special rates on BIX subscriptions. For all the details, call Customer Service at: 1-800-227-2983 (in NH, call 603-924-7681).

BIX

Just ^{me} and ^{my} Shadow

REGISTERED
TRADEMARK
REGISTERED
HOSPITALITY PROFESSIONAL
ColoriX
THE PIXEL PROJECT™



Curtains rise to a brilliant display of 256 colors at 1024 by 768.

At first glance, you think you may recognize this superstar. The spotlight focuses . . . **The Shadow**, a 1 MB VGA Card, takes center stage revealing the virtuoso.

The Shadow skillfully moves with lightning speed across the stage with its built-in cache memory FIFO's, delivering ultimate high speed performance in bus interface and memory updates. Clock rates of up to 65 MHz are measured as the audience watches in awe.

Harmonizing with its supporting players, EGA, CGA, MDA, and Hercules, the artiste effortlessly executes vertical panning and scrolling, horizontal panning and scrolling, and split screen while displaying mixed graphics and text windows.

The drama heightens as **The Shadow** easily slips into both interlaced and non-interlaced modes in one configuration.

He adroitly upgrades from 256K to 512K to 1MB without skipping a beat. The chip count is concise . . . a reduced number to ensure reliability and long life. A seven year warranty is applauded.

The play closes to a standing ovation as all users sing along . . . **Just Me and My Shadow.**

The credits roll with a long list of drivers, including Windows 3.0, AutoCAD 9 & 10, AutoShade, Lightning Zoom, AI (8514A), and many more.

The reviews are in . . . The Shadow earns international acclaim.

The season is open and **The Shadow** will run continually. To witness the performance and relish the spectacular display of this virtuoso, call now for a theatre (dealer) near you.

Circle 130 on Reader Service Card (RESELLERS: 131)



**GROUNDHOG
GRAPHICS**

AN OPEN AND SHUT CASE FOR DELL.

Not only does our laptop cost \$2,500 less than their laptop, it also happens to give you a great deal more for your money.

Like a choice of 20 MB (which brings the price down to \$3,199) and 40 MB hard drives.

Dell's unique "Continuous Power Battery System" that allows you to maintain your screen and save your data, even while you're changing batteries.

An industry standard half-card 8-bit slot that can be used for a network card or other advanced communications. And a dedicated slot for a Dell Data/Fax modem.

Illustrated documentation that's easy to read and understand, and is complete with Tutorial, Diagnostics and Utilities diskettes.

And last, but by no means least, the kind of award-winning service and support that has earned Dell the #1 rating in 6 out of 6 PC Week customer satisfaction polls for PC's. A no questions asked 30-day money-back

guarantee and one-year limited warranty. Toll-free technical support. And a full year of next business day, on-site service from the Xerox Corporation.^Δ And you get that service nearly anywhere in the contiguous US, even if you're a thousand miles from your desk. Which means you'll never have to take anything back to a retailer for service. Because when you buy from Dell, service comes to you.

Give us a call and we'll show you how easy it is to own the Dell 316LT through many purchase and lease plans that are available.

So, when it comes time to buy a laptop, you should think of all the crazy things you can do with the \$2,500 you'll save by choosing a Dell 316LT.



THE NEW DELL 486™ 33MHz AND 25MHz EISA SYSTEMS
The best value in high performance PCs, combining i486 performance, 32-bit EISA I/O bus, and the industry's top rated service and support.

- STANDARD FEATURES:**
- 486 microprocessor running at 33MHz or 25MHz.
 - 32-bit EISA bus architecture (downward compatible with ISA).
 - Standard 4MB of RAM* expandable to 16MB on system board, using optional 1MB and 2MB SIMMs.
 - VGA systems video adapter.
 - Integrated 387 compatible math coprocessor.
 - 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
 - 5 half-height drive bays.
 - Dual diskette and hard drive controller.
 - Six 32-bit EISA (ISA compatible), plus two 16-bit ISA expansion slots.
 - High performance IDE (80 MB, 100 MB, 190 MB, and 330 MB (330 MB, 650 MB) hard disk drives.
 - Enhanced 101-key keyboard.
 - 1 parallel and 2 serial ports.
 - 200 watt power supply.
 - 12 month On Site Service Contract provided by Xerox.
- **Commercial Lease Plan. Lease for as low as \$280/month (433E) and \$232/month (425E). Xerox Extended Service Plan pricing starts at \$617 (425E) and \$672 (433E).**

	433E	425E
80 MB VGA Monochrome System	\$7,899	\$6,399
192 MB VGA Color Plus System	\$8,699	\$7,199
330 MB Super VGA Color System (800 x 600)	\$9,599	\$8,099
650 MB Super VGA Color System (800 x 600)	\$10,799	\$9,299

Prices listed include 4 MB of RAM, 100 MB hard drive configurations also available.



THE DELL SYSTEM 325 25MHz 386 AND DELL SYSTEM 310 20MHz 386
The best combination of performance and value available in their class.

- STANDARD FEATURES:**
- Intel® 80386 microprocessor running at 25MHz (Dell 325) or 20MHz (Dell 310).
 - Standard 1 MB of RAM, optional 2 MB or 4 MB of RAM* expandable to 16 MB (using a dedicated high-speed 32-bit memory slot).
 - Advanced Intel 82385 Cache Memory Controller with 32 KB of high speed static RAM cache.
 - Page mode interleaved memory architecture.
 - Socket for Intel 80387 or WHITEK 3167 math coprocessor.
 - 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
 - Enhanced 101-key keyboard.
 - 1 parallel and 2 serial ports.
 - 200 watt power supply.
 - 8 industry standard expansion slots (6 available).
 - 12 month On Site Service Contract provided by Xerox.
- **Commercial Lease Plan. Lease for as low as \$131/month (325) and \$112/month (310). Xerox Extended Service Plan pricing starts at \$370 (325) and \$251 (310).**

	325	310
40 MB VGA Monochrome System	\$3,599	\$2,999
80 MB VGA Color Plus System	\$4,099	\$3,499
80 MB Super VGA Color System (800 x 600)	\$4,199	\$3,599
190 MB Super VGA Color System (800 x 600)	\$4,699	\$4,099

Prices listed include 1 MB of RAM, 100, 330 and 650 MB hard drive configurations also available.



THE NEW DELL SYSTEM 320LX 20MHz 386SX
One of the fastest SX's around.

- STANDARD FEATURES:**
- Intel 80386SX microprocessor running at 20MHz.
 - Standard 1 MB of RAM*, optional 2 MB or 4 MB expandable to 16 MB (on the system board).
 - VGA systems include a high performance 16-bit video adapter.
 - LIM 4.0 support for memory over 1 MB.
 - Socket for Intel 20MHz 80387SX math coprocessor.
 - 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
 - Integrated high performance hard disk interface and diskette controller on system board (ESDI based systems include a hard disk controller).
 - 1 parallel and 2 serial ports.
 - Enhanced 101-key keyboard.
 - 200 watt power supply.
 - 8 industry standard expansion slots (7 available).
 - 12 month On Site Service Contract provided by Xerox.
- **Commercial Lease Plan. Lease for as low as \$98/month. Xerox Extended Service Plan pricing starts at \$261.**

	320LX
40 MB VGA Monochrome System	\$2,599
40 MB VGA Color Plus System	\$2,899
80 MB Super VGA Color System (800 x 600)	\$3,199
100 MB Super VGA Color System (800 x 600)	\$3,399

Prices listed include 1 MB of RAM, 100, 330 and 650 MB hard drive configurations also available.

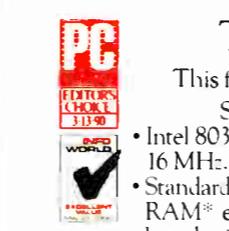


THE DELL SYSTEM 316SX 16MHz 386SX and DELL SYSTEM 210 12.5MHz 286
The perfect low profile mainstream computers.

- STANDARD FEATURES:**
- Intel 80386SX microprocessor running at 16MHz (Dell 316SX) or 80286 microprocessor running at 12.5MHz (Dell 210).
 - Standard 512 KB of RAM, optional 640 KB, 1 MB or 2 MB of RAM* expandable to 16 MB (8 MB [316SX] and 6 MB [210] on system board).
 - Page mode interleaved memory architecture.
 - LIM 4.0 support for memory over 640 KB.
 - Socket for Intel 80387SX (316SX) and 80287 (210) math coprocessor.
 - 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
 - Enhanced 101-key keyboard.
 - 1 parallel and 2 serial ports.
 - Full-speed 16-bit AT expansion slots available.
 - 12 month On Site Service Contract provided by Xerox.
- **Commercial Lease Plan. Lease for as low as \$73/month (316SX) and \$62/month (210). Xerox Extended Service Plan pricing starts at \$196 (316SX) and \$158 (210).**

	316SX	210
20 MB VGA Monochrome System	\$1,949	\$1,649
40 MB VGA Color Plus System	\$2,449	\$2,149
40 MB Super VGA Color System (800 x 600)	\$2,549	\$2,249
80 MB Super VGA Color System (800 x 600)	\$2,749	\$2,449

Prices listed include 1 MB of RAM. 2 MB versions of the above systems are available for an additional \$100. 100 and 190 MB hard drive configurations also available.



THE DELL SYSTEM® 316LT 16 MHz 386SX.

This full-featured, battery-powered 386SX laptop costs less than most 286 laptops.

STANDARD FEATURES:

- Intel 80386SX microprocessor running at 16 MHz.
- Standard 1 MB of RAM, optional 2 MB of RAM* expandable to 8 MB (on the system board using 1 MB SIMMs).
- LIM 4.0 support for memory over 1 MB.
- Adjustable and detachable 640 x 480 VGA Liquid Crystal Display.
- One industry standard half-size 8-bit expansion slot.
- Socket for 16 MHz Intel 80387SX math coprocessor.
- 3.5" 1.44 MB diskette drive.
- 83-key keyboard with embedded numeric keypad and separate cursor control keys.
- 1 parallel, 1 serial, and external VGA monitor port.

- Connector for 101-key keyboard or numeric keypad.
- Connector for external 5.25" 1.2 MB diskette drive.
- Two removable and rechargeable NiCad battery packs utilizing Dell's "Continuous Power Battery System" (patent pending).
- AC Adapter.
- 12-month On-Site Service Contract provided by Xerox.

****Commercial Lease Plan. Lease for as low as \$120/month. Xerox Extended Service Plan pricing starts at \$303.**

20 MB, 1 MB RAM	\$3,199
20 MB, 2 MB RAM	\$3,399
40 MB, 1 MB RAM	\$3,499
40 MB, 2 MB RAM	\$3,699

The Dell Systems 433E and 425E are FCC Class A devices sold for use in commercial environments only. Performance Enhancements: Within the first megabyte of memory, 128 KB (316SX, 316LT and 210) or 384 KB (320LX, 310, 325, 425E and 433E) of memory is reserved for use by the system to enhance performance. Can be optionally disabled on 316SX and 210. All systems are pre-installed with optional extra. All prices and specifications are subject to change without notice. Dell's online help system is available for free. Payment based on 16 month term and 10% down payment. Financing arranged by Leasing Group, Inc. In Canada configurations and prices vary. Dell 316LT is a registered trademark of Dell Computer Corporation. © 1990 Dell Computer Corporation. All rights reserved.

AD CODE 11E18

BYTE

15th anniversary

SUMMIT

*63 of the World's Most
Influential People in Personal Computing
Predict the Future, Analyze the Present*

**Future
Directions**
page
226

**Tomorrow's
Machines**
page
234

**New
Opportunities**
page
242

**Anticipated
Advances**
page
256

**Flashes
or Smashes?**
page
268

**Obstacles
to Overcome**
page
281

**Power
Plays**
page
291

**Social
Pressures**
page
303

**The Global
Market**
page
365

Brainteasers
page
351

**Future
Programming**
page
335

**The Software
Anchor**
page
324

**Picking
a Winner**
page
317



PC
MAGAZINE
EDITORS
CHOICE
3-13-90

Toshiba
T3100SX
16 MHz
80386SX
40 MB
1 MB RAM
VGA
14.9 lbs

\$5,999

**YOU'D HAVE TO
BE CRAZY TO BUY
ONE OF THESE
AWARD WINNERS.**



Dell 316LT
16 MHz
80386SX
40 MB
1 MB RAM
VGA
15.0 lbs

The laptop above is ours. The Dell™ 316LT. It comes with an Intel® 386™SX CPU running at 16 MHz. 1 MB of RAM, expandable to 8 MB, and a backlit VGA display. With a 40 MB hard drive it weighs 15 lbs. It won the *InfoWorld* Exceptional Value Award, and was one of only two 386SX laptops to win the *PC Magazine* Editor's Choice Award.

The one with the reddish screen on the opposite

page is theirs. The Toshiba T3100SX. With the same configuration as our laptop. It didn't win the same award from *InfoWorld*. But it did tie with Dell for *PC Magazine* Editor's Choice Award. Which is where the similarities stop.

TO ORDER, CALL NOW.

800-283-1190

HOURS: 7 AM-7 PM CT M-F 9 AM-2 PM CT SAT



ABOVE AND
BEYOND THE CALL

Circle 474 on Reader Service Card

World Radio History

BYTE'S 15TH ANNIVERSARY SUMMIT

Sixty-three of the world's
most influential business and technology
leaders predict the next
15 years of the personal computer industry

The personal computer industry started some 15 years ago, humbly, with a few primitive machines that today are museum pieces in every sense of the phrase. But their progeny—infinately more varied, numerous, and powerful than anyone then dared imagine—now populate desktops the world over.

BYTE magazine also started 15 years ago—the only general-circulation computer publication to have been there from the start, witness to every significant event in the phenomenal evolution of the microcomputer industry.

This month, in celebration of BYTE's 15th Anniversary, we've set out to bring you something truly unique: We've asked 63 of the world's most influential people in personal computing business and technology to predict the next 15 years of the personal computer industry. Their answers are insightful and sometimes downright unexpected. And it's not idle chatter: These 63 gurus are part of a select group that will make this future happen.

There's more, too. For example, along the way, these movers and shakers share insights into what makes the microcomputing industry tick today; what the new challenges are; what the opportunities are; what kind of hardware and software we'll be using in our business and personal lives in five, 10, 15, or more years; and much more. And to help put all this information in context, we've included a detailed time line, tracking the development of the personal computer industry from day one.

You'll find some great reading in the following pages, and we're very pleased to bring it to you. Thank you for being part of BYTE, and for sharing in this unique celebration.

—Fred Langa
Editor in Chief

BYTE

EDITOR IN CHIEF
Frederic S. Langa

MANAGING EDITOR
Anne Fischer Lent

NEWS

New York: *Managing Editor*: Rich Malloy
Associate News Editor: Andrew Reinhardt
Peterborough: *Senior Editor, Microbytes*:
D. Barker
Associate News Editors, What's New: David
Andrews, Martha Hicks
Editorial Assistant: Amanda Waterfield
San Francisco: *News Editor*: Owen
Linderholm
Associate News Editor: Jeffrey Bertolucci
London: *Senior Editor*: Colin Barker

BYTE LAB

Managing Editor: Michael Nadeau
Technical Director: Rick Grehan
Senior Editor: Dennis Allen
Technical Editors: Alan Joch, Robert
Mitchell, Tom Yager
Testing Editors/Engineers: Stephen Apiki,
Stanford Diehl, Howard Eglowstein,
Stanley Wazola

STATE OF THE ART

Senior Editor: Jane Morrill Tazelaar
Technical Editor: Robert M. Ryan

FEATURES

Senior Editor: Kenneth M. Sheldon
Technical Editors: Janet J. Barron,
Ben Smith

SENIOR EDITORS, AT LARGE

Tom Thompson, Jon Udell

SPECIAL PROJECTS

Senior Editor: Gene Smarte

SENIOR CONTRIBUTING EDITOR

Jerry Pournelle

CONTRIBUTING EDITORS

Bill Catchings, Don Crabb, David Fiedler,
Hugh Kenner, Mark J. Minasi, Wayne
Rash Jr., Mark L. Van Name

CONSULTING EDITORS

Jonathan Amsterdam, Nick Baran,
Laurence H. Loeb, Trevor Marshall, Stan
Mlastkowski, Dick Pountain, Phillip
Robinson, Peter Wayner

COPYEDITING

Chief Copy Editor: Lauren A. Stickler
Copy Administrator: Cathy Kingery
Copy Editors: Susan Colwell, Jeff
Edmonds, Judy Grehan, Nancy Hayes,
Margaret A. Richard, Warren Williamson

EDITORIAL ASSISTANTS

Office Manager: Peggy Dunham
Assistants: Linda C. Ryan, June Sheldon

ART

Director: Nancy Rice
Assistant Director: Joseph A. Gallagher
Art Assistants: Jan Muller, Lisa Nardecchia
Technical Artist: Alan Easton

PRODUCTION

Director: David R. Anderson
Senior Editorial Production Coordinator:
Virginia Reardon
Editorial Production Coordinators:
Barbara Busenbark, Denise Chartrand

TYPOGRAPHY

Systems Manager: Sherry Fiske
Applications Manager: Donna Sweeney
Typesetter: Christa Patterson

Be Objective.

Turbo Pascal,* the world-standard Pascal compiler, adds Object-Oriented Programming with our version 5.5. We combined the simplicity of Apple's Object Pascal language with the power and efficiency of C++ to create Turbo Pascal 5.5, the object-oriented programming language for the rest of us.

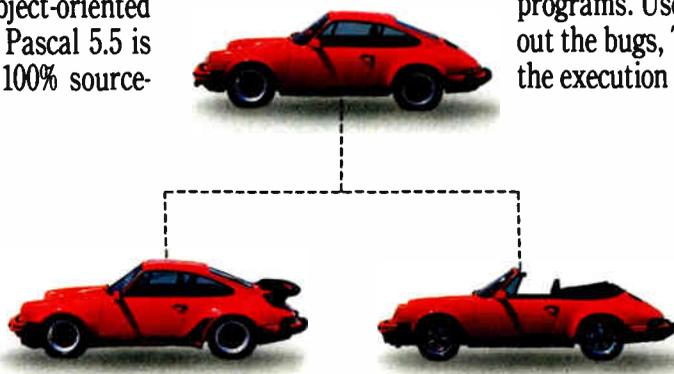
It's easy to extend yourself

If you're already programming with Turbo Pascal, it's easy to extend yourself from structured programming to object-oriented programming. And, Turbo Pascal 5.5 is the *only* compiler that is 100% source-code compatible with your existing Turbo Pascal 4.0 and 5.0 programs.

A fast object lesson

Object-oriented application programs more closely model the way you think. Objects contain both data and code.

As in a spreadsheet cell, the value and the formula are together. Objects can *inherit* properties from other



Inheritance provides powerful modeling capabilities by allowing objects to inherit attributes from other objects.

objects. For example, a Porsche Carrera inherits most attributes from the base model 911, but it also sports a whale tail.

Turbo Pascal 5.5's object-oriented extensions give you code that's easier to change, extend and support.

Support your objective

The Turbo Pascal* 5.5 Professional 2nd edition comes with the new Turbo Debugger* & Tools 2.0, which supports building faster, more reliable programs. Use Turbo Debugger to shake out the bugs, Turbo Profiler™ to pinpoint the execution bottlenecks, and Turbo Assembler* to turbo-charge time-critical sections of your program.

Get object-oriented now!

Turbo Pascal 5.5 and the Turbo Pascal 5.5 Professional 2nd edition are available *Now* at the dealer nearest you.

Special upgrade prices are available to Turbo Pascal owners.* CALL NOW (800) 331-0877.

Turbo Pascal 5.5

- Compiles @ > 34,000 lines/minute
- New integrated environment tutorial
- Hypertext Help with copy and paste
- Support for 8087/80287/80387

Turbo Debugger & Tools

- Turbo Debugger 2.0
 - Object hierarchy browser and inspectors
 - Reverse execution
- New Turbo Profiler
- Improved Turbo Assembler 2.0



B O R L A N D

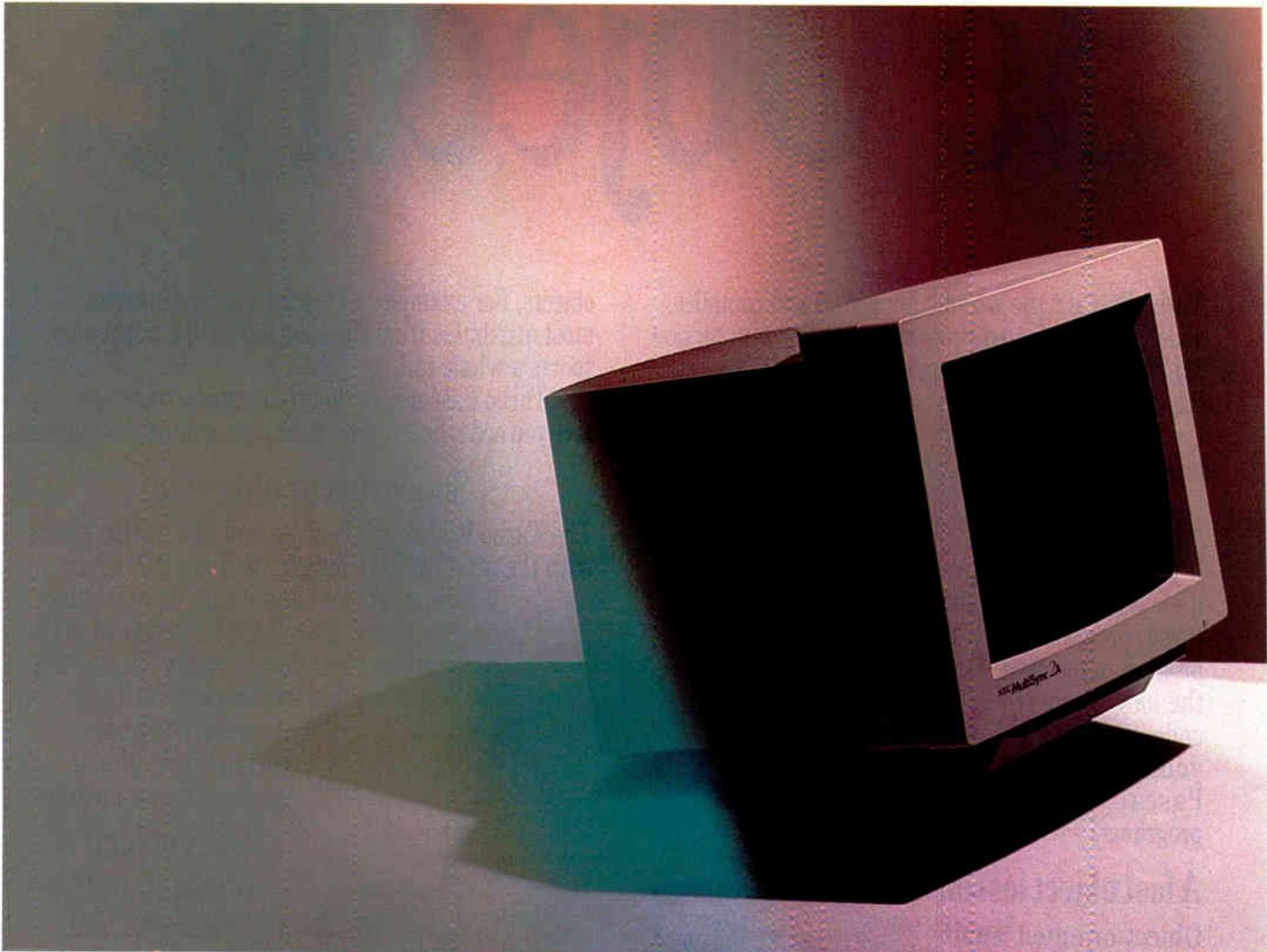
Code: MA76

*Mail upgrade orders to: Borland, P.O. Box 660001, Scotts Valley, CA 95067-0001. For orders outside the U.S., call (408) 438-5300.

Turbo Pascal, Turbo Debugger, Turbo Profiler and Turbo Assembler are trademarks or registered trademarks of Borland International, Inc. Copyright © 1990, Borland International, Inc. All right reserved BI 1324A

Circle 461 on Reader Service Card (RESELLERS: 462)

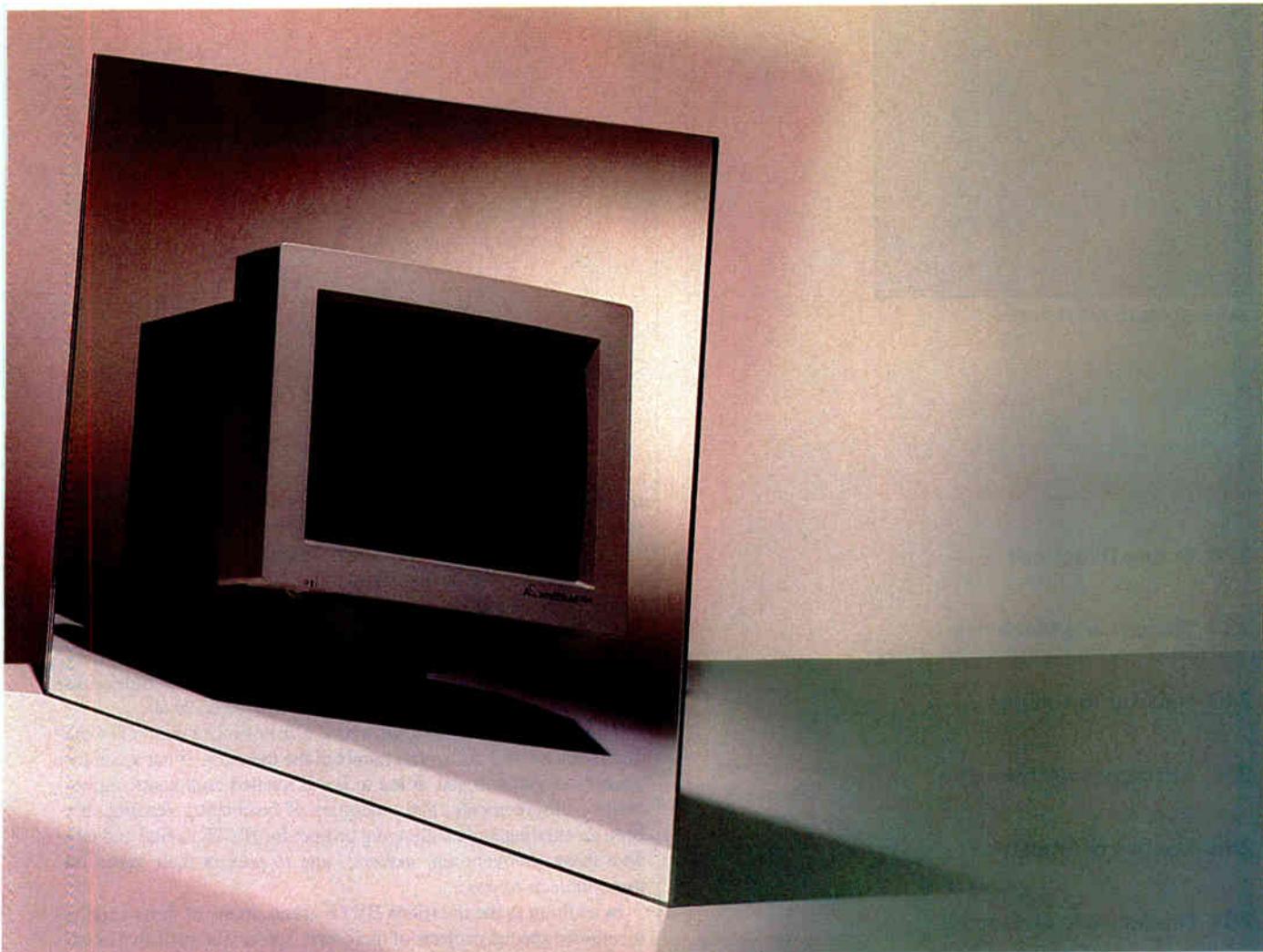
On the left, the best-selling VGA monitor. On



The MultiSync® 2A is one monitor that performs like two. On one hand, it's an uncompromised VGA monitor that works so well, VGA users have made it the best-selling 14" VGA color monitor in America.

On the other hand, the MultiSync 2A is also an equally uncompromised SuperVGA monitor, providing the perfect upgrade path to a standard that, at 800 x 600, gives you 56% more resolution than VGA.

the right, the best-selling SuperVGA monitor.



It's even available in a gray-scale version—the MultiSync GS2A—
which delivers everything the 2A does, in glorious shades of gray.

The MultiSync 2A. It's two of the best monitors you've ever seen.

For technical information or for the location of the dealer nearest
you, call 1-800-FONE-NEC. For product literature, call 1-800-826-2255.

In Canada, call 1-800-268-3997.

MultiSync is a registered trademark of NEC Technologies, Inc. © 1990 NEC Technologies, Inc.

Circle 510 on Reader Service Card

NEC



JANE MORRILL TAZELAAR

C O N T E N T S

- 226 Future Directions
- 234 Tomorrow's Machines
- 242 New Opportunities
- 256 Anticipated Advances
- 268 Flashes or Smashes?
- 281 Obstacles to Overcome
- 291 Power Plays
- 303 Social Pressures
- 317 Picking a Winner
- 324 The Software Anchor
- 335 Future Programming
- 351 Brainteasers
- 365 The Global Market

W E L

Leaders of industry, top academicians, and leading industry commentators come together in these pages to provide their unique perspectives on the microcomputer industry of the future.

This landmark project began with a list of questions that covered a broad spectrum of topics. They range from the future of the industry to the possibility of Marshall McLuhan's "global village" becoming a reality; from why software seems to lag so far behind hardware to the usefulness of neural networks, chaos, and fuzzy logic in the future; and from expected breakthroughs to bottlenecks and limitations in technology—13 different subjects in all.

To this list of questions, we added a list of more than 60 of the most creative and influential minds in the industry. What a combination! As you will see, it led to some spirited comments, agreements, disagreements, and quantities of fascinating reading. It's been an exciting and challenging project for BYTE to find and talk with these "movers and shakers" and to present their views on these subjects to you.

In addition to the questions BYTE asked, many of these experts mentioned special projects of their own, special interests that occupy them. The Insights located between the various BYTE Summit questions present those unique viewpoints from the industry's elite.

One of the people we spoke with was the late Robert Noyce. You often hear the phrase "a gentleman and a scholar" bandied about, but in this case particularly, both were true. Bob Noyce was one of the great gentlemen of our industry, and his intellectual accomplishments are legendary. We are pleased to be able to present some of his final comments on the future of computing, a future which, sadly, he will miss. As one of the fathers of our industry, however, he will never be forgotten.

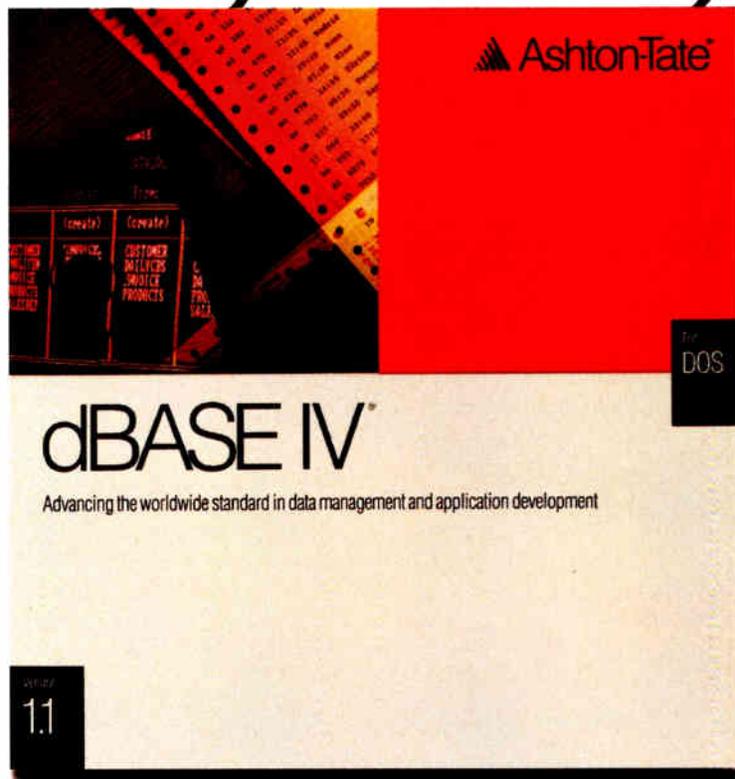
We discovered many fascinating facts about the people we talked to, and thus about the industry. For one thing, while more of them use 286- and 386-based machines than Macs at work, at home they have more Macs. For another, we found quite a few new business opportunities for the would-be entrepreneurs among you. In addition—well, I'll leave the rest for you to discover as you read the pages that follow. Anything further that I could say would simply be soda and Cheez Whiz in contrast to the fine wine—correction, make that champagne—and caviar that you'll find in the pages of the BYTE Summit.

—Jane Morrill Tazelaar
Senior Editor, *State of the Art*

C O M E
TO THE
BYTE SUMMIT



You Asked. We Listen. Smaller, Faster, More



Introducing dBASE IV®
version 1.1.

Smaller because the new Dynamic Memory Management System (dMMS)™ reduces memory requirements from 516K to 450K. So you can run larger applications.

Faster because the same dMMS reduces dBASE IV's need to access your hard disk. On top of that, the new built-in Disk Caching Option uses extended or expanded

memory to further improve disk performance.

More reliable too. Thanks to one of the largest pre-release (beta) testing programs ever conducted for a PC database.

Tested By Some Very Independent People.

dBASE IV version 1.1 was found to be more reliable in tests conducted by over 2700 independent developers, users and MIS departments. All

together, they used over 1000 different single and multi-user system configurations.

The result of all this is a smaller, faster, more reliable dBASE IV. With a simpler installation to get you up and running quicker.

Which means you can now start working faster and more efficiently than you ever have before.

Especially since you can operate dBASE IV through

Trademarks/owners: dBASE, dBASE III PLUS, dBASE IV dMMS, Ashton-Tate, Ashton-Tate Logo/Ashton-Tate Corp. Other product names used herein are for identification purposes only and may be trademarks of their respective companies.

ned. Introducing A e Reliable dBASE IV.

the powerful Control Center interface.

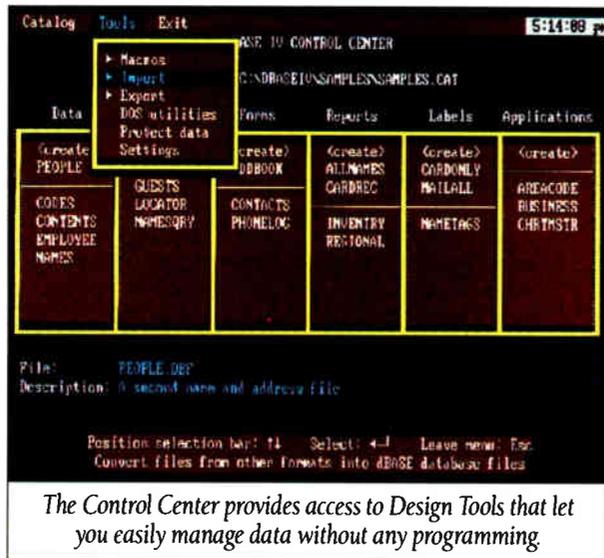
Now Anyone Can Use dBASE IV.

The Control Center is powerful because it's so simple. It's like a window to your data that you work with intuitively.

It gives you access to What-You-See-Is-What-You-Get (WYSIWYG) Design Tools that work through simple pull-down menus. The tools let you easily create custom forms, reports, labels and databases—without programming a single line of code. In addition, there's Query By Example (QBE) for quick answers without any programming—even if all your data is spread across multiple databases.

The Design Tools ensure that first time users will be up and running quickly, and that experienced users will realize high productivity gains.

In fact, even beginners can develop complete applications



The Control Center provides access to Design Tools that let you easily manage data without any programming.

automatically by letting our Applications Generator easily tie together everything they've created with the tools.

New Developments For Developers.

If you're a developer, you'll appreciate the new language enhancements and more flexible User Defined Functions (UDFs). Plus the Automatic Code Generator, which produces structured dBASE® code for any object you create with the Control Center's Design Tools. In addition, there's the built-in Debugger/Editor for streamlining the program debugging process. If you buy

the Developer's Edition, you'll also enjoy exclusive features like the Template Language—which lets you control the way dBASE IV generates code. And the RunTime Module for free, unlimited distribution of your applications.

Call Us Today. We'll Listen Closely.

But no matter who you are, you'll appreciate our new support policy.

Free, unlimited telephone support. (Your only charge is your toll call.) So see your Ashton-Tate® dealer today. Or call 1-800-437-4329 ext. 1403 for more information. Better yet, dBASE III PLUS® users can call 1-800-2-ASHTON for an immediate upgrade. Registered dBASE IV version 1.0 users will get a free upgrade.

Call now and tell us what we can do for you.

You can rest assured, we'll be listening.

 Ashton-Tate®



T

he only thing

that has consistently grown

faster than hardware is

human expectation.

—Bjarne Stroustrup

THE BYTE SUMMIT

FUTURE DIRECTIONS

Where do you think the microcomputer

industry is heading in the next five, 10, 15 years?

Jim Manzi (*see biography, page 292*): There's no question that it's heading, in a sense, to dominate the entire computing landscape, which, in some sense, it already does. I think the dominance of microcomputing—personal computing, workstation computing, desktop computing—will be so overwhelming five years from now, at an ever-increasing rate, largely because it's a broad-based phenomenon.

Paul Carroll (*see page 230*): I certainly think the industry will continue to grow. I think that the growth will slow down. This year it looks like it will be 10 to 15 percent, and it might even get into the single digits at some point.

Mitch Kapor (*see page 269*): I think the basic outlines of the future shape of the industry are already visible today. I don't think there's going to be the kind of rampant change we've seen earlier. In fact, I think we haven't seen rampant change. The thing that sits on your desk today pretty much looks like the kind of thing that sat on your desk almost 10 years ago—if you had one on your desk. It's just a lot more powerful. It's heading right for the mainstream—it *is* the mainstream.

Dick Shaffer (*see page 340*): As far as machines based upon microprocessors [are concerned]: It's the dominant technology, as far as I'm concerned, over the next several [years].

Bill Joy (*see page 262*): Except for very-large-scale scientific computers, which may use special-purpose cellular hardware or neural nets or some sort of other architecture, all computing will be done with microprocessors. Certainly, all interesting computers will be micros, so the microcomputer industry essentially will equal the computer industry.

Tom McWilliams (*see page 294*): Today, what is a workstation and what is a PC are merging. Workstations are continuing to drop in price to the point where today you can buy some workstations for less money than your large PCs. So I think that the hardware distinction between a workstation and a PC is blurring. PCs and workstations have different software, where typically

workstations are Unix-based and PCs [use] MS-DOS or Apple software.

Niklaus Wirth (*see page 366*): Well, microprocessors have certainly changed also life in academic institutes and research as well as in teaching. In teaching particularly, we have changed from the use of large computation centers to the individual workstations, and that I am sure is here to stay.

BYTE: *What about the power of the hardware? Will that increase significantly? Or have we gone about as far as we can go?*

Gordon Campbell (*see page 229*): In the last decade, which is about as old as the industry is, we've gone from fairly crude tenth-of-a-MIP machines to 5- to 10-MIP machines as average PCs now. In the next decade, we're going to see microprocessors, basically, hooked up with more than one in a box. We will have true multiprocessing, and that will allow us to push into the 100- to 200-, 300-MIP category, still very cost effectively. On the high end, I think you're going to see the use of multiple processors. On the low end, we're going to see the true integration finally of the PC architecture and the microprocessor into a single chip.

Michael Slater (*see page 340*): I think that there are a lot of things that are pretty obvious; the amount of memory that people expect to have in their typical PC will be 4 megabytes in the next couple of years, and probably 8 to 16 megabytes within five years. That's going to be important as people go to graphical user interfaces, and more and more imaging-oriented parts of their software, and are doing multitasking, and are doing networking, running bigger and bigger and more complex applications.

Stewart Alsop (*see page 227*): Bigger, faster, cheaper. I'm serious about that. Obviously, where it's headed is where it's been heading for the last 10 years, which is [to] more and more functional and capable computers.

Gordon Bell (*see page 228*): You can take any scenario of what everybody has today and just run that out, minimally giving them a factor of 10 more.

Donald Knuth (see page 282): People in my department are saying that computers are going to double in speed every year until 1995, and then they're going to run out of ideas. But we've got another factor of 30 or something to look forward to in that time. And then they will have squeezed out all of the slop.

John Cocke (see page 235): Well, I feel that we'll have very dense memory, and [we'll] have much, much larger memory on the desktop. The machines will probably be equivalent to, say, large scientific machines, have any kind of features you want, like vectors and so forth, because they will be very fast. That's what I envision in the next, maybe less than 10 years.

Michael Slater: Actually, I think that in most all of these things you can actually look at where workstations are today, and PCs will be there within a few years in terms of the memory size, the display resolution, and built-in networking.

Bill Gates (see page 250): Well, the vision Paul Allen and I had when we started the company was: A PC on every desk and in every home—the tool of the information age to let people see the information they're interested in and try out new ideas—and really nothing has changed our view of that. It was predicated on processors getting faster and software getting better, and all these advances sometimes take longer than we expect.

Bjarne Stroustrup (see page 352): That's a huge question. I think the answer is [that] the PCs are going to be more powerful. That doesn't mean nirvana, because people seem to soak up cycles faster than the hardware manufacturers can build them. The only thing that has consistently grown faster than hardware in the last 40 years is human expectation.

Jack Kilby (see page 272): In 15 years, you will be able to do anything you want to.

Jerry Pournelle (see page 326): I said in BYTE, in the first issue I wrote in, that by the year 2000, anybody in Western civilization would be able to get the answer to any question that has an answer. I see no reason to change that prediction. Gates' notion that there will be a computer on every desk and in every classroom is absolutely right. The information revolution is just proceeding apace. There is nothing that surprises me in that sense, because I said it all 10 to 15 years ago, in BYTE.

BYTE: *To get a little more detailed, how do you expect semiconductors to evolve? And what will be the effect of that evolution?*

Jack Kilby: As far as integrated circuits are concerned, we're on our way down to 0.7- and 0.5-micron lines, and we will see those happen.

Bob Noyce (see page 318): Well, I see a continued trend of bigger, faster, better machines that can cram more and more onto a chip for another decade, but then we'll have to take a look at it. You do see some barriers arising, but still, those barriers have been about a decade away for some time. As we get more experience, we find ways to move those barriers back about 10 years. So I think that it will last another 10 years or so.

Lee Felsenstein (see page 246): I've come to realize that as long as the chips are as cheap as they are, you can afford to waste some of the capability. When I say waste, I mean you don't design something from the ground up that makes use of 100 percent of the capability. Maybe it makes use of 40 percent of it. But then, you figure out ways to make that other 60 percent available when people want to have it available. That makes it a personal computer.

Ken Olsen (see page 318): The same chip goes into the workstation, the desktop server, the bigger one, and the minicomputers. And they all have the same chip in them and therefore run at about the same speed. But one goes up close to \$1,000,000 and one goes [for] \$10,000. And the world gets confused, and sometimes the advertising confuses. [It's] all the other capabilities, of course, that [make the difference].

BYTE: *What about the software side of the equation? Or are all the changes coming in hardware?*

Jonathan Titus (see page 352): I would say, within 10 to 15 years, we're looking at tremendous advances in the amount of processing that people will have available on their desks. I am not sure, though, that they'll know exactly what to do with it.

Rich Malloy (see page 288): I think the main changes we'll see are in terms of hardware—things getting much faster and smaller and cheaper. And then software will try to catch up to that, but there are problems.

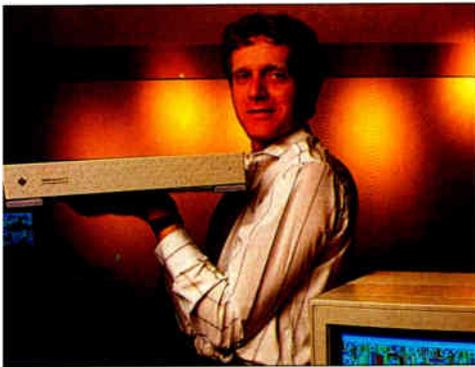
continued



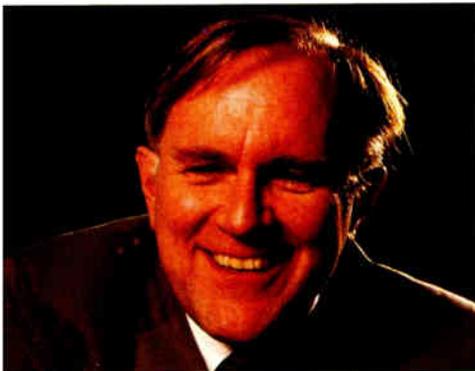
Paul G. Allen is chairman and president of *Asymetrix*, developer of *Toolbox for Windows 3.0*. In 1975, he cofounded *Microsoft Corp.* with *Bill Gates* and served as its executive vice president of research and new product development.



Stewart Alsop III is president of *Industry Publishing Company, Inc.*, and editor and publisher of *P.C. Letter*, a newsletter for executives in the personal computer industry.



Andreas Bechtolsheim is vice president of technology for *Sun Microsystems*, which he cofounded in 1982. He has been the principal designer of many Sun workstations, including the SPARCstation 1.



C. Gordon Bell is chief scientist at *Stardent Computer*, a company he cofounded. He is best known for the design and development of Digital Equipment Corp.'s VAX computer. He is also cofounder and director of The Computer Museum.

Brian Kernighan (see page 272): Software, unfortunately, is not nearly as easy to make go better as hardware seems to be.

Bob Frankston (see page 246): I think that tension [between hardware and software] is going to exist forever.

Brian Kernighan: It seems likely that the hardware is going to continue to get cheaper, so that you'll be able to get more and more power on your desk or whatever. And the software will not get better fast enough, and so you'll piddle away more and more of [the power] on stuff that doesn't quite work the way you want it to, or that doesn't quite work together.

Ken Olsen: [What] I think that people want in general computers is to have software applications that they can transport to anybody's computer. Any operating system, anybody's computer—transportable software. And they want, or should want if they've stopped analyzing, anybody's computer, anybody's operating system to work on a network around the world. And you come to the obvious conclusion that you want to write to standards, all the standards, and then the software plays in anybody's machine.

BYTE: *How about networks—what do you see as their future? How will networking change the industry?*

Michael Slater: Networking, I think, will become standard in PCs, as it is standard in workstations today.

Paul Allen (see page 227): I think natural evolution in terms of business computing is that everybody's going to have a super-powerful network machine on their desk, maybe 15 years out.

Paul Carroll: There are some powerful trends going on now that will certainly continue, with emphasis on networking probably being the most important of those. I think that will facilitate the development of better electronic mail systems, which I happen to believe will be just awfully important. I think those will change the way I work and certainly will change the way a lot of other people work.

Terry Winograd (see page 366): What I see happening is the integration of what was good about the mainframes and what is good about the microcomputers, [and] what was good about the old systems was that they tied together people. Now with net-

working, you get the advantages you had from the stand-alone workstation, all the advantages of interaction you had, and now all the advantages of coordinating the information with a network. I think over the next five to 10 years, it will be odd to have a microcomputer in a work setting that isn't tied into a network. And, of course, we'll have other technology to tie into that—radio networks and cellular phone networks, etc.

Danny Hillis (see page 250): Well, I think initially it will be telephone networks and local area networks, and then those local area networks would one way or another be connected to a big network. So in some sense, the whole concept of the network will break down, and everything will be connected to everything in some software sense. So there will be everything from groups of computers connected together by telephone to things like the gigabyte network that Senator Gore is talking about. Either you'll be connected into it all, or you won't be connected into it at all.

Jonathan Titus: I think that major advances, from my point of view, over at least the next five years, are going to come in communications, and the ability for people to have one computer talk to another computer almost anywhere in the U.S., and perhaps in Western Europe, much the way our dial phones are set up now.

Bjarne Stroustrup: It doesn't mean networking with the next office. That's uninteresting. If I want something from [the guy in] the next office, I'll go in and talk to him. It's harder to have an argument with a guy in Stockholm—not much harder if you're networked properly. I think that's going to make changes in the way people use computers and the way people think about computers.

John Kemeny (see page 270): I still look forward to major progress in networking, and I think then we will have the best of all worlds—I mean, the advantages of time-sharing and the advantages of personal computers coupled.

Brian Kernighan: More and more of these machines are being networked, but fundamentally, the P in PC is *personal*. That's the strength of the thing, but also the weakness. It's the strength because, by god, it's yours, do what you want with it, nobody else tells you what to do with it, and so on. But that's also the weakness. It's very hard to communicate with anybody else in any

convenient way. And the kind of communication, sort of hopping around the machines, getting mail from people, and all these other things that I take for granted [on larger systems] are, I think, somewhat far away in the PC world as seen by most people.

Brit Hume (see page 262): Well, it strikes me that what we have commonly thought of as microcomputers are becoming so powerful that they can be used as the core systems for networks that will be comparable to the systems that now run as minicomputers and mid-range systems. That's an obvious development that seems to have been coming for a long time.

BYTE: *Speaking of minicomputers, how will the evolution of microcomputers affect minicomputers and mainframes?*

Andy Bechtolsheim (see page 228): Basically, the next generation of [microcomputers] will have just about the same specs as the best mainframes you can get [today]. Of course, supercomputers are still faster. I mean, Cray, he gets another order of magnitude of power out of that. But in terms of the technology, it's reaching the mainframe level.

Tony Hoare (see page 257): I think the microprocessor industry will come to dominate the whole of the computer industry. And, as it has done in the past 10 years, it will reproduce the evolutionary history of minicomputers and mainframes.

Bob Noyce: Well, the line I used to use is that the microcomputer is what the mainframe was 10 years ago. I think at this point in time the microcomputer is *becoming* a mainframe. Things are doubling every 1½ years, so I really can't use that first line anymore. Now I think the real question is, "Will the microcomputer be the top-of-the-line computer?" And I guess my real feeling is that it will be.

Bill Stallings (see page 352): My guess would be the mainframe is not going to go away.

Tom McWilliams: Well, I think what we have been seeing is that the microcomputer used to be for fairly specialized applications. What has happened is that the power available on a microcomputer grows exponentially with time. As they have grown, they've overcome various classes of machines. Basically, today, they've replaced the minicomputers. I see the microcom-

puter becoming more and more dominant and taking over all computing except the largest machines'.

Terry Winograd: The problem with the mainframe was [that] integration was forced by the centralization adherent to the particular functionality of that mainframe. The idea was one of a central function where everybody played their pieces. Now we have a much more open-ended type of integration where we put the connections in where they count.

Wayne Ratliff (see page 326): So I think the real computer substance lies in the personal computers. They're not the toys anymore. They're the thing. I probably can think of a lot of examples, but I guess I'm thinking mostly right now of when small mammals took over the world, and took the world away from the dinosaurs. I see the mainframes as being the dinosaurs. They're big. They are enormously powerful—massive, extensive. And here these little computers are like the small mammals, 60 million years ago or whatever. Although they are small, they are very facile in a variety of ways. They are small, cheap, [we] have lots of them, [and] they can stay alive at night.

BYTE: *And how about the user interface? How do you think we will interact with computers in 10 or 15 years?*

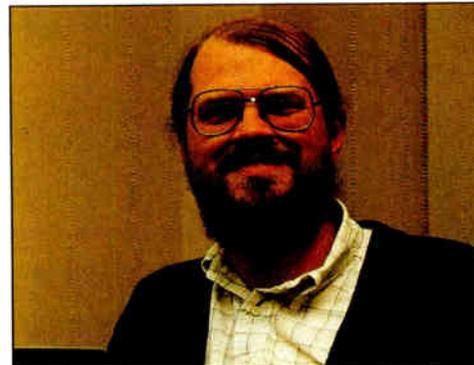
Michael Slater: I think the character-mode applications will almost entirely go away, and everybody will make the transition into graphical user interface applications.

Charles Simonyi (see page 340): The graphical user interface is a given; there is no doubt about it. It's a given today, and it will be stable for the foreseeable future.

David Evans (see page 243): I think one of the curious things is that people have known that computing ought to be done interactively, and it ought to be graphics, and it ought to be on-line access. We've known that for at least 30 years, or maybe more than that. I think we'll see that kind of thing continuing. I think we'll see that better interfaces, and better human interfaces, and so forth, will continue to come on in the mass market at the bottom of the price [range].

Terry Winograd: We won't be using data gloves or anything like that. Rather than having a bunch of applications, we will

continued



James F. Blinn is associate director of project mathematics at Cal Tech. He is a pioneer in the fields of computer graphics and animation.



Gordon A. Campbell is founder, president, and CEO of *Chips & Technologies, Inc.*, which produces VLSI chip sets and firmware and provides design services to personal computer manufacturers. He is a 20-year veteran of the semiconductor business.



J. Rod Canion is cofounder, president, and CEO of *Compaq Computer Corp.*, where he has directed its operations and growth since 1982. Canion spent over 16 years in engineering and management at Texas Instruments.

Paul B. Carroll (not shown) is a technology reporter in the New York bureau of the *Wall Street Journal*. His main focus is covering IBM and other computer companies in the New York and Philadelphia areas.

have more of an integrated environment into an interface that lets me move smoothly into what I want to do, and it will organize what I want to do instead of organizing it by individual pieces of software. You won't have to get out of one environment to get into another thing.

Paul Allen: Graphical user interface options will be dominant here pretty quickly in the next few years. But I guess the big shift that I see is toward applications that work the way people think about solving their problems. Instead of a spreadsheet thinking about $A1 + A2$ or something like that, they will be dealing with higher-level content.

Philippe Kahn (see page 269): I think that the next generation will [have] more direct communication and more direct use of personal computers and not [force] people to work the way the personal computer works, but rather have the personal computer work the way people work. That's very important.

Seymour Papert (see page 325): I think the interface is part of a larger thing. I think that putting the emphasis on the interface somewhat confuses the issues. Clearly, having icons and a mouse, for many people, if not everybody, is a more comfortable interface than having to type in a lot of instructions in a mathematical form. I think that kind of direction opens computation to a lot more people, but if only the interface [is changed], and what lies behind it and what you can do with the system isn't changed, you're only scratching the surface. The interface is only the surface. I think we need deeper ways to think about differences in computation.

Bill Gates: There are a few discontinuities that are unclear when they'll come about and what their impact will be. [One of them is] so-called AI where the machine [has the] ability to move up in the reasoning chain beyond just "Here's a number; here's some text," to help you plan things, understand rules about your business. [AI is] one I'm optimistic about, but the track record the last 10 years is that not too much has gotten done. If you look at the business environment, just a natural evolution of the electronic-mail group-productivity tools should get us toward that vision.

David Evans: I still think the place that the micros and everything else are going to change is the human interface. Surely, they'll understand the spoken language.



he graphical

user interface is a given;

there is no doubt about it.

—Charles Simonyi

Esther Dyson (see page 236): I think the eighties were the decade of direct manipulation, [and] I think the nineties are going to be about programmability. I don't want to sit and move stuff around on my screen all day and look at figures and have it recognize my gestures and listen to my voice. I want to tell it what to do and then go away; I don't want to babysit this computer. I want it to act *for me*, not *with me*.

BYTE: *So, where does this take us? Can someone tie it all together?*

Jim Manzi: In terms of the next three, four, five years, we think one of the biggest wins is obviously tying in microcomputers or desktop computing into an organizational context. That will then extend, not just to the internal fabric of companies and organizations, but obviously to the external community as well, given things like ISDN and EDI, and things like that. But at the heart of it is going to be desktop computing, because that's where information is useful.

Grace Hopper (see page 257): I think the microcomputers will continue to communicate. Actually, any company will have a very large system composed of computers. It will not be individual computers. There will be mainframes, minis, micros, and everything else all linked together, and the entire system will be what supports the company, not the individual pieces.

Jim Manzi: The big opportunity, I think, in computing generally, is to increase, in some sense, the information velocity, which is the speed with which information is moved, shared, accessed, used, and then shared again. Because information, all by itself, used by one person, is useless. So the whole concept of organization computing, or group computing, or network computing, starts and ends, in some sense, with an individual. ■

THE SCIENCE OF COMPUTER HARDWARE BUYING DECISIONS IS ABOUT TO BENEFIT FROM A LITTLE MAGIC.

Clean out your filing cabinets. Say goodbye to your folders and folders of product literature. You're about to enjoy the benefits of some high-tech sleight of hand.

Introducing **HardFacts™ on disk**, a monthly database that provides PC Industry Professionals with instant, up-to-date information on over 7,000 microcomputer hardware products. No on-line charges. No key word searches. HardFacts is an advanced and powerful

information tool brought to you by NECS®, the ten-year-old company known for its database technology.

A one-year subscription to HardFacts costs only \$695 (plus shipping and handling) and includes *update disks every 30 days*—keeping you briefed on all the latest products. So why waste another minute? Accelerate your hardware buying decisions today! Call (508) 927-1370, and we'll rush you the current issue of HardFacts immediately.

The screenshot shows the HardFacts software interface with the following callout boxes:

- Make your selection from over 25 product categories, ranging from personal computers to peripherals to board-level products.** (Points to the 'Category' menu)
- Choose from a list of over 1,000 companies, and target your product search by manufacturer.** (Points to the 'Manufacturer' menu)
- For your convenience, we've included a directory of fax, telephone and toll-free numbers for thousands of distributors, manufacturers and mail-order sources.** (Points to the 'Telephone Books' menu)
- Once you've selected a product category, HardFacts displays a list of up to 60 buying criteria to choose from.** (Points to the 'SPEC'S' list)
- Highlight the criteria you need, and develop your own list of buying requirements.** (Points to the 'NEXT ACTION' menu)
- Keep in touch with the latest product introductions.** (Points to the 'New Items' menu)
- When your list is complete, HardFacts tells you exactly how many products fit your needs.** (Points to the 'RECORDS: 365 HITS: 15' display)
- At the stroke of a key, HardFacts lists only the models that meet your requirements. Then, for each model, you'll view comprehensive information, including detailed product specifications, list price, "street" price, industry awards, product reviews, distributors, and mail-order sources.** (Points to the 'YOUR SELECTIONS' list)
- HardFacts maintains a complete image database with thousands of spec sheets on file, available to you as part of your subscription. 7 days a week, 24 hours a day, you can retrieve the ones you need—by instant fax!** (Points to the 'TO RECEIVE MANUFACTURERS' DATA SHEETS' section)

“Perfect for anyone who makes large computer purchases.”

Byte Week, June 11, 1990

For intelligent hardware buying decisions

HARDFACTS™
ON DISK

to subscribe or to receive a free demo disk call

(508) 927-1370

HardFacts supports Novell networks.

©New England Circuit Sales, 1990. NECS is a registered trademark of New England Circuit Sales, Inc.

Circle 486 on Reader Service Card

World Radio History

Alan Kay:

On Computers in Education

I have worked with children over most of my career in Macintosh stuff. The PARC stuff that we did was originally designed for children. It works on adults because we have to think harder to design the stuff for children.

I don't think the technology is as big an issue [in education] as people's attitudes and values. Putting computers into schools is like [if] for some reason we thought our kids wouldn't succeed if they didn't become musicians [so] the state legislature decided to put pianos in every classroom. It's not going to help. Any musician will tell you that music is not in a piano. What I'm trying to say is, if you put computers in every school, it's like pianos in every school.

Everybody wants media and technology to save them, but it's attitudes, [and machines don't affect attitudes]. People think there is content in technology. And there isn't content except in what it makes us into. And that's something we have to decide. That's what our value system has to decide.

It doesn't require any money to have an attitude change. That's why it is so hard. We don't grow things, we fix

them. So our idea about education is that children are defective adults—they have to be "fixed" in school—whereas more enlightened people like [Jean] Piaget and Jerome Brunner think of children as something you grow. They're all right the way they are. What we try to do is grow them in a certain direction. But there's nothing deficient about them. And the difference between those two attitudes is huge.

The way to save education is to get parents directly involved in the welfare of the children. That's the number-one thing. I've visited a lot of schools in the last 22 years, and the ones that have worked, 100 percent of them have had strong parent involvement. Because the thing about a school—a school is a lot of different kinds of things. Some schools are more regimented than others, but they all are kaleidoscopic. There's tons of stuff going on. It is extremely difficult for kids to actually consolidate any knowledge in the classroom. What happens at best is they are exposed to new ideas and different kinds of things. A consolidation, when it happens, happens at home. And it is *how* it happens,

it's the attitude of their parents: if their parents are learners, if their parents are readers, if their parents come into the classroom.

I'm fully behind this thing that Iacocca and the head of the National PTA are trying to do, which is besides having something like maternity leave, also get companies to give employees a half day a month off with pay if they go into their kid's school. You don't need all this [stuff]. You just need the parents to make sure the television is off for a reasonable amount of time, parent involvement, parents coming into the classroom, the parent obviously valuing what the life of the child is. And the children will respond every time.

When you have something like that, you can come in with the technology—you can come in with a piano, you can come in with a computer, and you can amplify the hell out of it because technology is just an amplifier. If you've got [junk], you're going to get [junk] amplified a millionfold.

Editor's note:

See biography, page 270.

Alvy Ray Smith:

On Software Patents

Patent issues. I think that's the number one problem. I think that's the most serious problem confronting the software industry in the next decade.

One of the things that I see holding us up is software patent issues, a monster that's raised its head in the past year or two. One of the things that the U.S. is blessed with, that's extremely creative, is a mass of brilliant software inventors. Suddenly, the patent office tried to start patenting software. It's a very large-

bandwidth, creative system, and they're trying to just push it through the narrow bandwidth system of the patent office, which cannot possibly handle it. I'm very afraid that the patent issues are going to stifle the innovation we currently enjoy in the software industry. That's the number one problem facing us here. I think it would be a mistake to miss that very important issue.

The one that's on the top of my mind right now is the Pontel patent for patent-

ed airbrushes. What a trivial idea. Really trivial ideas are going to be patented. Those of us who sit around and wheel and deal in software are going to be completely restrained. That has to be solved in the next decade. I hope it gets solved immediately. All of this could come to a screeching halt if we don't get rid of this software patent issue.

Editor's note:

See biography, page 352.



If you push your PC to the limit, memory shortage problems are an all-too-familiar frustration. Here's how to forget they ever existed.

Buy an Intel® Above™ Board. It's the number one expanded memory card. It's guaranteed compatible and reliable. And it's from Intel, so you get the best warranty in the business, plus outstanding technical support.

To take maximum advantage of your Above Board memory, add QRAM™, Quarterdeck's top-selling memory management software. Coupled with the Above Board, it helps solve "RAM Cram" and easily

handles large applications!

And for a limited time, you can get QRAM free. You'll save about \$140, not to mention a few frustrations. It's easy, your QRAM coupon is right inside the Above Board box.

To take advantage of this memory solution see your nearest Intel dealer, or call Intel at (800) 538-3373. Or if you'd like more information on both products faxed directly to you, call (800) 525-3019 and request Doc.#9950.

The sooner you do, the sooner your memory problems will fade away.



*Memory saved varies according to application and system.
 QRAM is a trademark of Quarterdeck Office Systems. Offer ends 12/31/90. Redemption coupon must be received by Intel by 2/1/91. Offer good on Above Board purchases in the U.S. and Internationally, except where prohibited by law.

Circle 488 on Reader Service Card (RESELLERS: 489)



What do you think a typical microcomputer will look like in 10 or 15 years?

What does 1000 MIPS mean? It's kind of hard to wrap your head around it.

—Alvy Ray Smith

Bill Joy: Fifteen is pretty hard to say. Ten years—very powerful, multiprocessor, enormous amount of semiconductor memory, probably [will] not have a disk. Probably it will all be semiconductor, run on batteries, be portable, have a different metaphor than mouse/keyboard, probably involving voice, and you'll surely need a higher bandwidth output device, [and] vision—you'll have] a very high-quality animated display.

Ryoichi Mori (see biography, page 304): Ten or 15 years [from now], typical microcomputers will look like today's microcomputers. Here, "look like" means that the price and the size of most packages will be typically the same. The contents—that is, the scale of integration and the computing capability—will be improved 100 to 1000 times. Most of the improved capability will be consumed to provide better user interface. This means that microcomputers will have more "common sense"—that is, better database—and make better judgment using it. To support this, magnetic or optical storage devices will become smaller and smaller and will be built into the microcomputers more widely.

Jay Miner (see page 296): I would suspect that the trends that we have seen in the past are going to continue—mainly, more miniaturization, more complexity, more function per dollar, more portability—since CMOS is getting much more sophisticated now, and most of the new big microprocessors are going CMOS, which allows them to be portable.

Andy Bechtolsheim: The workstations already are looking more and more the same as PCs—one or two disk drives and the floppy disk and some audio and slots. Obviously, we can assume that performance keeps doubling each year, and maybe we'll get to 1000 MIPS by the year 2000.

Alvy Ray Smith (see page 352): It won't be too much of a stretch, say, that the desktops will be in the 1000-MIPS range by 2000. I don't think that's too hard to see at all. In fact, my numbers have it at 2000. What does it mean? What does 1000 MIPS mean? It's kind of hard to wrap your head around it.

Dick Shaffer: I'm convinced that we will have personal supercomputers. Not Crays; nobody gives a fig about Crays on your desktop. Let's just think what you could do if you had today's R6000 or today's MIPS machines or today's Silicon Graphics—\$100,000 personal, graphics supercomputers—available for about \$1000.

Gordon Bell: I think that [in 15 years,] things are going to structure out in these different strata. I think there'll be the \$10 computer that is essentially the credit-card kind of thing. We could make a universal card that has all the information on it. That you'll see. The \$100 dictating machine that basically is a memo-minder that you walk with. The \$1000—I see the bulk of the machines are going to be those \$1000 totally portable machines that you run around with, and that those go into a more central system. I think everybody's got to have the concept of a mainframe.

Gordon Campbell: I think you're still going to have base systems. I think people will gradually evolve to where they'll have a base system in their home and a base system in their office. And you will have any number of portable computers, whether they are palmtops, laptops, notebooks, whatever. We'll see a seamless exchange of data, some through hard wire, some through wireless LANs.

Stephen Wolfram (see page 366): The most likely mechanism for connecting to peripheral devices would be some kind of an infrared-based thing. I mean, the whole idea of having wires and definite connectors is clearly not a particularly good one. If you have a sufficient bandwidth, the best thing to do is to have some kind of bar around your computer that emits infrared, and you plug devices onto it.

Paul Allen: Well, I think that the market will basically bifurcate. We're seeing some of it now. Portable computers are going to be like—something along the lines of the old Xerox Dynabook kind of concept where you've got a portable computer with a high-resolution screen that'll be in color. And you'll be able to input into that using either a keyboard or probably a stylus that can read handwriting or printing or whatever.

And I guess I see another kind of computer that's really your workhorse in a desktop computer that'll have a graphical user interface. That will be incredibly powerful, perhaps on the order of a Cray in terms of the power, and have a huge amount—gigabytes—of disk storage. Obviously, in an office environment, it's going to be on the network. There will also be multimedia capabilities integrated into that.

BYTE: *Let's discuss the subject of portability. Do you think we'll have notebook computers or pocket computers? How do you think the size will evolve?*

Mitch Kapor: We're going to see the next generation in portability, things that are smaller than today's laptops: clipboard-size computers and shirt-pocket-size computers. The stylus-based interface is going to be very, very important for that class of devices because you can't have a keyboard, by definition.

Paul Carroll: I think it will be much smaller than it is now, maybe on the order of just a few pounds. I also think that it'll be better in all the normal ways: It'll be smaller, it'll be many times as fast, it'll have much better resolution, it'll have color, you'll be able to use a stylus to have it recognize your handwriting, do your data input that way if you like. I suspect that while these devices will be set up so I can pop one in my briefcase when I head on the road, there also will be a much larger screen on my desk to facilitate the handling of several tasks at once.

Bob Frankston: I find even [notebook computers] large; you want to be able to view it on your wrist, the Dick Tracy-type model, except [that] the reason for it—it's not so it'll be fancy—is you don't need any hands to view something on your wrist.

Gordon Bell: The computer will disappear by another 10 years in [its present form]. There will be zero-cost notebook-size computers with one chip in them that will have about 32 megabytes. So people will be carrying around these sort of minicellular, really connected, computers that go into their own databases somewhere.

Doug Engelbart (see page 236): Everyone's going to have a computer—carried around, or surgically implanted, or sitting on your hat or your spectacles or what—and they're all going to be connected into networks just totally, [and] those networks will be wireless.

Steve Leininger (see page 287): Well, to me, it would look an awful lot like one of these Day-Timer Seniors or day-runner seniors, basically an 8½ by 11 notebook with a low resolution. One would be 1024 by 768 color LCD. I think this unit will also have like a cellular phone capability: You'll have the voice capability on it, but you'll also have facsimile, you'll have storage. If someone called you, instead of your beeper going off, it'll be your notebook that'll go off. They'll quit being so much like computers, I think.

BYTE: *This sounds more like a portable office than a portable computer. Do you really think cellular phones and faxes will enter the notebook arena?*

Dick Pick (see page 325): I think you'll see something that's integrated with the fax and the cellular phone, all in one small, couple-of-pound package. The way they're going, you're going to be down to where it's going to be smaller than a notebook, and it's going to have a fax machine, and a cellular phone, and the whole thing is going to be wrapped up into one unit. You just pick it up and use it.

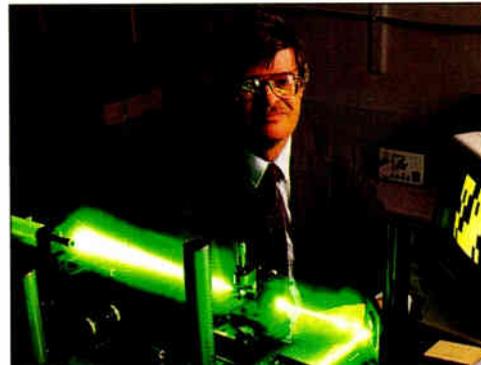
Gordon Campbell: We probably will see things like cellular telephone migrate in, so that we can receive voice-mail and fax capabilities in notebook-style computers as well. And I think people will rely upon the portable computer as a way to stay in touch. The flaw in the cellular phone is that it really doesn't effectively take voice-mail messages or faxes yet. I think that the notebook and cellular marriage will solve a lot of that problem.

Steve Leininger: I think you are going to see a lot more of it having to do with your telephone. Perhaps you'll have a combination telephone, facsimile, computer database. It'll sort of be your personal manager. And it'll definitely be small enough to carry around with you.

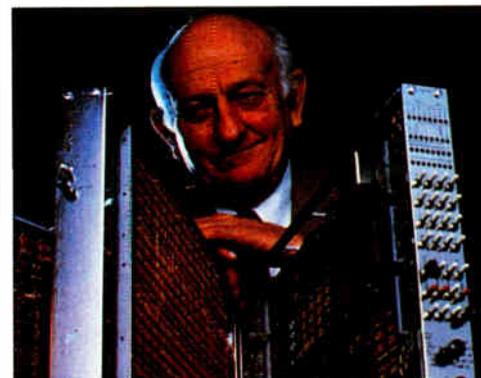
Rod Canion (see page 230): In addition to [getting smaller and smaller], of course, you have all the other technologies like voice recognition and artificial intelligence, the evolution of cellular communications. We will have resources that we can call upon at any time through natural voice communications, access to data around the world (perhaps around the solar system at that time).

Bill Gates: That's a little radical. I don't

continued



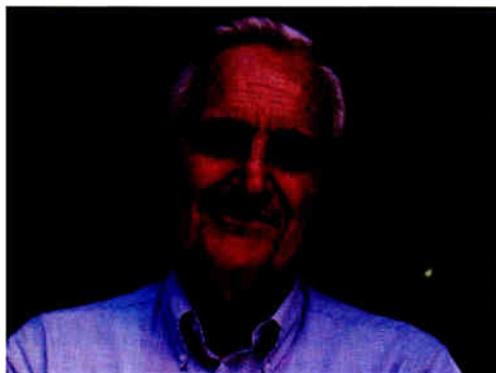
H. John Caulfield is director of the Center for Applied Optics and research professor of both optical engineering and optical science at The University of Alabama in Huntsville. He is an authority on optical computing and holographic storage.



John Cocke is an IBM Fellow and a pioneer in the fields of computer architecture and optimizing compilers. He was instrumental in the conception, design, and implementation of the first RISC computer and is responsible for such architectural innovations as "look-ahead" virtual memory and instruction pipelining. Cocke is a recipient of the A. M. Turing award from the ACM.



Esther Dyson is editor and publisher of *Release 1.0*, a monthly newsletter for the personal computer industry, and president of *EDventure Holdings*, which also produces the Annual PC Forum. In October, EDventure will produce the inaugural East-West High-Tech Forum in Budapest, Hungary.



Douglas Engelbart is the director of the Bootstrap Project at *Stanford University*. He developed the NLS, one of the first microcomputers, in the 1960s. He is also known for his pioneering work in augmentation and in groupware.

think it's necessary. If you can connect up every few hours, that's good enough. The machine in the office will just have this optic fiber that will go off to the world network out there. It will directly connect to some kind of server and will have a lot of storage.

Nicholas Negroponte (see page 304): There will be a family of physical products that will range from things the size of your wallet or a cellular telephone to real bona fide laptops to desktops. And they're going to start intercommunicating with each other in ways that are really very, very different than what we currently do or have now. I think there will be much more intercommunication between desktop computer—microelectronics—and your inside pocket or your pocketbook or your wrist.

Bob Frankston: We already have phones now that are ornery—I wouldn't quite call them intelligent but definitely ornery—but we'll be able to [link] into the telecommunications, a combination of—simple ISDN—smarter systems. You'll be able to teach your phone how to find you, whether to find you, and [how to] handle things more intelligently.

Doug Engelbart: Everybody remotely associated with communicating with other people will have something to carry around with them. The size will be limited to what kind of display and input stuff that you want.

Lee Felsenstein: One of the things that I'm looking toward, what we're developing here, will amount to a desk that you can hang on your belt. I look forward to that kind of product proliferating in various forms. I'm trying to make it an open architecture design.

John Markoff (see page 292): Right now most people have desktop computers as their principal computers, and they have a laptop as a secondary computer. And I think that all the innovation is going to be taking place in the smaller packages. We're all still trying to build a Dynabook basically. This is Alan Kay's vision of the early 1970s, and we're going to get progressively closer to it.

Alan Kay (see page 270): [There were] three physical forms we thought up for the Dynabook in 1968. One of them was the very slim notebook, weighing around 2 pounds or so. That's the thing that most people picture it as. And that's the one I

made a cardboard model of. The second one was a head-mounted display; [we] thought it would be dandy for airplanes. And the third thing was [the] wristwatch idea, which is where networking gets really pervasive. Just as we would be surprised to walk into a room [today] without an electric outlet, at some point in the future, we'll be surprised to walk into a room that doesn't have a transponder in it, a cellular transponder type of thing.

Mitch Kapor: I think [the typical microcomputer is] going to look pretty much like the ones today, except that there are going to be new form factors like palmtop computers, desktop supercomputers, and there will be a lot more embedded microprocessors in things.

BYTE: *That raises another point. Will the typical microcomputer be a box of any sort, or will it be hidden?*

Nicholas Negroponte: First of all, they will be buried, for the most part, inside other things, so there won't be a typical microcomputer, as such. It'll be part of something else.

Rich Malloy: Probably, we won't see it. It will be hidden someplace, either inside a monitor or inside some other device, maybe inside a keyboard. And it'll probably be hidden in a lot of objects. Practically every electrical object will have some kind of microprocessor controlling it, maybe even as small as inside a pen.

Gary Kildall (see page 282): Well, I think that a lot of the future we are going to see [with] microprocessors is probably pretty much the same way it started originally—that's oriented toward a lot of embedded microprocessors and devices that we use in everyday life. More functionality at a lower cost, in everything from communications to multimedia and in general.

Jonathan Sachs (see page 336): As computers get cheaper and cheaper and more and more powerful, I think we're going to see more and more special-purpose systems. We're going to see more and more computers incorporated into other products (either visibly or invisibly). It's already happening—computers have even been incorporated in computers. I think we'll see a lot more very targeted hardware/software turnkey solutions.

Seymour Papert: What I hope is that
continued



PC Proof. The People's Choice for Better Writing.

AT LAST.

PERFECT PROPOSALS,
PROFESSIONAL LETTERS
AND PRIZEWINNING
PRESENTATIONS.

Grin the wicked grin of confidence. Get to the point. Organize. Never worry about mistakes in spelling or usage.

PC Proof is fully interactive and easy to use. Corrections are made instantly and the original document is updated, with no separate printouts to review.

Whether it's a business proposal, a letter or manual, a contract or a speech, PC Proof can help you refine your writing until it's letter perfect.

PC Proof. Proofreading and text-revision software for IBM and compatibles by Lexpertise. Now for only \$159.00 (suggested retail price). MacProof available for Apple Macintosh. For more information, contact your local dealer or call toll free 1-800-354-5656.

PC Proof requires 640K RAM and runs on MS-DOS or PC-DOS version 2.1 or higher. PC Proof is format-compatible with Microsoft Word 3.0, 4.0, and 5.0 and WordPerfect 4.2, 5.0 and 5.1. It is text-compatible with all ASCII files. Call Lexpertise for further information on product compatibility at 1-800-354-5656.

Circle 499 on Reader Service Card

PC Proof.

YOUR ENGLISH PROOFREADER BY LEXPERTISE

World Radio History

sometime, maybe 15 or 20 years—maybe 10 or 15 years is too soon—sometime we won't even talk about the computer. It will dissolve away into the environment or world we live in.

Tony Hoare: There will be no such thing as a typical microcomputer, and for certain embedded applications, microcomputers will become more and more application-

oriented and specialized. For general applications, they will surely come to look like and play the role of minicomputers, mainframes, and even supercomputers. The most numerous, of course, will be the application-oriented embedded systems.

BYTE: *And what do you think the typical microcomputer will be able to do in 10 or 15 years?*

Some of the most enlightening articles in a magazine never make it to the table of contents.

Open to the table of contents in any publication and you can find some insightful stories. You'll also find some missing. Because the advertising isn't there.

Advertising is important. It's informative. It lets you know your options. And helps you to make decisions.

Like which car to buy. Which airline to fly. And what to serve for dinner.

So, next time you open a magazine, read it. From cover to cover.

Because what's on the back cover, may be just as important as what's on the front.

ADVERTISING.

Without it you wouldn't know.



AMERICAN ADVERTISING
FEDERATION



t this point in

time the microcomputer is

becoming a mainframe.

—Bob Noyce

Jim Blinn (*see page 229*): Well, I don't think computers have done anything new for the last 20 years. They've just done the same sorts of things, only cheaper and faster. I'm not sure of that. Maybe the multimedia craze with CD players and whatnot will do something substantially different. But in some sense, that's always been doable. It just hasn't been doable on a wide-spread cheap range.

Charles Simonyi: The differences will probably be in a better use of multimedia on the machine—in CD-ROM and other optical memories providing sufficient storage and then having very efficient standard algorithms to encode audio and video information. The other capability I think will be important [is] stylus control, initially developed for handwriting input, [but giving] rise to an even more efficient shorthand way of communicating with the computer.

Brit Hume: It's easy to [see] a small kernel running in memory that would be able to conduct searches of CD-ROM databases that contain encyclopedias and, of course, the things we already have, dictionaries and thesauruses and so on, dictionaries of quotations.

Paul Carroll: It seems to me that video text will take off in some form and at the least will mean that people more and more will rely on electronic media to get the breaking news. Many, many more databases will become accessible to people, and you'll get all kinds of encyclopedias on-line. You'll get far more types of publications on-line.

Danny Hillis: I think [the] emphasis will be on the human interaction part and on talking to the network, so that it becomes your interface—the network. But an awful lot of the real data and the real computing will, in fact, be done remotely when you have big problems.

continued

Discover Parallel Processing

Quadputer™

The Microway Quadputer is the world's most popular PC Transputer development environment. It can be purchased with two to four Transputers and one to four megabytes of RAM per processor. The Quadputer runs all the popular Transputer development software, all of which is available from Microway. It is compatible with our Monoputer™ which provides 1 to 16 megabytes of RAM and a single T800, our Videoputer™ which comes in VGA and higher resolution versions and is powered by a memory mapped pair (T800 and 34010), and our Linkputer™ whose cross bar switching network can dynamically link up to 32 Transputers. Finally, all Microway Transputer products can be used with our Number Smasher-860 to provide out-of-this-world numeric performance!

For more information, please call 508-746-7341.

Microway

The World Leader in PC Numerics

Corporate Headquarters, Research Park, Box 79, Kingston, MA 02364
TEL 508-746-7341 • FAX 508-746-4678
U.K. - 32 High St., Kingston-Upon-Thames, 081-541-5466 • Italy 02-74.90.749
Holland 40 836455 • Germany 069-75-2023 • Japan 81 3 222 0544

Number Smasher™ 860

The highest performance coprocessor card to ever run in a PC, Number Smasher-860 delivers up to 80 million single precision floating point operations per second at 40 MHz and produces over 10 Linkpack megaflops. The board comes standard with an ISA interface, two Transputer Link Adaptors that allow it to interface with a Microway Quadputer or Videoputer, your choice of our NDP Fortran, C or Pascal for the 80860, plus 8 megabytes of high speed memory.

NDP Fortran-860, C-860 and C++-860

Microway NDP 860 Compilers make it easy to recompile your favorite mainframe, 80386 or PC application for the 80860. The resulting code runs on our XTEND-860™ environment under DOS, UNIX or XENIX.



Stewart Alsop: [We need] new network operating systems. I think the ones we've got are wrong. [They] don't optimize human interaction in a workgroup; instead they're optimizing the computer-to-computer [interaction]. And we're going to get something of a revolution from users in that respect. They're going to rebel. I can't find any other solution to the problem.

Lee Felsenstein: Well, the most significant thing [the microcomputer] will be able to do is communicate with others of its kind and over a broad range.

John Warnock (see page 354): I think technology has a tendency to be exponential in its growth rather than linear, so I would see computers used primarily as very, very effective communication tools— aids for helping people communicate.

Bill Gates: On that screen, based on how you've customized it, will be the scheduling, sales, budget, project, news—the information that would interest you. As you click in on that information, it will show

you more detail, what's going on. You can combine that information in new ways and communicate with people. It will be your fundamental tool for knowing what's happening.

Paul Carroll: It'll also be connected much better to lots of other things, to your telephone, to a laser printer. A laser printer will become a copier, which will become a scanner, which will become a fax. All those distinctions will disappear, and there will be local connections between my PC and a device like that either on my desk or not very far away from me.

Lee Felsenstein: What I expect is that various types of desk work will be made available to the user without requiring that the user be at a desk. People who have functions that take them into the actual operations of the enterprise will now be able to handle portions of the desk work. And the separation between paperwork and "real work" will blur and begin to diminish.

Mitch Kapor: When you can start carry-

ing around a computing environment with you everywhere you go, it will let people stay in constant contact. I think that in that context, the digital cellular developments in the mid-nineties will be very important, because you'll be able to have a reliable, wireless data link from a remote device to anywhere else. These will not only be "go everywhere" devices, but they'll be "always in contact" devices.

BYTE: *It certainly sounds like tomorrow's machines are going to be fantastic.*

Rod Canion: I think if you extrapolate some of the technical trends, what you'll see is incredible computing performance, storage capacity, and all the resources we need in a very, very small package: the wristwatch supercomputer. I always think that you can only talk about the next five years. If you're going to go out 10 to 15 years, you really have to go beyond just about the most incredible science fiction that you've ever imagined to see what we're really going to be doing with microcomputers. ■

Attention U.S. BYTE Subscribers

Watch for the next **BYTE DECK** mailing that will be arriving in your mailbox soon!

Use this as a fast, convenient tool to purchase computer products and services. It's loaded with essential hardware and software products that you should be aware of when making your buying decisions...and it's absolutely **FREE!**

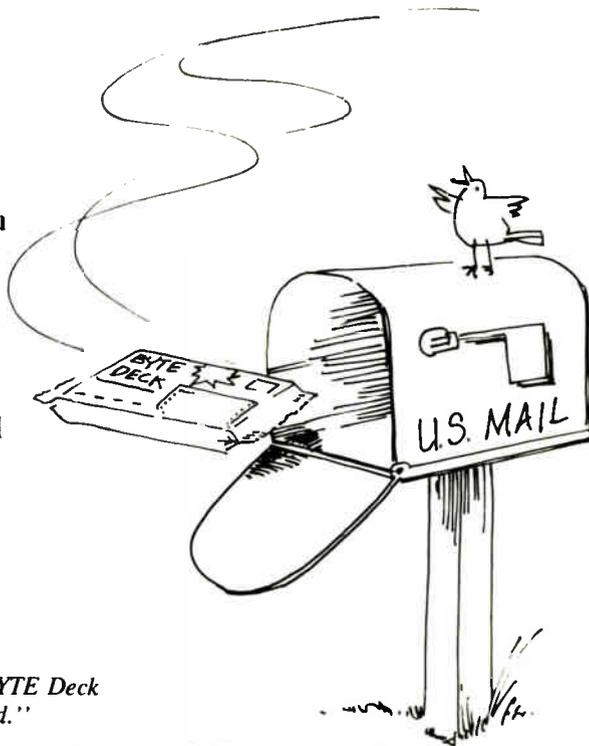
If you have a computer product or service, and would like to reach 275,000 influential **BYTE** magazine subscribers, please give Ed Ware a call today at (603) 924-2596.

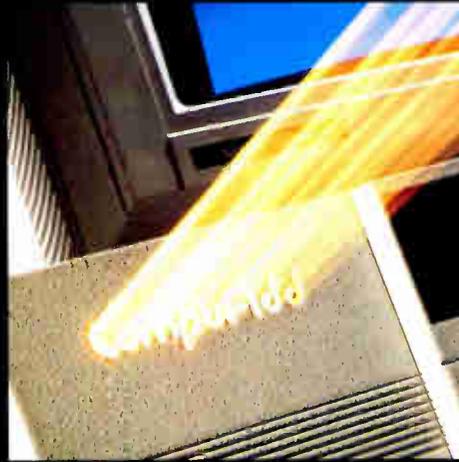
**BYTE
DECK**

Here's what a **BYTE Deck** advertiser has to say:

*"Galacticomm does a lot of card-deck advertising, and the **BYTE Deck** has consistently out-pulled every other deck we have ever used."*

Timothy Stryker, Galacticomm, Inc., Fort Lauderdale, FL



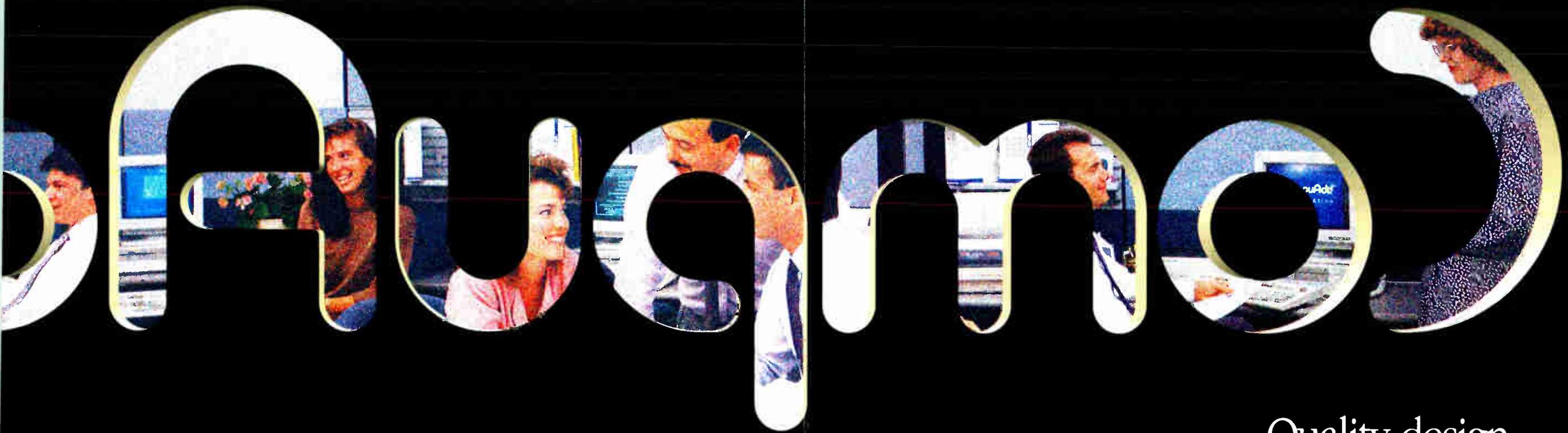


You'll be
surprised to see
what's behind the
CompuAdd name.

CompuAdd[®]
Customer driven, by design.[™]



It's not
what you think.



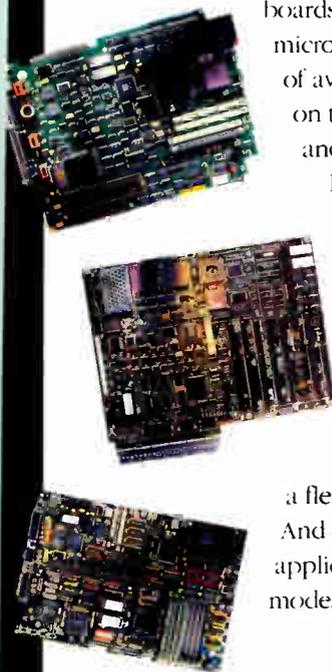
Is it the motherboard?

Is it performance?

Is it price?

Quality design, better performance, highest value...

Look inside an IBM® PS/2 Model 70-386, a Compaq® Model 84-386 and a CompuAdd® system. See any visible differences? All three companies design and manufacture their own motherboards. They all use an Intel microprocessor and offer a number of available expansion slots (three on the IBM, six on the Compaq and five on the CompuAdd).



Each motherboard uses advanced surface-mount technology and top-quality components. Each manufacturer offers a choice of memory configurations, internal storage devices and a host of other options to create a flexible computing environment. And all three support DOS applications and VGA graphics modes.



■ PageMaker®
■ Magellan®
■ AutoCAD®

We ran head-to-head benchmark tests* on these systems under three CPU-intensive applications: PageMaker, Magellan/1-2-3 and AutoCAD. While the results were no surprise to us, they might surprise you. Under PageMaker, CompuAdd performed 43% faster than IBM and 7% faster than Compaq. Running Magellan/1-2-3, CompuAdd was 46% faster than IBM and 26% faster than Compaq. And under power-hungry AutoCAD, CompuAdd outran IBM by 42% and edged Compaq by 8%.

(*Completion time in seconds)

Once again, numbers tell the story. At \$4,995, CompuAdd's system is 41% less than IBM's. And 50% less than Compaq's. How do we do it? We design and manufacture every CompuAdd system from the ground up and deliver the quality and savings directly to you.

IBM
\$8500

Compaq
\$10,040

CompuAdd
\$4995

Through corporate sales, in 89 CompuAdd Superstores nationwide and through our catalogs. Then we back all our hardware and accessories with a 30-Day No-Questions-Asked Guarantee, a full year's warranty, toll-free technical support, an onsite service option and complete in-store service facilities.

So what else could be behind the CompuAdd name?

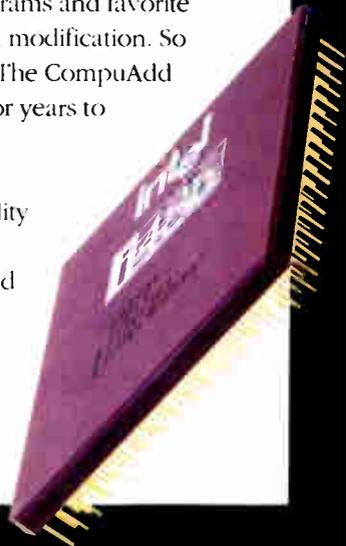
The most powerful chip on the market.

Surprise! We've been comparing the competition's 386-based machines to the state-of-the-art CompuAdd 425. Based on the revolutionary Intel 486 microprocessor — the "mainframe on a chip" — the CompuAdd 425 provides astonishing performance *at less than half the cost* of these 386s. And the value doesn't end there. You can continue to run all your old DOS programs and favorite 286/386 applications without modification. So why buy 386 obsolescence? The CompuAdd 425 will be *the* technology for years to come.

So what's behind the CompuAdd name? High-quality components, superior performance, affordability and leading-edge technology.

And what's in front of the CompuAdd name?

A lot of smiling faces.





CompuAdd 425

System price: \$4995 (66652)

The technology of tomorrow is here! The CompuAdd 425 delivers 25MHz, i486 micro-processor computing to your desktop—power for the most demanding spreadsheet, database, network or CAD/CAM applications. The CompuAdd 425 offers full MS-DOS, OS/2, SCO XENIX and Novell compatibility. Step up to the next generation of computing with the CompuAdd 425!

- i486 microprocessor running at 25MHz
- Standard 4MB DRAM expandable to 16MB
- ROM shadowing for increased system speed
- Diskette controller and hard drive interface on motherboard
- Three full-sized and two half-sized expansion slots
- One 5.25" and two 3.5" half-height drive bays
- CompuAdd MS-DOS 4.01 and DOS Help! utility
- Windows 3.0 software
- 5.25" 1.2MB or 3.5" 1.44MB high-density diskette drive
- Color VGA monitor and 16-bit video graphics adapter
- 80MB hard drive with free PC-Fullbak backup utility software
- CompuAdd serial mouse
- FREE one-year onsite service

CompuAdd 425 Enhanced Configuration

- Super high-resolution (1024x768) color VGA monitor
- CompuAdd 16-bit Hi-Rez VGA card
- 110MB hard drive
- **Enhanced system price: \$5595 (66654)**



The CompuAdd 425 is FCC Class A Approved. Not intended for residential use.

CompuAdd 316sl

The CompuAdd 316sl packs the computing power of the 386SX into a convenient laptop at a price far below competitive models. The 316sl gives you flexibility to run your favorite 286 application or new 386 multitasking programs.



- 386SX microprocessor running at 16MHz
- 2MB DRAM expandable to 6MB
- Built-in serial, parallel, external VGA monitor, keyboard and 5.25" diskette drive ports
- Superwist 8" x 6" sidelit LCD, 640x480 monographics VGA display
- 3.5" 1.44MB high-density diskette drive
- 40MB (28ms) hard drive
- 85-key keyboard with 101-key emulation, 12 function keys and 4 cursor keys
- **System price: \$2895 (62202)**

CompuAdd Companion

The ultralight 4.4 pound Companion puts the performance of a full-sized 286 right in your briefcase! Completely AT compatible, the sleek Companion offers computing flexibility and performance on the run.



- 80C286 microprocessor running at 6, 8 or 12 MHz
- 1MB DRAM expandable to 3MB on motherboard
- Compatible with MS-DOS, OS 2, SCO XENIX and Novell
- High-resolution, monographics VGA display
- 20MB hard disk drive with 23ms access time
- Compact dimensions of 8.5" x 11" x 1.1"
- MS-DOS 4.01, LapLink II in ROM
- 79-key keyboard, 101-key emulation
- **System price: \$2895 (62280)**

CALL TODAY! or visit a CompuAdd Superstore for these savings.

800-288-4445

Hours: Monday - Friday 7:00am to 7:00pm CST

Key Code 5651

We accept MasterCard, VISA, money orders, certified checks and personal checks (please allow ten days for processing). C.O.D.s (\$50 minimum order), company and institutional purchase orders (minimum initial purchase \$500, thereafter \$50) and wire transfers.

Please add 2% to all purchases for shipping and handling (minimum \$4 shipping outside the continental United States will increase cost). Add \$6 for shipping and handling to APO/FPO addresses (minimum \$10). AZ, CO, CT, DE, FL, GA, HI, IL, IN, KS, LA, MA, MD, MI, MN, MO, NE, NH, NJ, NY, OH, OK, PA, RI, SC, TN, TX, VA, and WI residents, please add appropriate local sales tax. Thirty-day money-back guarantee does not include return freight or shipping and handling. Opened software, videotapes, and other consumables are non-refundable. All return items must be accompanied by a return merchandise authorization (RMA) number. Prices and product descriptions are subject to change without notice. CompuAdd is not liable for damage due to omissions or typographical errors. Call 800-660-1872 for a copy of CompuAdd's complete warranty.

Think Technology, Think CompuAdd.

CompuAdd®

Customer driven. by design.™

12405 Technology, Austin, Texas 78727
 FAX: 512-555-0250
 Telex: 765544 COMPU-ADD AT S

Technical Support 800-999-9901
 Outside US 512-258-5575
 Canada 800-857-5266

Alan Kay:

On the Next Revolution

I think of the computer as being an event like the invention of writing, long, long ago. Some of the significant things that happened in the history of writing are similar to some of the significant things that have happened in the last 40 years [with computers]. We're sort of compressing 40,000 years into 40 here.

I think the first revolution in writing was getting it off the wall and into books. The first revolution in computing was getting out of batch processing and into timesharing. So, you have a nice analogy there. If you look at the pictures of the old libraries, they didn't have shelves because the big town library would only have maybe 25 books or so, and each one would have its own table. It looked a lot like a timesharing bull pen to me. So, I think of this first phase—this first computer revolution—as being institutional timesharing, where the institution still has to own all the equipment, and you have to intercede with them in order to get access, and so forth.

The second revolution in printing—Gutenberg—made books that were possible for an individual to own, but [that] imitated the old manuscript, like a personal computer today looks like an old timesharing terminal. As McLuhan pointed out, every time you create a new medium, it takes its initial content from the old. So you have these lags. The initial content on the microcomputer was the same content as the timesharing. MS-DOS is really an extension of the timesharing wave.

To me, the second computer revolution is not just the computer on the desktop, but the Macintosh/Xerox PARC way of doing [the] user interface. And there, the big transition was in going from a user interface (in the timesharing system and on the MS-DOS machines) that is mainly thought of as access to function.

What the Mac did was to redefine the relationship of the user in a couple of

important ways. One is [that] instead of its main job being access to function, the main job of the Mac is to be a learning environment. Its main job is awareness, not access, not control. So, the idea is, whatever task you have, you should learn about 70 percent of all there is to know by being driven by any particular task, and you can transfer [that knowledge] from application to application. And that works out well enough to constitute a revolution such that even IBM is interested in doing it.

The third revolution that is going to come is one that is driven by networking—it's a pervasive technology—and I call [it] the intimate revolution.

Tools and Agents

Another way to think about the Mac [interface] is that it is tool-based. At PARC, we had an impulse to try and bring the computer into human scale. Anything that is larger than human scale—it could be a sports figure—we treat religiously. It's not even a joke. It's actually the way our nervous system works.

So, one of the first things you have to do is to bring things into human scale, and the two human-level ways we have [had] of extending ourselves over the last several hundred thousand years is by tools—both physical and mental tools—and by agenting. Agenting is where you get somebody else to do your goals for you.

I've heard pointed out that for most of human history, most machines that humans have constructed have had other humans as moving parts. So we build society and so forth. We build these organizations that have fewer goals than the number of parts in them. And we are a species that is interested in getting our goals cloned, and we are also willing to have goals cloned into us. If we weren't, we'd be bumblebees.

So, the two ways of getting something

into human scale are by making it into something like a tool or making it into something like an agent. The thing we decided to do at PARC was to make the machine be like a tool. That's where all the icons [came from]. So, a tool is something that you look at and manipulate. Manipulation is a very important part. An agent is something that looks at you, [something] you manage.

The belief that some of us have is that this third computer revolution, the way I think of it, is driven by networking. Computers without on/off switches: Like a wristwatch, they'll be too useful. You won't want to turn them [off] because you'll be using them for such trivial things, as well as important things, that you won't want to wait for them to fire up, and stuff like that. The user interface, unlike the Mac, will be not tool-based, but agent-based.

And the thing that is going to drive the interface to be agent-based is [this] problem: In 10 years, we will be hooked up to more than a trillion objects of useful knowledge, and no direct manipulation interface can handle that. People are not going to sit down with a super SQL application and start fishing around the entire world for things that might be of use to them. Instead, [the interfaces] are going to be 24-hour retrievers that are constantly firing away doing things.

At some level, as you want [agents] to take on more and more complex goals, you'll want them to be more and more in our context, more and more flexible, more and more intelligent. But just the ability to be able to defer things like access goals [is significant]—like an agent that would tell you if amongst your 100 pending E-mail [messages], that there is one that is really important, [that would] notice words like "meeting" and "canceled."

Editor's note:

See biography, page 270.



THE BYTE SUMMIT

NEW OPPORTUNITIES

If you were going to start a new company now, what market area would you aim at?



Innovating is

easy: You just rub smart people and money together.

—Alan Kay

Lee Felsenstein: First of all, I would advise anybody, find out what everyone says won't sell and do that. Because the primary feature that I have discovered in terms of the marketing product-development function is basically a hysterical aversion to innovation and a desire to play it safe by designing or creating that which has already been created. When you get into production, that's another matter. As Ted Nelson has so aptly said, everyone wants to be second. So, that's my major tip. Do what everybody else won't do, especially when there is no good reason.

John Caulfield: (*see biography, page 235*): I would aim at niches first of all. I am not ashamed of that word. I think all computers are now a niche technology. The time of the general-purpose computer that IBM had is gone. Microcomputers destroyed it. Basically, your miniprocessors did. There's a supercomputer niche, innumerable microcomputer niches; there are multiprocessor niches.

Ken Olsen: You have to adjust to the world. And if you are starting a company, you always have to be reminded that there are some things a small company can do better, and there are some things only a big company can do. And a big company that's going to go out and compete with a small company on things that [the small company] can do better always loses. When it comes to specialized applications, they are done by a small company that is expert in something. And a big company cannot be that expert in everything.

Dick Pick: It may not be the most glamorous, but the people that are going to be successful in computing, and make livings off of computing, are people that are going to identify [a vertical market] and know more about that field than the people out there, and [who] can take it to the [emergence] of the computing technology, the data management technology, the communications, the various stuff, and be able to provide solutions.

BYTE: *But what specific areas do you think will be big winners?*

Bill Gates: There are opportunities in mul-

timedia [and] artificial intelligence. I wouldn't start one to do another word processor—that's a tough business to try to enter into. I still wouldn't do a hardware company, but that's probably just my match of skills. There's a lot in software, and hopefully people will take us established guys and, to some degree, blow us away.

Jerry Pournelle: That's no secret, I've said it many times—multimedia. Gates is absolutely right.

Gordon Campbell: Multimedia. While I think we're probably still a number of years away from its becoming a reality, I think as we can migrate real-time video into the PC, we have a tremendous tool for education. People have adjusted pretty effectively to television over the last 20 to 30 years. I think the migration of real-time video into PCs is going to be a real godsend.

Alan Kay: This is the biggest trap in multimedia. Most people think that by taking something and making images out of it, you can bypass what people aren't getting from books. But that's, in fact, not true. Images beg to be recognized, and words beg to be understood.

Paul Carroll: I don't see multimedia as a market, but I do see it as a very important technology that will facilitate more work in desktop presentations and corporate training, [and] better teaching in universities, high schools, and grade schools.

Gordon Campbell: I'd like to see the multimedia time frame moved out, and the primary reason for that is that I think it will ultimately be by far the most effective educational vehicle that we can have. If there is a vehicle that would allow us to effectively combine with [TV]—a lot of what kids like to do is just watch TV—and make it a strong educational tool, I think it would help the U.S. quite a lot.

Jim Blinn: What I think would be interesting to do is maybe something to do with multimedia, or something to do with video production. I do that [now] because I'm interested in it, and doing it as a company might be only slightly different from what I'm doing now—produce videotape, pro-

duce educational videotapes for the high school mathematics-level education.

Stewart Alsop: I believe in the area of multimedia, and a number of component technologies need to happen. I think video compression is a really important technology. I think that every computer needs to have compression built into it. I believe in multimedia enough that I think every computer should come equipped with both a camera and a microphone.

Jonathan Sachs: Well, I guess I see [multimedia] as the next fad. I'm not sure I feel it's the next serious thing. I'm not even sure I know what it means. To the extent that it means being able to make up audiovisual slide shows that are interactive and things like that, yes, there's a market for it, but it's a fairly narrow thing. I think it's something that's invented by Apple after they've sort of conquered the desktop publishing market to say, OK, here is the next great thing that we're going to conquer.

Ted Nelson (see page 304): Well, desktop movie-making is going to be awfully big. And the RenderMan standard, this is already beginning on the Amiga. My understanding is, for example, that Disney Productions now models on the Amiga and renders on bigger machines, so that the same capabilities that Hollywood's most sophisticated production organizations have [are] now coming into the hands of the people. And that will be the democratization of visualization. This is a great step forward.

Terry Winograd: Multimedia is finally going to come into its place. It will become much more a central part of computers.

Charles Simonyi: It is no longer programmers making doodles on pieces of paper. It is almost an issue of individual arts to exploit the multimedia capabilities.

John Markoff: I'm intrigued by multimedia, although I think it's probably a decade [away from being] mainstream. The tools are just nowhere near good enough to permit people to use them as easily as they use tools like word processors. They just have to put a lot more power and control into that class of tool.

Gordon Campbell: I think in addition to that, we are going to need to have, from a software perspective, some efficient ways to manage the databases that become available as we can actually migrate video and vast—and when I say vast, I'm talking

about more than just encyclopedias and dictionaries—[amounts of information] into the CD-realm form factor.

Stewart Alsop: Multimedia literature. What I mean is not just programming, but a combination of programming and editorial development to create products that engage the intellectual and emotional capacities that we have as human beings, but they'll run on computers. People in the computer business think of data as data. It's this lifeless thing that you cram onto a CD-ROM and sell to people for \$1000. But there's something else you do to the data, called editing, [that] creates an experience for the customer. And it's that experience that you're selling. That's different [from] data.

Nicholas Negroponte: Now, on the same list of things that are going to be big wins is flat-panel display technology. Over the next 10 years, that will be a very, very substantial field. The CRT, in spite of what people think, has locked us into a definition of what resolution should be. I think this will change very substantially.

BYTE: *What opportunities does anyone else foresee in the area of display technology?*

Steve Leininger: Color, flat-panel displays—portable, high-resolution, high-information-content displays.

Charles Simonyi: Displays will have better resolution; they will be perfectly flat.

Michael Slater: Display resolution, I think, will go up. Today, everyone is used to 640 by 480 in the PC world, and roughly 1280 by 1000 or 1000 by 800 in the workstation world. I think you'll see the PC world moving up to the workstation-level resolution.

Gordon Bell: We'll all be sitting with big screens, big color screens. I don't know whether it's as big as a 45-inch screen or not, but that will be the interaction mode.

Bill Gates: The ability to get a very large screen and see a lot of information on it—people underestimate the impact of that. We will be flat-panel by then, and a lot of people will have their entire desktop or white-board-type areas be computer displays.

Michael Slater: I think all the flat-paneled display technologies are important. The

continued

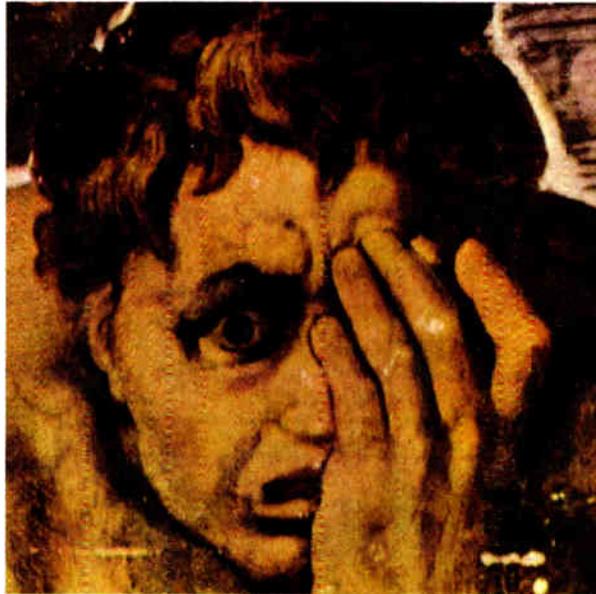


David C. Evans is cofounder, chairman, president, and CEO of *Evans & Sutherland Computer Corp.* His major contributions in computers have been in interactive computing, graphics, and CAD/CAM.



Federico Faggin is cofounder and president of *Synaptics, Inc.*, which is dedicated to the creation of hardware for neural networks and other machine intelligence applications. He conceived, designed, or codesigned many of the earliest microprocessors, including the 8008 and 8080 for Intel, and the Z80 for Zilog, a company that he cofounded.

Death Taxes Software Piracy



We can save you from one of them.

Sorry. Death we can't do anything about. As for taxes, when you use our product you'll probably wind up paying more. But software piracy: there we offer some help. Our family of software protection devices (dongles) have improved unit sales for over 2,000 companies around the world. Our products can be used in the MS-DOS, OS/2 and Macintosh environments.

Build Your Own Custom Protection Environment

Use our patented "dual-locking" ASIC chip as the basic building platform. Next, add options like: on-the-fly read/write memory, write-once or multiple-write locking codes, and encryption shells. Then add your

own programming creativity to build a protection environment best suited to your product.

Users attach the device to their parallel port, and programs won't run without it. Back-up copies, hard disk and LAN operation are not interfered with.

Your Intellectual Property Belongs To You

And if you don't protect it, who will? Our products offer the most equitable way to protect your interests without sacrificing the rights of your customers. Call us today for information and demonstration units.

Macintosh is a trade mark of Apple Computer Inc., Activator, Mactivator are trade marks of Software Security, Inc. illustration: detail from Michelangelo's Last Judgement



Software

USA
1011 High Ridge Road
Stamford, CT 06905
1-800 333-0407 ext. 101
203 329-8870
Fax 203 329-7428
BBS 203 329-7263
Apple Link D2379



Europe Ltd.
Selborne House
Old Avenue
Weybridge, Surrey
UK, KT13 OPQ
44-932-821-230
Fax 44-932-246-268

Security

UK Ltd.
21 A The Precinct
High Street
Egham, Surrey
UK, TW20 9-HE
44-784-430-060
Fax 784-430-050

active-matrix LCD technology that is now in the early stages of being a commercial technology has a reasonable chance to become a dominant technology for computer displays.

Lee Felsenstein: "Thick-film," active-matrix liquid-crystal displays. It's using a different technology; it's using cadmium sulfide and cadmium cyanide, which engineers will recognize as being common materials in photocells and stuff like that. [The interesting thing is] that if two people had walked down the hall at Bell Labs in 1947, we would not be using silicon for transistors. We'd be using these materials, because there was development going on in cadmium sulfide and [cadmium] cyanide in one office, and in the other office, they were doing the point-contact transistor.

David Evans: Everybody would like a high-resolution, flat-display device, bright enough and rich enough and cheap enough. We limit ourselves to seeing very crude representations of things. That's one domain where I think we know that there's a

real need for something better. I think that HD television will probably produce the technology that we'll enjoy, for example.

John Markoff: The most important step is going to be in display technology, I think, in a lot of ways. HDTV, there's the real question: There's this collision coming between the television makers and the computer makers, and I'm not sure who's going to come out alive, but I think [it] will be who innovates best.

Seymour Papert: We need to break down the barriers between television and the computer. You know, when we started out, we used to use the television as a monitor, and I think we'll go back to this, in a sense. I have an idea that eventually the computer will be more flexible. I would like to see a "softer" computer that doesn't respond in such a "hard-edged" way. I'd like computers to have more common sense. I don't know which technologies will dominate, but the solution will be related to understanding—how to think about thinking. We'll do it by understanding people better

[instead of] by using new technology—it's a product of ideas rather than technology.

John Warnock: I would like to see the standards in television increase. The technology that I would like to see in place to enable everything in the future is the higher-bandwidth communication, because that's starting to become a limiting factor.

BYTE: *Communications and its many related fields have been pretty active in the recent past. Do you think there are opportunities in these areas in the future?*

Jonathan Titus: I think there's a lot to be done in terms of communications software. And it just seems to me that that would be the place that I would look. That market seems to be pretty well fragmented between people [who] are offering bits and pieces of the solution but nothing really that ties everything together.

Bob Noyce: Well, I think [the key is] distributed memory—shared memory. I think *continued*

SAVE 30 MINUTES EVERY TIME YOU HAVE A PC PROBLEM!

By using CheckIt® to find out if the problem is Hardware or Software

The second you suspect a problem with your PC, you should reach for CheckIt, the world's most popular PC diagnostic software. Running CheckIt should be the first thing you do -- because confirming or eliminating your PC's hardware as the source of the problem can save you time, money, and unnecessary repair calls.

CheckIt will test your PC's main system board, memory, hard disk drive and floppy disk drives, video subsystem, communication ports, printer, keyboard, mouse, or joystick. CheckIt will also display key software and setup data, including your PC's exact equipment configuration, current IRQ assignments, memory allocation, device drivers, and CMOS table.

Take a minute to run CheckIt the next time you have a PC problem. Then you'll know the answer to these key questions: Should you back it up, pack it up, and send it out for repair? Should you fix a hardware problem yourself? Or, should you concentrate on the software and configuration problems that you can correct?

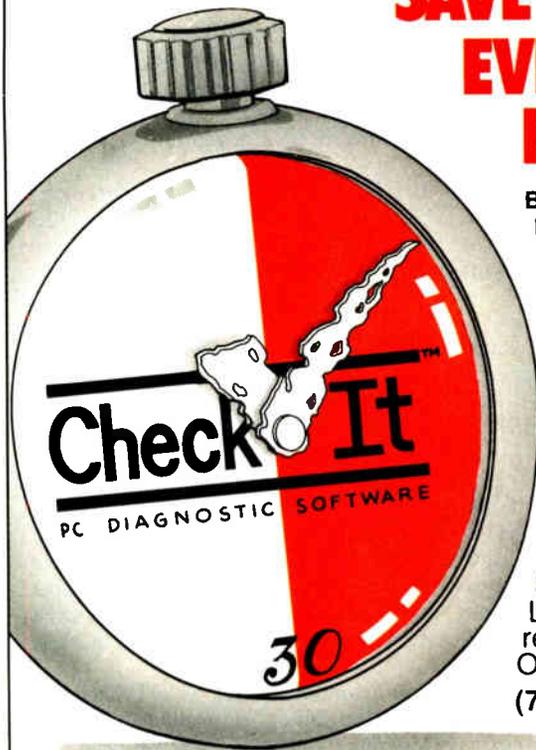
The moment you suspect a PC problem, run CheckIt. *It's about time!*

Look for CheckIt at leading retail stores everywhere, Or call TouchStone TODAY!
(714) 969-7746 or (800) 531-0450

TouchStone
Software Corporation

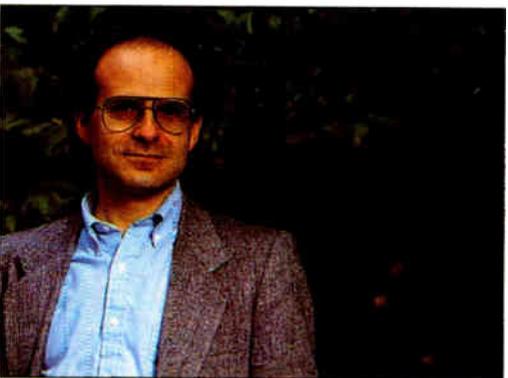
2130 Main Street, Suite 250, Huntington Beach, CA 92648

CheckIt is a registered trademark of TouchStone Software Corporation. Copyright © 1990 TouchStone Software Corporation. ALL RIGHTS RESERVED.





Lee Felsenstein is president and chief engineer for *Golemic, Inc.*, a microcomputer hardware R&D company. He designed the first video display adapter for the S-100 bus as well as the Osborne-1, the first portable computer.



Robert Frankston is coinventor of the first electronic spreadsheet, *VisiCalc*. He is currently employed by *Lotus Development Corp.*

it's breaking down the problems and parceling them out like you do in a company. Maybe we may organize our computing as we do a company—with managers, etc., and a hierarchy. We don't know how to manage distributed processing.

Niklaus Wirth: I have no intention to start a company, but the interesting, the challenging field is that of distributed systems and parallel processing. That is what will be a likely field; whether it is commercially that viable, I don't know. But it's certainly, from the conceptual point of view, the challenge.

Jim Manzi: Also, distributed computing applications. Distributed applications that make network usage as integrated as desktop usage will be in the next year or two. Running an object-oriented network operating environment, a graphical environment, across a network where a user can access anything, and do anything right from his or her desktop with the least amount of pain and frustration.

Bill Stallings: I think you'll go more to distributed processing as the applications get solidified. That's a big area of work in ISO—developing distributed applications with recovery and things like distributed transaction processing. I think a lot of that will be distributed.

Bill Joy: I think the exciting area in the nineties is going to be writing, developing interesting systems, distributed systems, to automate and to make more productive groups of people. And I think getting involved with writing end-user applications and developing those kinds of systems would be very exciting.

Terry Winograd: I guess it would be systems for design of integrated work settings, something with user customizability, group customizability. People are beginning to use computers much more that way.

Doug Engelbart: I think the big market opening is in groupware—it hasn't even begun to be really tapped. That's what's really going to cause so much new alignment in markets and products in order for things to work inside organizations, between people. That's the big challenge.

Stewart Alsop: I also believe in groupware very strongly. I hate the term *groupware*, because it suggests all kinds of AI-type stuff. I prefer to call it network applications.

Terry Winograd: Networking is important, and anything having to do with networking has to come.

Michael Slater: I think bringing networking into something that companies can do without having to go through a great deal of pain, and having to have somebody devoted to maintaining the network, is a real important growth area.

Stewart Alsop: [The appropriate network model] includes the notion of ad hoc use of network resources instead of this tightly controlled centralized use of network resources. There's a very PC-like future for network computing, which is that you can install your own applications, that you can mix and match on the network, and share stuff without having to get official approval.

John Warnock: Standards in the communications business are extremely important. People say that standards stifle innovation, and in communications that's not true. Standards enable communications.

Terry Winograd: If I were to define something in the hardware line, I guess it would be in portable computing and networking.

Andy Bechtolsheim: I think you're going to get 486s in laptops probably this year or next year—and there's going to be very little difference between laptops and desktop machines in the near future.

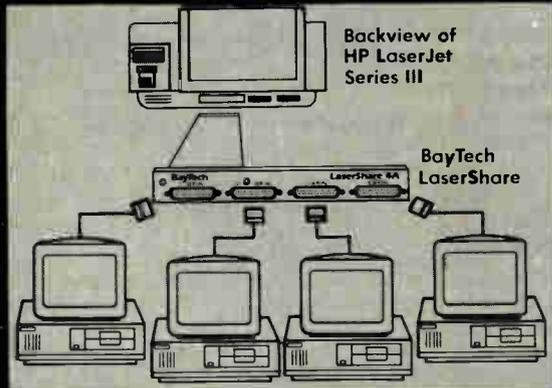
Brit Hume: If I were going to start a company, I would try to develop some applications for laptop computers. My idea would be that I would try to reverse the process in terms of the growth of programs' current size. For example, I would see a real market for a scaled-down version of a program like Procomm. And it is my view that you could get a program that would be about 80K. I think there's a market out there because the laptop market is growing.

Gordon Campbell: I think there will be a tremendous number of opportunities still in the PC arena as we migrate into these different areas. So the communication aspect of portables, I think, will still be a strong market—one of the most difficult markets.

Bob Frankston: What we're limited by is more the failure of imagination, people who don't understand why we need gigabytes of communication capacity per person.

continued

LaserShare®: The Choice Is Crystal Clear



LaserShare is an expansion card that allows four users to connect to one laser printer, including the new HP LaserJet Series III. LaserShare simply plugs into the I/O slot of your laser printer, giving each computer access as if it were directly connected.

Up To 4MB Buffer And More!

All operations are transparent to the user, and with its large dynamically-allocated buffer (256K and 1MB, also available to 4MB!), LaserShare is equipped to handle the most complex printing jobs. LaserShare also has a variety of user-programmable features, such as serial port configuration, so it can accommodate your individual printer-sharing needs. LaserShare's baud rate can be configured to speeds to 19.2K bps. And, since several users have access to one laser printer, the per-user cost of your laser printer is dramatically reduced. There's no more wasting time waiting for print jobs. When it comes to laser printer sharing at a reasonable price, the choice is crystal clear — LASERSHARE! Call now for details!

Crystal-Clear Solutions

Locate your laser printer below, next to its solution:

- HP LaserJet II, IID, III, Canon LPB8II, LPB8III, or Wang LDP8
 - Brother HL8e
- LaserShare 4A (4 parallel ports)
 LaserShare 4C (4 serial ports)
 LaserShare 4E (2 parallel, 2 serial ports)
 LaserShare 4CB (4 serial ports)

BayTech

Data Communications Products Division
200 N. 2nd St., P.O. Box 387, Bay St. Louis, MS 39520 USA
Fax: 601-467-4551 PHONE: 601-467-8231 or toll-free

800-523-2702

All product or company names are trademarks of their respective holders.

Circle 457 on Reader Service Card (RESELLERS: 458)

INTERNATIONAL DEALERS

- Australia**
Melbourne Shuttle Technologies, Ltd. (03) 587 4920
- Melbourne**
Goya Tech, Pty., Ltd. (03) 747-8455
- Benelux**
Belgium Multiway Data Belgium 016-29 22 78
- The Netherlands**
Netherlands 079-424 111
- Denmark**
Trend Communications 53 65 23 45
- Finland**
Genline Oy Impdata (921) 335700
- France**
Paris Komdex International (1) 47 72 63 11
- Suresnes**
Gradco France (1) 42 94 99 69
- Germany**
Munich AMS Computech GmbH (089) 126806-0
- Dusseldorf**
Multiway Data Germany 0211-25 18 75
- Italy**
Torino BRM Italiana (011) 771.00.10
- Milano**
I.T.D. (02) 749.0749
- Norway**
A/S Kjell Bakke 47-6-832000
- Singapore**
Mark Systems (FE) Pte., Ltd. 65-2261877
- Spain**
Vidmar Control (93) 2454803
- Sweden**
Solna Microcom/Maldata (08) 7344100
- Sollentuna**
Beon Data 08-626 92 26
- Switzerland**
Sengstag Computers AG 0041.1.950.54.44
- United Kingdom**
Leicester A-Line Dataspeed Devices 0533-778899
- Buckinghamshire**
Trend Datalink, Ltd. (06285) 30611

Alan Kay: Communications services are what the nineties are all about. In the future, we don't want to think of [the computer] as what we think of it now. We have to think of it as something like clothing. We have to think of it as something like a communications device. That will tell us a lot more about what the thing should be, rather than thinking of it as something that is going to do desktop publishing better.

BYTE: *Are there any other opportunities for new companies out there?*

Danny Hillis: I guess I think the big market need today is making computers simpler to use. And in reducing the complexity of interacting with [them].

Tony Hoare: I am quite convinced that the central question is how to make computers more usable, how to make their software more comprehensible, and how to avoid the dangers imposed by the complexities of standard software in the current generation.

Rod Canion: The ability to interact with the computer will get better and better because of things like multimedia and artificial intelligence that are all just right on the horizon here.

Mitch Kapor: [One] of the most interesting things, for instance, is this whole area of virtual reality. The notion of creating an interactive 3-D computer graphics simulation of some environment, whether real or imaginary, that you participate in—not simply by looking at a screen and moving around a mouse, but by basically wearing some special clothing, some goggles, and a data glove.

Rich Malloy: I think that the most interesting area right now is where you take input that has been very hard for a computer to recognize—for example, handwriting, voice recognition. What looks very interesting is neural-network technology and that kind of thing. I would look into that area, try to develop products that could allow us as humans to interact better and more efficiently with computers.

Bill Joy: Figuring out new ways of interacting with the user. The really great applications invent new metaphors in each application domain. That is going to be really exciting.

Mitch Kapor: I think [desktop virtual reality] will give rise to new metaphors for

computing—the cyberspace metaphor as opposed to the desktop metaphor.

Bill Stallings: One area that strikes me is going more toward human-oriented interfaces. For example, there's an area that's almost nonexistent now but is projected to grow very dramatically: hand-held, hand-written systems.

Philippe Kahn: I'm sure that pen-based computing is important, because there is going to be a lot of [it]. Within three or four years, at least in a very commercial use, a lot of people will be using pen-based machines to actually do a lot of things.

Dick Shaffer: At the moment, I think stylus systems is a hot area. Somewhere in two to five years, I think that a major company will be started in that field. Commercialize what you can do in handwriting recognition today.

Paul Carroll: I've also become intrigued by these handwriting-recognition systems. I don't think those will have much of an impact over the next few years, anyway, but I think that within three, four, five years, maybe a little bit longer, those will open up whole new markets.

Bill Joy: The problem we really have is not printing, but handwriting input, voice input, and some of these things that require massive amounts of computation. I'm not sure even extrapolated parallel RISC machines are going to have enough power to recognize most people's handwriting.

Paul Carroll: If I could commercialize something on the drawing board, it would be the ability to interpret all kinds of writing, not just block printing but cursive writing and so forth.

Bill Stallings: Handwritten input, voice input, human input as opposed to keyboard/mouse input—I think that's going to really broaden the base of where things are used.

Ken Sakamura (see page 336): Keyboards [are] already good enough for most Americans. Japanese people have no experience with keyboards, and in order to get good widespread use of computers, we need an input method that people feel comfortable with. So there's a tremendous incentive for Japanese companies to develop good handwriting-recognition technology.

Federico Faggin (see page 243): [If] you

What we're limited

by is more the failure of
imagination.

—Bob Frankston

have to read the unconstrained handwriting of a person writing about a subject that you don't even know about—there the information is mostly in the context, and so you get a lot of clues as to how to interpret handwriting that way—that is an extremely complex task. There, neural networks will be very helpful.

Jay Miner: Handwriting—I don't see that. I think voice is much more important.

Nicholas Negroponte: I'd put speech I/O very much at the top of the list because I think that the primary means of communication with computers in the next millennium will be speech.

Jay Miner: Voice recognition is coming, I'm sure. It's not here yet. But as the chips get denser and more efficient and smaller and [more powerful], I think it will be coming on as a help for interfacing with computers. Voice recognition will be very handy.

Steve Leininger: In the 15-year time frame, I think you'll have perfected speech input and output. I think a computer will become conversational. To be able to consult experts system-wide in a voice mode, we're probably talking about 15 years out.

Wayne Ratliff: Someday, we're going to be able to talk to computers, and they are going to understand what we say. At least in some form or another, they are going to understand at least as well as a keyboard can understand what we're saying, and that is going to be a giant change in computers.

Dick Pick: I think we'll have a talking typewriter, so that when you talk in continuous speech, you see your words on the screen. It's not going to be a generalized

continued

386 and 486 Windows users:

DOS Lives. Despite what you may have read.

Insufficient memory to run application;



close one or more applications to increase available memory and try again.

Windows 3.0 may have been a big step forward for some programs.

But it was a big step backward for DOS. Suddenly, it was 1987 all over again. Not enough room for DOS programs to run because TSRs, utilities, drivers and buffers were taking up room your DOS programs need.

QEMM 5.1 to the rescue

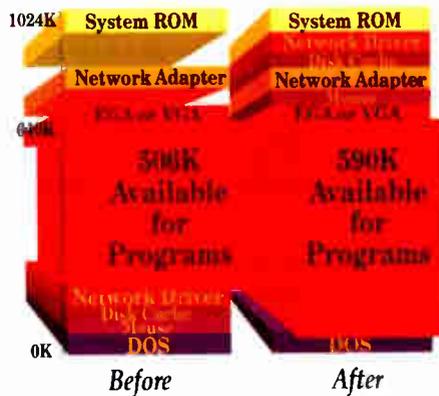
Now, we've updated QEMM to provide additional memory for DOS programs within Windows 3.0.

QEMM 5.1 works with the built-in capabilities of your 80386 or i486 processor to find and recover unused memory segments. As you can see in the chart, there are gaps in your PC's memory usage above 640K. QEMM 5.1 fills those gaps and provides more room for your DOS programs to run.

And of course, QEMM 5.1 still works with DOS when you're not running

When Windows 3.0 says there's not enough room to run your DOS programs, it's just trying to tell you it needs QEMM 5.1.

Windows. You get all the same benefits: up to 130K more memory to run the new generation of memory-hungry programs; space for larger spreadsheets and database files.



Unused memory is like hidden gold in your PC. QEMM finds it and makes it available.

Introducing DESQview 2.3 and DESQview 386 2.3

for users of Windows 3.0

They said it couldn't be done, but DESQview 2.3 can run Windows 3.0 programs. Not just in Windows "Real mode" but in "Standard" mode. That means programs can be up to 16MB.

And it can run DOS programs and DOS-extended programs i.e., 1-2-3 Release 3, side-by-side.

DESQview 386 2.3 does all that and more. It lets you run 386 DOS extended programs like AutoCAD 386 and IBM Interleaf side-by-side.

DOS, extended DOS; Windows—whatever standards you set, we will support. We're committed to helping you get the most out of your hardware and software today. And tomorrow.

QEMM-386 System Requirements: 80386-based PCs and PS/2s and PCs with 80386 add-in boards. Operating system: PC-DOS 2.0-4.0, MS-DOS 2.0-3.3, Windows 3.0. Conventional memory requirement: 15K.
DESQview System Requirements: IBM Personal Computer and 100% compatibles (with 8086, 8088, 80286, or 80386 processors) with monochromes or color displays; IBM Personal System/2 • Memory: 640K recommended; for DESQview itself 0-145K • Expanded Memory: (Optional) expanded memory boards compatible with the Intel AboveBoard; enhanced expanded memory boards compatible with the AST RAMpage; EMS 4.0 expanded memory boards • Disk: two diskette drives or one diskette drive and a hard disk • Graphics Card (Optional): Hercules, IBM Color/Graphics (CGA), IBM Enhanced Graphics (EGA), IBM PS/2 Advanced Graphics (VGA) • Mouse (Optional): Mouse Systems, Microsoft and compatibles • Modem for Auto-Dialer (Optional): Hayes or compatible • Operating System: PC-DOS 2.0-4.0; MS-DOS 2.0-3.3 • Software: Most PC-DOS and MS-DOS programs; programs specific to Microsoft Windows: 1.03-2.1, GEM 1.1-3.0, IBM TopView 1.1 • Media: DESQview is available on either 5-1/4" or 3-1/2" floppy diskette.

Trademarks: Windows, MS-DOS: Microsoft Corporation; PS/2, Interleaf, TopView: IBM Corporation; 80386, i486, AboveBoard: Intel Corporation; 1-2-3: Lotus Development Corporation; AutoCAD 386: Autodesk, Inc.; RAMpage: AST Research; Hercules; Mouse Systems; Hayes; GEM: Digital Research, Inc.

Yes! I need increased DOS productivity in Windows!

Payment method Visa MasterCard

Expiration _____/_____/_____

Card # _____

Name _____ Please allow 3 weeks for delivery

Address _____

City _____

State _____ Zip _____

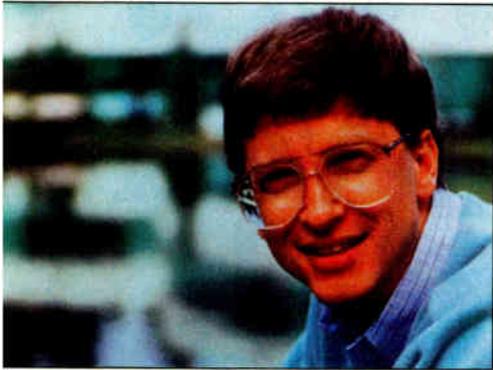
Qty	Product	5-1/4	3-1/2	Each	Totals
	QEMM 386 5.1			\$99.95	
	DESQview 386 2.3 (includes QEMM)			\$219.95	
	DESQview 2.3			\$129.95	
Shipping & Handling \$5 in USA/\$10 outside USA California Residents add 6.75%					
Grand Total					

Quarterdeck

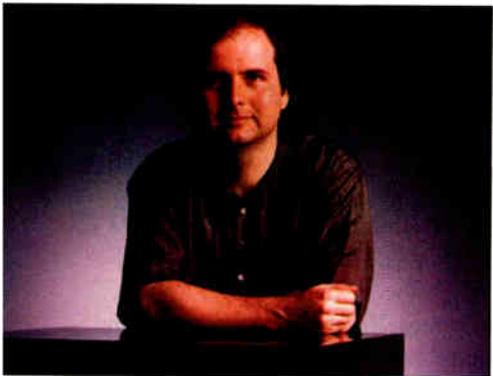
Quarterdeck Office Systems, 150 Pico Blvd., Santa Monica, CA 90405 (213) 392-9851 Fax: (213) 399-3802

Circle 527 on Reader Service Card

World Radio History



William H. Gates III is cofounder, chairman, and CEO of *Microsoft Corp.*, the world's largest personal computer software company. While still an undergraduate, he and Paul Allen developed a BASIC implementation for the MITS Altair and formed Microsoft.



W. Daniel Hillis is cofounder of *Thinking Machines Corp.*, which produces the massively parallel Connection Machine. His current research is on evolution and parallel learning algorithms.

algorithm that's going to do all speech. It's going to start out and gradually understand you, personally. You'll need a fair amount of processing power for that.

Ed Yourdon (see page 366): One of the big limitations up to this point was the number crunching required to process human speech. But if you have a machine that is 1000 times faster than sits on your desk, it may be possible.

Dick Pick: I think for the first time, you really can justify some of the processing power in those machines. It's really kind of interesting, because in the last 20 years, you've gone from CPUs that were almost 100 percent utilized to CPUs that are almost 100 percent unutilized.

Dick Shaffer: I think there will be commercial possibilities in voice-recognition dictation systems.

Gary Kildall: We've had trainable voice-recognition devices for a long time, but it seems we're getting better, and speech is getting better.

Esther Dyson: In order to do [voice recognition] effectively, [you] would also need domain-specific natural-language understanding.

Dick Shaffer: I think there are application possibilities that depend on new areas of software, such as natural-language understanding. A lot of what needs to be done—and what will be done with computer power over the next decade—will be applied toward getting the machine to know what it is we want done.

Bob Noyce: Even with sophisticated computers, processors still can't do things that many two-year-olds can do—e.g., recognize Mama. I think there are a lot of opportunities in [pattern recognition].

Wayne Ratliff: Even long before that there are going to be other things; expert systems, I think, are kind of fascinating. I really think there is a lot to be done there.

Ken Sakamura: Clearly, intelligent objects are going to be an important trend in the future, and I'd want my company to be in on that. Computers already exist in most of the electronic gadgets that we own—microwave ovens, VCRs, watches. What's needed is a way to connect all these computers together. I think there's great potential for applications that can allow data to



would advise

anybody, find out what

everyone says won't sell and

do that.

—Lee Felsenstein

be exchanged between a PC and a VCR, for example.

Dick Shaffer: I think there are a lot of things that won't happen. I believe that computers will do many things that look intelligent but that they will not "think," and I think that's good. I don't want a computer to think; I want a slave. I want a machine that does all of the boring, mindless things that I have no intention of doing.

BYTE: *Is there any final piece of advice you'd like to give to someone trying to start a new business today?*

Lee Felsenstein: My advice to anybody who is going into business or starting a company is, stay away from venture capital as much as you can. Raid the cookie jar or whatever, then plan on a situation that is not necessarily high-growth at the outset. Do your work. Do it for important technical reasons, and understand what you are doing. Be able to explain what it is you're building, and make it something that explains itself. Once you do that, you've got a chance of being able to secure the financing when it's necessary.

David Evans: The way I work, I have to have this sort of a feeling of discovery. This is wonderful and new, and the world will be better or different if I do this. I think that I'll never wind up in a start-up where you've gotten to what it should be by some analysis process. If you look at NeXT, for example, in many ways that's as ordinary a computer as you can find. But there are people who are sure it's not, and [that] it's the key to the next generation for everybody. And I think you sort of have to have that kind of emotional commitment to make it go. ■

When the object is programming



Be Objective

Object-Oriented Programming

(OOP) is programming in the '90s. It's the next step after structured programming and is the best way to write applications.

And Turbo C++ Professional is the first turbo-charged native code C++ compiler that brings Object-Oriented Programming to your PC.

+ ANSI C

Turbo C++ Professional also compiles ANSI C code, so you can stay productive with C now, and move to C++ at your own pace.

Environment ++

The best compiler deserves the best environment, and our new Programmer's Platform™ environment makes you more productive. It features overlapping windows and mouse support. And sports a new multi-file editor, an integrated debugger, and a smart project manager. Its advanced open architecture lets you integrate the tools you need to feel right at home.

VROOMM adds room

VROOMM™ (Virtual Runtime Object-Oriented Memory Manager) lets you break

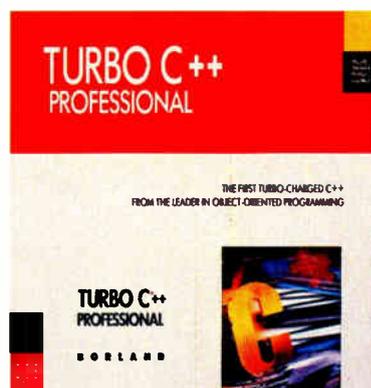
the 640K barrier. Just select the application code you want to overlay, and VROOMM does the rest—swapping modules on demand. It's fast, easy, automatic.

Another +

Turbo C++ Professional gives you all the tools you need to build fast, reliable C++ programs.

Turbo Debugger® 2.0 debugs your object-oriented programs. This powerful new version is the first and only debugger to support *reverse execution*. Letting you step backwards through your code to find the bugs you might have missed.

New Turbo Profiler™, the world's first interactive profiler, displays histograms of your program's performance. With it, you



can easily spot execution bottlenecks, and see where improvements or redesign of your code will yield maximum performance gains.

And Turbo Assembler® 2.0 lets you replace time-critical segments of your code using the world's fastest MASM-compatible assembler.

Turbo C++ Professional Compiler

- C++ conforming to AT&T's 2.0 specification
- C++ class libraries
- Full ANSI C compiler
- VROOMM overlay manager
- Complete documentation and tutorials

Programmer's Platform

- Open architecture for integration of your own tools
- Overlapping windows with mouse support
- Multifile, macro-based editor
- Smart project manager provides visual MAKE
- Integrated debugging and hypertext help

Turbo Debugger 2.0

- Class hierarchy browser and inspectors
- Reverse execution provides "true" undo
- 286 protected-mode and 386 virtual-mode debugging
- Keystroke record and playback

NEW Turbo Profiler

- Displays histograms of program execution
- Tracks call history, overlays, interrupts, file I/O

Turbo Assembler 2.0

- Multipass assembler with NOP squishing and 486 support

Special Offer

The suggested retail price for Turbo C++ Professional is \$299.⁹⁵ (\$199.⁹⁵ for Turbo C++). Borland is offering a special discount for registered Turbo C owners. So be objective, and SEE YOUR DEALER or call Borland at 1-800-331-0877 now!

B O R L A N D

Code: MC94

Mail orders to: Borland, P.O. Box 660001, Scotts Valley, CA 95067-0001. For orders outside the U.S., call (408) 438-5300. Turbo C, VROOMM, Turbo Debugger, Turbo Profiler and Turbo Assembler are trademarks or registered trademarks of Borland International, Inc. Copyright © 1990, Borland International, Inc. All rights reserved. BI-13338

Circle 551 on Reader Service Card (RESELLERS: 552)

Circle 490 on Reader Service Card

We'll Build It

ASSEMBLE YOUR OWN COMPUTER KIT!

- Building your own computer provides you with a better understanding of components and their functions
- Upgrading is a snap
- In-depth assembly instructions included
- Have your new computer assembled and running in three hours, using common tools
- Software included
- Purchase computer kits configured by Jameco or design your own

Jameco 12MHz 80286 Desktop Computer Kit

Includes:

- 80286 Motherboard with 512KB RAM (expandable to 4MB)
- 101-key enhanced keyboard
- Multi I/O Card
- TEAC 1.2MB, 5.25" DSHD floppy disk drive
- Baby AT flip-top metal case
- 200 Watt power supply
- DR DOS by Digital Research, Diagsoft's QAPLUS diagnostic software and WordStar Easy word processor

~~\$~~**\$599.95**
JE3008^{monitor extra}

Jameco 25MHz 80386 Vertical Computer Kit

Includes:

- 80386 Motherboard with 4MB RAM (expandable to 16MB) with cache
- 101-key enhanced keyboard
- Multi I/O Card
- Conner IDE 80MB 25ms hard disk drive
- Toshiba 1.44MB, 3.5" DSHD floppy disk drive
- TEAC 1.2MB, 5.25" DSHD floppy disk drive
- Vertical enclosure with 7 half-height drive bays
- 300 Watt power supply
- Concurrent DOS 386

~~\$~~**\$2949.95**
JE3556^{monitor extra}

UPGRADE YOUR COMPUTER!

- Today's new software requires power; you may be able to upgrade
- Call us for information on upgrading your system today

LOOK TO JAMECO . . .

- Inexpensive entry to computing
- Powerful office computer
- Upgrading your current system

*Let us show you what we have to offer;
call or write for the latest Jameco Catalog!*

(415) 592-8097

JAMECO
COMPUTER PRODUCTS

1355 Shoreway Rd., Belmont, CA 94002

Circle 491 on Reader Service Card

Terms: Prices are subject to change without notice. Items subject to availability and prior sale. Complete list of terms/warranties is available upon request. All trade names are registered trademarks of their respective companies.

if You Put it Together.





Absolutely!

**Intel will lose their
monopoly over the 386
architecture.**

—Michael Slater

THE BYTE SUMMIT

ANTICIPATED ADVANCES

What technological advances will we see in the 1990s that result in improved computer systems?

Jim Blinn: What really goes on is a very slow evolution. Things get a little bit better every month—no major breakthroughs, no stunning things—every month 1.2 times as much storage as the last month, something like that. Nothing real radical. But if you stand back and look at that over five or 10 years, that's a big difference. It's kind of a slow evolution.

Mitch Kapor: That continuing, underlying exponential increase in capability is really going to be the fundamental technology driver.

John Cocke: I believe you [will be able to] build, more or less, any kind of machine you want in the next 10 years on a few chips. The density is going to be so fantastic that it will be hard to predict exactly what people will build. But they can build more or less what they want, and have [it] very fast.

Bill Joy: We'll see 64-megabit RAMs, and we'll see flat-paneled high-res displays, and portable machines, and ISDN, and fiber-optic networks, and 32-bit secure operating systems, graphical prototyping software, the beginnings of voice input, and all sorts of things that people have talked about for so long. Those will all be available.

Dick Shaffer: We should see, toward the end of this decade, tens of megabytes of main memory in desktop machines. It would be very easy, in my view, to have 16 MB in eight or nine chips by the end of the decade.

Chuck Peddle (*see biography, page 325*): Memory technology continues to drive the processing capability we've got. Four-meg memory is an enormous scientific breakthrough. We're going to live with the process that makes that for a long time, and I think you're going to get some great products out of it.

Dick Shaffer: We will not get much beyond 32 address lines, because there's no need to address that much physical memory, and

there's not time to do it. Do you know how large a number 2^{64} is? It's $18\frac{1}{2}$ quintillion. The 32-bit microprocessor in the generation that is with us now will be with us for at least a decade. It will be the longest-lived microprocessor generation ever.

Bill Gates: The address base now is this 4-gigabyte, 32-bit address base, and it will be fairly late into the nineties before that starts to pain us. We'll probably skip from a 32-bit to a 64-bit address base. That will last us a long time. Even the 32-bit—the mainframes have gotten [by] with that for a long time.

Gordon Campbell: I think you're going to see a pretty predictable progression of higher-density DRAMs. No one really sees a huge barrier until we get down to about a quarter of a micron. What that basically suggests is that we have five or six factors of 10 [to go] to still add productivity in semiconductors. I think by the end of the decade, we'll be approaching that quarter micron. What that would suggest is that we have a lot of productivity we can contribute before we hit that barrier.

John Cocke: I believe we will certainly have [CMOS scaled to] less than 2000 angstroms—that's 0.2 micron—numbers less than that. I would expect to see large caches and things come, even on desktop machines, and very dense memory.

Jack Kilby: I don't think we'll see much of the combination [of gallium arsenide and silicon]. There are inherent incompatibilities of lattices, and the process will be too complex. The reason integrated circuits moved so rapidly is because making them was a relatively simple process. Remember how hard it was to get people to use bipolar and CMOS? They were very resistant to even this.

Doug Engelbart: The underlying phenomenon is, I keep expecting there to be some real shifts away from the semiconductor. By my figurings, in the fifties, semiconductor phenomena would run into a limit that was associated with impedance and ca-

capitance problems, whereas other phenomena, even mechanical ones, could potentially start operating down there. So I just have a feeling that at some point there really is going to be a shift, whether it's to high-temperature superconductive or a nanotechnology sort of thing.

Rich Malloy: As far as chip design [goes], I think we may be bumping into a physical boundary, where the traces on the wire, the equivalent of wires on the chips, are so small that they cannot get any smaller. But people may be able to go around that problem using other types of technology, using parallel technologies. And I think parallelism will be a real hot topic in the next few years.

Jonathan Titus: I think we'll see advances in the ability to do things in parallel on the chip, and also the ability to take some of the tasks that the main CPU does and transfer them to some intelligent coprocessors or auxiliary processors, much the way that was done for graphics control and for math coprocessors. It strikes me that we're in desperate need of some I/O coprocessors to remove that bottleneck from the CPU chip.

Ryoichi Mori: We will, of course, see significant progress [in] storage devices, CPUs, and I/O systems. However, such progress will not solve the problem of the smooth distribution of digital information.

Steve Leininger: I think you'll have dedicated power to the I/O channel—the user-interface channel, if you will.

Paul Carroll: I think the improvements in CPUs will be dramatic but kind of predictable, because they'll follow more or less the same curve that they have for a while. I think that you'll start to see many more things integrated onto that main chip, to the point where you will basically have a full computer on a chip, with the exception of the memory.

Ken Sakamura: I think a big trend will be toward single-chip systems—CPU, memory, BIOS, I/O controllers—everything on a single chip. This is the way we've already done things in TRON, and it's very effective. This may be a slight exaggeration, but I think when you open the case of computers at the end of the 1990s, you're likely to see nothing but a single chip inside.

Jonathan Titus: And I think, too, we will see more and more the incorporation of digital signal processing close to the central

processing unit as well. [This is driven by] the requirement for extremely high-speed mathematics, both in vector operations and in matrix operations. The architectures of those chips are set up to handle them beautifully.

Gordon Campbell: The other thing I would expect to see is brand-new memory architectures where, instead of looking at memories more as serial devices, we'll see massive parallelism, which means that we can basically input and output data at much faster rates. I would expect that we'll see CPUs individually that can process up to 50 to 100 MIPS by the end of the decade.

Dick Shaffer: My guess is that about that time, we will have parallel architectures—massively parallel in the sense that they will use commercially produced microprocessors of no more than 32-bit width in parallel. My guess is that the AT design and the Intel architecture will still be dominant, but that we'll see microprocessors with memory and most other parts of the PC built into them.

Federico Faggin: The single most important event in terms of traditional microcomputing would be the use of massive parallelism and the appearance of chips that will contain two, four, 16, 64, and on, powerful processors in them, and of course, the memory as well.

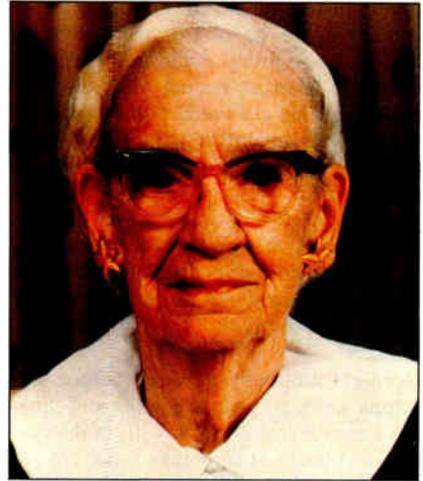
Mitch Kapor: I think parallelism and parallel computing [are] going to become commercially very important in the next decade, particularly on architectures that use multiple RISC microprocessors in a scalable fashion. I think that the research breakthroughs have to do parallel algorithms for doing the software automatically, so people will write software pretty much the way they write it today, but the compilers and other tools will figure out ways to very efficiently use multiple independent processors.

Tony Hoare: People who can take advantage of large-scale parallelism and produce interactive supercomputer applications will surely find a very ready market for their products.

David Evans: At the level of building computers, we're dealing with the bulk properties rather than with the properties of atoms as they are connected together. I just feel that there has been a lot of success in doing computer models at the level of atoms and

continued

C. Anthony R. Hoare (not shown) is professor of computation at *Oxford University* and the 1981 recipient of the A. M. Turing Award. He is a noted authority on programming theory and languages. His current research deals with parallel programming and communications processes.



Grace Murray Hopper is a consultant to *Digital Equipment Corp.* She is a pioneer in the development of standardized application programming languages, including COBOL. She is a Rear Admiral (retired) in the U.S. Naval Reserve.

bonds and being structured so that people can see those models and understand, from what those things look like, something about how they'll behave. We're going down to where the numbers of the layers in the integrated circuit are not very many atoms thick. It seems like you can expect that when you get to there, you may make use of some knowledge of the atom-to-atom things. We're pretty crude in the kind of things we build, compared with the memory things that are found in the living organs, living creatures. I think that we'll make use of a much more refined way of relationships.

BYTE: *Well, then, let's look at our current systems on a more detailed level. What kind of architectures do you think will dominate in the 1990s?*

Gordon Campbell: In the microprocessor, I think we're going to see in the mid-nineties a reassessment, if you will, of the current architectural directions, and I don't think Intel will be able to push up a compatible product line much past 1995. And I think the RISC architecture and some of the other things are going to push for the fundamental changes on the processor.

Michael Slater: Well, the usual couple of questions regarding microprocessors are, will Intel [lose] their monopoly over the 386 architecture, and will the RISC architectures overtake the CISC architectures? My feeling on both questions is, absolutely. Intel will lose their monopoly over the 386 architecture. I think you'll see the first products this year and see a number of products next year. I think the 386 architecture will become a multivendor, industry-standard architecture.

Chuck Peddle: There definitely is going to be some sort of marketplace rebellion against the level of control that Intel has.

Gordon Bell: It's hard for me to see how people are going to break out of the current Intel mold, because they have got so much software.

Bill Gates: The Intel architecture will continue to dominate, there's no doubt about that. So the most interesting thing processor-wise is 486, 586, 686—like that—which is pretty evolutionary stuff.

Jay Miner: IBM is going to continue to dominate with whatever CPU it decides to pick. The marketing clout and the image they've got is almost unbeatable at this

point. I think others will continue to occur, and some will continue to survive and be successful, as I hope the Amiga will, but the dominant machine is going to [be] IBM for a long, long time, with whatever CPU they decide to pick.

Philippe Kahn: It's difficult to say. The world is going in two different directions. On one side, you're going to have RISC chips that are getting more popular, and on the other side, you have Intel continuing the evolution of 486 to 586 to 686, and I'm sure the 786, whatever that is. So you're going to see different trends—I'm talking about the most popular ones. Clearly, the Intel chip set will be popular, and some RISC chips will be popular.

Michael Slater: I think the RISC processors are going to wipe out CISC processors in the engineering workstation arena. I think they will be much, much slower to take over much of the business market. Multiuser commercial computing will be the first place that you'll see RISC appearing in the business world. As [for] your business desktop computers, I think those are going to stay CISC-based for quite some time. The inertia of the whole PC market cannot be underestimated.

John Markoff: From my point of view, it's going to take a long time to unseat the CISC architectures because of software inertia. But, at some point, the cost issues and the performance issues will be just unavoidable on the RISC side, and the RISC people will be emulating CISC at the same performance levels that CISC will obtain, and it will be easier to shift over in the future. However, I think the big wins are parallel architectures, coupling together dozens or hundreds of RISC devices.

Paul Carroll: I think that it's even possible there will be a merger. If you take a look at the 486 at the moment, as I understand, it has some RISC attributes. I think there's a digital signal processor part of that chip that is a RISC technology.

Dick Pick: Well, obviously, it's kind of an oscillating thing, going back and forth between complex instruction sets and reduced instruction sets. Basically, that's all tied to where we are in terms of the number of elements that you can put on a chip.

Lee Felsenstein: The possibility of using small die sizes, fast technologies, and a balancing of the memory capability with the processor capability is really what

RISC is about. I think that that will really come into its own in the next five years, but no sooner than three years from now—my guess.

Jim Manzi: [You'll see] accelerating advances in RISC, and you'll have a 486, and a 586, and by the end of the decade, we'll see a 986. I wouldn't underestimate the amount of momentum around the primary architectures, either—the Intel world, the Motorola family. But RISC will become increasingly important. The advances in CISC architectures will continue at an accelerating rate as well.

Rod Canion: RISC architecture will be important, although I don't think we'll see one RISC chip or the other dominate. It will be simply the use of RISC architecture in the processors that become the standard processors.

Ken Sakamura: I'm not very optimistic about the future of RISC. It uses too much power.

Danny Hillis: Well, I think it's bimodal. I think that certainly it is clear that RISC processors are becoming occasionally important. But I think that the interesting architecture will not so much be the architecture of the individual computer; it'll be the architecture of the whole network. I think the computing device that people will use is the network, of which their computer is only the window into it.

BYTE: *What kinds of storage devices do you think we'll see?*

Michael Slater: A hard disk capacity of 100 MB is probably a base-level capacity that everybody will have, and a couple of hundred MB for the more serious users. Optical storage may or may not be a significant player. I think CD-ROMs will become important as a distribution and database medium. Whether optical read/write drives become significant as an alternative to Winchester hard disk drives, I think, is still an open question.

John Warnock: Read/write optical clearly has a future. But you never know what other technologies are going to come along to completely displace them overnight.

John Caulfield: In terms of optical storage, we're at the very beginning. We have read/write disks. They're not very good, but they're on the way. Holographic and

continued



What can a ScanMan™ scan, man?

Virtually anything. Logos or photos. Digits or dingbats. Art or articles. A soda can. How can you get them into your PC? You could play cut and paste with the copier down the hall. Or use your own, do-it-in-a-flash, hand-held scanner. ScanMan.

Images. Select 1, 2, 3, or 400 d.p.i., then pop any image up to 4" x 14" into a file for your publishing program. Or into your Windows™ clipboard. Or use PaintShow Plus™—included with your ScanMan—for editing and coloring.

Text. Our Catchword™ software converts virtually any typeface into ASCII files for your word processor, desktop publisher, or spreadsheet. It reads horizontally or vertically, scans words or numbers from 6 to 20 point, and matches adjacently scanned columns perfectly.

Should you buy it? Once you've got it you'll wonder what you did without it. And it's only \$339.* Backed by our Customer Satisfaction Guarantee, and 7 Days-a-Week Support.

For information, call: 800-231-7717

In California:
800-552-8885
In Europe: ++41
-21-869-96-56



*For IBM PC and compatibles; includes Paintshow Plus. List price for the IBM Micro-Channel version is \$399. Catchword is an optional extra for \$199.

Circle 500 on Reader Service Card (RESELLERS: 501)



Save that tiger.

Save face.

Scan the globe.

Take this job and shove it.

Catch a wave.

Save the day.

Can scan.

There goes the neighborhood.

Scan the horizon.

Get reel.

TODAY'S TIMES ONLY

FIELD OF DREAMS (PG) THX Sound
11:15, 1:45, 4:30, 7:30, 10:00

SCANDAL (R)
11:15, 1:55, 4:35, 7:15, 9:40 Dolby

BARON MUNCHHAUSEN (PG)
11:15, 1:45, 4:25, 7:40, 10:30 Dolby

RENEGADES (R) Dolby
11:15, 1:45, 4:25, 7:00, 10:15

NO HOLDS BARRED (PG-13)
11:15, 2:40, 5:15, 8:05, 10:15

A FEW DAYS WITH ME (PG-13)
11:20, 2:50, 4:40, 7:20, 9:55

BEACHES (PG-13) Dolby
11:45, 1:15, 3:45, 7:55, 10:35

WARM NIGHTS ON A SLOW
MOVING TRAIN (R) 12:00, 2:30, 5:00, 8:10, 10:40

ADULT ADDRESSON - SHORT CIRCUIT #1 #17
#18 #19 #20 #21 #22

The single most important event in terms of traditional microcomputing would be the use of massive parallelism.

—Federico Faggin

nonholographic [storage] will allow us to do much faster random-access memory operations on much larger stores of data. There is a variety of such techniques. I get such flak all the time when I talk about holographic memories. In the 1970s, every

major high-tech company in the world had a major program in holographic data storage—in this country, led by AT&T and IBM.

Dick Pick: Well, certainly, optical storage, I think, is [coming]. There's going to have to be some clever software to take advantage of it that nobody has really done yet. I think that's probably going to be around for a while.

Jim Manzi: I think that optical storage is really still scratching the surface, though high-density optical storage, I think, is going to change the world in many ways.

Jay Miner: I would say videodisk storage is probably the biggest comer in terms of growth and usefulness and large mass storage capabilities at a moderate cost. Laser disk types of things. Things that store data like disks do. Disk advancements in the area of optics.

Charles Simonyi: Optical storage is sold hard, but I think it is very worthwhile, cer-

tainly, in terms of CD-ROM and also in rewritable optical storage. I don't think that is oversold. It is nice at this stage of the game to have the diversity. And I think that new ideas can still emerge.

Paul Carroll: I really think that erasable optical will finally happen in the nineties.

Brit Hume: Optical storage, rewritable CDs—once the endless rewritability of those things is perfected (that is to say, they don't deteriorate) and the price comes down, that [will allow] it to be a major new market. What we're talking about there, seems to me, are improvements on existing hardware.

Gordon Campbell: I would expect to see higher-density CD-ROM with higher data rates. We'll probably see low-cost optical disks that wind up being fairly productive.

Rod Canion: Disk drives will get smaller and [provide] higher capacity and higher performance.

continued

POWER

POWERSTATION 486-25

- 486 25MHz Intel Processor 8K Cache
- 80387 Compatible Floating Point Co-Processor
- 4Mb of 32 bit DRAM (Expandable to 16Mb System Board)
- 210Mb 18ms IDE Hard Drive
- 64K look ahead caching buffer
- 1 2 Floppy Drive
- 1 44 Floppy Drive
- 101 Keyboard
- (8) 16 bit Expansion Card Slots
- Weitek Co-Processor Support
- 1 Serial & 1 Parallel Port
- 14" VGA Mono Monitor
- 16 bit Video Controller w/ 256K Memory
- DOS 4.01 or 3.3
- 230 Watt Power Supply
- Tower Case
- 1 Year Warranty on Parts and Labor



\$5595

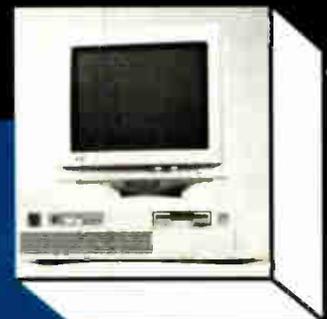
14" SVGA Color Monitor (1024x768) \$5995

LANSTATION 286

- 286 12MHz Intel Processor
- Slim Profile Case
- 200 Watt Power Supply
- 1Mb RAM
- 16 bit Ethernet or Arcnet Card
- Boot ROM
- High Resolution Flatscreen Mono Monitor
- 1 Serial, 1 Parallel Port
- 101 Enhanced Keyboard

\$899

VGA Color System \$1299
40Mb Internal Hard Drive
ADD \$450



Rio Computers

SERVING THE COMPUTER INDUSTRY SINCE 1984

800-445-6649

Texas, U.S., Canada & Mexico

6900 San Pedro, Suite 127
San Antonio, Texas 78216
512-828-7774
512-828-1155 FAX



Corporate & Government Purchase Orders
Financing/Leasing Available

Intel is a registered trademark of Intel Corp.,
DOS is a registered trademark of Microsoft Corp.

Circle 530 on Reader Service Card (RESELLERS: 531)

WorldRadioHistory.com



WORK SPACE VS. SPACE THAT WORKS

You're tripping over your keyboard. Your monitor is too low. That report you're working on has vanished. The printer noise is driving you crazy. Paper is everywhere.

But don't give up.

What you need is some help from Kensington. Store your keyboard out of the way with Keyboard Slideaway.[®]

See eye to eye with the data you're entering with SideClip.[®]



Silence your noisy printer with Printer Muffler[®]80 and Stand.

Get your CPU off your desk with our sturdy Universal System Stand.

Even keep your printouts organized with our Universal Printer Stand's convenient paper catcher.



And unlike other accessories, Kensington's products fit right in with the design of your PC.

The styling is complementary.

The construction is solid. The materials are of the same high quality.

Kensington.

Because you can't work efficiently if your space doesn't work.

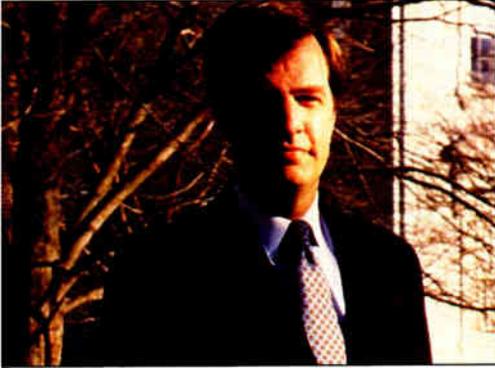
For a free brochure, and the dealer nearest you, call 800-535-4242 or 212-475-5200.

Circle 497 on Reader Service Card

KENSINGTON[®]

Keyboard Slideaway, Printer Muffler, SideClip, Kensington and the Kensington logo are registered trademarks of Kensington Microware Limited. IBM is a registered trademark of International Business Machines Corporation. © 1991 Kensington Microware Limited.

World Radio History



Brit Hume is ABC News chief White House correspondent and a syndicated computer columnist. Previously, he covered Capitol Hill for 11 years for ABC and worked for the *Closeup* documentary series. He was a 1969 Fellow at the Washington Journalism Center.



William N. Joy is cofounder and vice president of R&D for Sun Microsystems and is a leading Unix expert. He designed NFS and co-designed the SPARC architecture. He also designed BSD Unix and wrote the Unix vi editor.

Lee Felsenstein: Optical disks will stabilize at this 8-centimeter level. The 3-inch CD-ROM is going to be significant. It will also be portable, as 5-inch CD-ROMs are right now. They're just beginning.

Steve Leininger: It would be neat to be able to record and play back compact disk kinds of things. I'm not sure that an erasable compact disk is as important as just being able to record it in the first place.

I think there's going to be really, really big things in compact disk-based information, data-retrieval something or other. I don't know if that's data bookshelves, or if it's going to be the next library, or something. A lot of it's going to depend on display technology. We've got smatterings of it now, but it just costs too much. But anything, if you make enough of it, all of a sudden starts getting pretty cheap. Look at compact disk players—you can buy those for \$150 or less, unless you want to stick it in your computer. Then, it's still \$700.

Bill Gates: Optical disks, because they'll be read/write, have a very narrow role to play. All you have is the CD (which is read-only and deserves to exist because it's leveraged off all those consumer volumes), [and] then the read/write devices that have to compete with magnetic. Magnetic will continue to improve. In fact, there are a lot of techniques that will drive magnetic, like the vertical recording.

Rich Malloy: The disk drive capabilities will increase a lot. I think the magnetic disk drives seem to be in a race with the optical drives, and magnetics are reaching a point where opticals were supposed to reach. It's going to be a battle between the two as to which is more cost-effective and which has the higher capabilities. We may see hard drives as small as a little audiocassette, maybe some as small as a DAT cassette.

Rod Canion: People have been predicting the day when optical disk technology would replace magnetic disk technology. I don't think that's likely to ever happen.

Jonathan Titus: I have a feeling that whatever we look at in five or 10 years will still have some sort of magnetic medium. People will have optical read-only disks [so] that if you want a thesaurus or something else—an on-line encyclopedia—you can buy it or perhaps even borrow it from a library.

Jerry Pournelle: I always thought that spinning metal as mass storage devices

would go away, to be replaced by some kind of electronic device—something in silicon. I think that over the long run I was right, but over the short run, that was probably the most disastrously wrong prediction I ever made. I thought that by now the hard disk would be gone, and you would be using something like bubble [memory]. Some kind of nonvolatile silicon storage is what I thought we would have by now. I think that's still the case, you understand. It's just that it has taken a lot longer.

Ken Sakamura: Disks are becoming obsolete for many important uses. The real trend will be toward large solid-state memories that use less and less power. We need computers that can run on the power of a Walkman battery. You just cannot make disks that can run on that little power. I want to see fast computers that can run on as little power as possible.

Ted Nelson: Optical system on a disk. The CD-ROM thing is so absurd. They have standardized this dinky little disk. It seemed so big at first. What is it, 40 million bytes? And now, it seems so cramped. With CD-ROM, you are stuck with only what you have in those 40 million bytes, whereas with the networking data vision, you have the whole world—no boundaries.

BYTE: *Are there any overall advances that we should expect to see?*

Rod Canion: I think we're going to continue to see standards dominate the computer industry—in fact, in an increasing way. I think what's happening in the PC arena with standards will eventually migrate into minicomputers and mainframes. What that means is that we'll see the concept of truly compatible systems running the same software packages and using the same peripherals, etc., over a much broader range of computing resource power.

Seymour Papert: Maybe if there's one thing I would pick on, it's throwing away all concepts of standards—to throw away the idea of standardized anything.

Alan Kay: The main advancements we need are a considerable change in the ability of the American businessman to exploit innovation. That's the biggest bottleneck. Innovating is easy: You just rub smart people and money together. The thing that we have fallen down completely on is being able to do anything with it. The Japanese are the ones who go out and do the actual technology transfer. ■

Engineered for the office. Designed for people.

The Panasonic PostScript printer presents word publishing. And spreadsheet publishing.

The Panasonic Free Adobe Typeface Offer

Besides getting a great PostScript laser printer, buying a Panasonic 4455 PostScript printer will entitle you to a FREE Adobe Publishing Pack. Each Publishing Pack contains several Adobe typefaces selected for use in newsletters, forms and presentations. The Publishing Pack has a retail value of up to \$475 and is available in versions for both IBM-compatible and Macintosh PCs.

If you're interested, just call 1-800-742-8086, ext. 190, and the people at Panasonic will tell you how to receive these free typefaces.

1-800-742-8086

Bates Industries Ltd

L.R. Bates
V. P. President

A. D. Bryman
Vice President
Finance & Finance

J. Cascard

Bates Industries Ltd

UNIT VOLUME

PRODUCT	Estimated	Actual	Index	Es
TS-3000	320	375	117	\$
TS-4800	180	165	110	\$
TS-5600	146	139	99	\$
TS-6400	170	143	143	\$1
Subtotal	710	622	116	\$1
RG-2100	550	675	121	\$
RG-4200	300	340	112	\$
RG-6400	240	180	75	\$
Subtotal	1,100	1,195	109	\$
LS-220	230	255	111	\$
LS-420	425	420	121	\$
LS-680	500	605	121	\$
Subtotal	1,155	1,280	111	\$
AL-4320	450	495	110	\$
AL-5730	200	185	93	\$
AL-6890	700	750	107	\$
Subtotal	1,350	1,430	106	\$
Totals	4,215	4,727	110	\$

\$343,000 \$4,122,050 \$4,854,680 118

VIEWPOINT

VOLUME 3 ISSUE 4

Business climate will heat up in the '90s

Thanks to an outstanding effort by everyone at Bates, sales rose by 21% in January versus last year. The growth came mostly through price increases we haven't raised a month. The success came and more customers are buying since the high value price cuts we made here at Bates.

A special thank you to the staff for their hard work and dedication.

Company's fastest growing line is each "heat line". The RD line is the trademark of Bates design. Lamer's line: "It's developed this line," says Lamer. "So that the chairs pay divided costs, and spread evenly - one to one." Sales are expected to grow at least 10% year with introduction of the new RD and RD 900 chairs.

Next time we'll be looking for you to be a part of it.

1989 Sales by Product Line

Attached is some preliminary production information for the new TS-6400 desk chair. It may have been the product and other some features to the TS-4800 (improvement).

Bates Industries Ltd

TO: Gene Hunt

FROM: Roger Fabbro

RE: CONFIDENTIAL

1989 TS Line Sales

Product	Estimated	Actual
TS-3000	320	375
TS-4800	180	165
TS-5600	146	139
TS-6400	170	143

And just-about-everything-you-want-to-publish publishing.

	Standard
Speed	11 Pages Per Minute
Interfaces	RS-232C/422 Serial, Centronics Parallel, and Appletalk
Fonts	39 Adobe PostScript Fonts
Cassettes	2 250-Sheet Letter-size
Ram	2 Megabytes
Emulation	HP LaserJet* Series II Diablo* 630

Specifications are subject to change without notice. This product may be subject to export control regulations.



Introducing the Panasonic KX-P4455 Laser Partner with Adobe* PostScript.*

It will bring a polished, professional look to everything you print. A new persuasiveness to all your communications.

Now you can enhance every proposal, every report, every memo with multiple fonts, varied type sizes, even graphics rotated and scaled to fit. All at up to 11 pages per minute, and with superb print quality.

You get all the features you need to get the most out of PostScript... standard. Features like dual-bin paper cassettes, and interfaces for MS-DOS,* UNIX* and Appletalk,* standard.

In fact, you'll find this a surprisingly affordable way to make a little publishing history of your own. For more information, and details on how to get up to \$475.00 worth of free Adobe typefaces, call toll-free **1-800-742-8086**, extension 190.

Printers, Peripherals, Computers, Copiers, Typewriters and Facsimiles

Panasonic
Office Automation **OA**

* PostScript, LaserJet, UNIX, Macintosh and Appletalk, MS-DOS and Diablo are registered trademarks of Adobe Systems Inc., Hewlett-Packard Inc., AT&T, Apple Computer Inc., Microsoft Corp., and Xerox Corp., respectively.

LPS-BY

Circle 522 on Reader Service Card

Brit Hume:

On Computers and Writing

I always thought that writing on a computer makes writing easier because it takes the pain out of revision. And that's the simplest and most obvious point to be made about it. But there's some controversy within the business about whether it makes you a better writer or not, and whether by overcoming your resistance to revision it allows you—it encourages you—to put things down in the first place that you would never have written if you feared you'd have to change it—[that] what [using a computer] tends to do is inhibit, or make less rigorous, the thought process that goes into your original drafting of your work.

I think there's an argument that could be made for that, but I think that with the quality of writing that is being done on computers now, it is pretty hard to argue that that's actually happening, which is not to say that there is not superbly elegant writing being done without them. There certainly is. George Will, for example, writes in longhand, with an old-fashioned pen—doesn't even type—and writes beautifully. But others [using computers] write beautifully as well.

Editor's note:

See biography, page 262.

Ed Yourdon:

On "Pure" Object-Oriented Languages

Well, [pure object-oriented languages] are that much more pure and lovely to work with, but I don't see them taking over the world. I think that it is much more likely that a C++ is going to dominate over a Smalltalk or Eiffel or some of the other ones, simply because you have got that many existing programmers.

The object-oriented purists are violently opposed to that whole concept. And there was a big flap at the last OOPSLA conference on that issue, which got written up in some of the magazines. It was a big panel session with all the famous names prognosticating about what was going to happen with object-oriented languages and so on. And I stood up in the audience during the question session and said, "What do you propose to do with the 3,000,000 existing COBOL programmers?" And the answer was, "Shoot them." Well, that's fine, [so I asked] "What are you

going to do with the 81,000,000,000 lines of COBOL out there?" and they said, "Throw it away; it probably isn't any good, anyway." [The panelists were] fairly serious, although they do represent the radical revolutionary component in the object-oriented world.

But in plain obvious fact, you can't shoot 3,000,000 COBOL programmers and God knows how many million C programmers. And equally important, you can't get rid of the billions of lines of existing code in COBOL and C and FORTRAN and whatnot. So I think it is much, much more likely that you are going to see the existing procedural languages extended with object-oriented features over the next five years or so. I just don't see any kind of wholesale replacement with pure object-oriented languages.

Editor's note:

See biography, page 366.

Bill Stallings:

On Moving to OSI

What many companies now are doing is using TCP/IP-based products to hook things together. And there [are] starting to be board-level products that you can plug into micros that support something like Ethernet or Token Ring but also have a lot of the TCP/IP software right on the board, so you can get pretty sophisticated support for distributed applications on micros in a LAN environment by using the TCP/IP.

That has been kind of a main thrust for the last few years, and I think that will continue for a while, and eventually that will start transitioning over to OSI-based products. And that's, maybe, going to be less of a problem in the micro area than in the minicomputer and mainframe area. But it's still an issue that a lot of companies are going to have to face if they've already made an investment in TCP/IP stuff and then they want to transition over [to OSI stuff].

There are a couple of ways that can be done, but there's really no clean way to transition from TCP/IP to OSI. So that's an area where there will be a lot of attention over the next few years. And then, the other is direct support for ISDN for personal computers and workstations. Those kinds of products are starting to show up. There will be more applications using those.

Outside of the IBM and SNA environment, [TCP/IP will be the main way to connect NetBIOS-based and PC LANs to other types of networks]. And even in IBM there's more support for that. But right now if you want to do something that's standardized, the way to go is TCP/IP. And there's a lot of software [and boards] out there, not just for Unix-based systems, but also for NetBIOS kinds of systems.

Where's OSI?

What has happened [is] OSI is just taking too long to get out the door. But, sooner or later, companies that make a heavy investment in TCP/IP are going to have to face a transition issue to OSI. But that's not to say they're doing the wrong thing by going with TCP/IP. It's the way you have to go right now if you want to get networking capability in to get the interoperability.

A couple of things [are missing in terms of OSI]. One is just simply the products, particularly at the upper layers, the application layers. There's still not a lot of software out there. A second problem is that at the lower layers, the transport layer and the inter-networking layer, the standards have solidified, but there's just not much experience with them. What the TCP/IP community has found is that the software is so complex that it's just not something that you can plug and play; there's got to be a shakedown period. As vendors start bringing out OSI-based transport and internet software, they're going to find that they don't easily talk to other vendors. And the customers are going to get caught in that kind of a bind.

It is [ironic]. The way the industry is trying to respond to that is by certification, like the kinds of things the Corporation for Open Systems is putting together—certification test beds. Say, if a vendor like DEC comes out with an OSI-based product and they go and get it certified—that means that their product will interoperate with a test bed. And a test bed is something nobody will ever buy or use. If Hewlett-Packard also gets a certification, it doesn't absolutely guarantee that those two will play

against each other. The mathematical tools really aren't [there] to verify all this stuff. It's still as much an art as a science.

You have to get the products together and have them interact with each other, and see what happens. When you do that, you find flaws in the vendor products, and sometimes you even find some flaws in the standard specs. And I think that there's still going to be, for the next few years, things showing up. Because actually it's a remarkably small amount of experience with the OSI-based products. So, I think that there are some problems looming there that we'll see in the next few years.

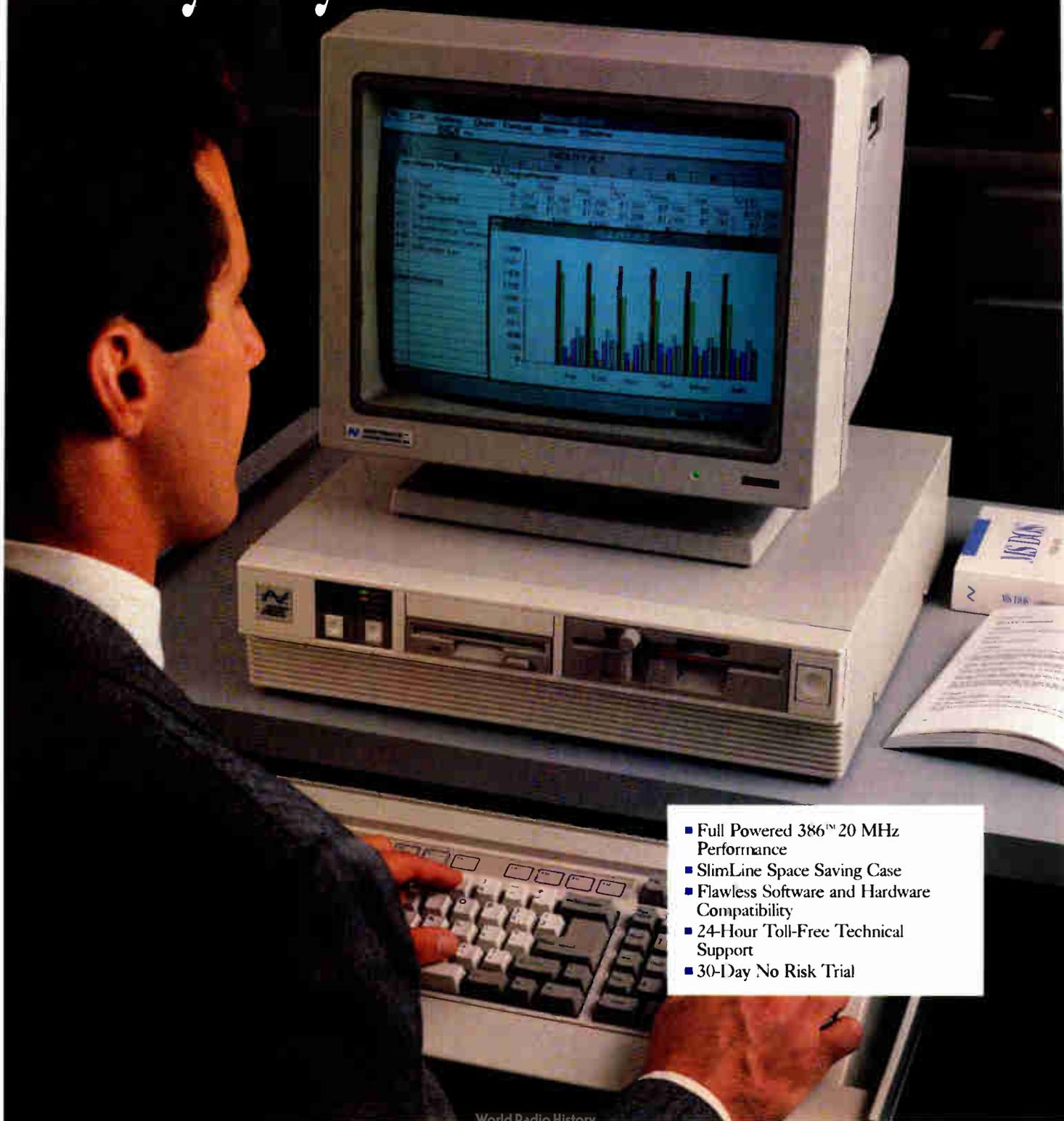
Uncle Sam Goes First

I think [the transition to OSI] is really starting—I'd say within the next year or two—within the federal government and the military. They have developed some tools for doing a transition, and they are pushing rather hard to get to OSI. The first substantial body of experience you're going to see is within the U.S. military as they start to make that transition. But they're being driven to it by policy decisions, which companies don't have to face. And I think companies are going to put it off until they have to do it. And I think that means putting it off four or five years at least. I think in the mid-nineties there's going to be a lot more in terms of products and approaches for doing transition than now. Some of it will be spun off from the way the military has done it, and some will be other approaches that people are trying.

Editor's note:
See biography, page 352.

PC Magazine says...

**“When it’s this good, this cheap,
why buy less?”***



- Full Powered 386™ 20 MHz Performance
- SlimLine Space Saving Case
- Flawless Software and Hardware Compatibility
- 24-Hour Toll-Free Technical Support
- 30-Day No Risk Trial

"Northgate's SlimLine™ 386/20 is a good reason for not buying a 386 SX."* Here's why:

You want maximum performance and value in a space-saving desktop case. Northgate delivers! You know all the reasons to buy DX architecture, not SX ... SlimLine 320 packs all of the power of a full-size 386/20 MHz system into a performance package only 4.25" high and 16.5" square.

PC Magazine said: "(SlimLine) doesn't take up a lot of room ... but it delivers plenty of computer for a price you might expect to pay for a 286 system."

The heart of the system is a new Northgate proprietary motherboard. Smaller than a sheet of legal paper, it gives you a host of features that are add-ons in other's systems ... built-in hard and floppy disk controllers, one parallel and two serial ports and 16-bit VGA video. And with five expansion slots, you have plenty of room for all your peripherals.

SlimLine comes standard with 1Mb of RAM, a 40Mb hard drive, 5.25" 1.2Mb and 3.5" 1.44Mb floppy drives, a 12" high-resolution monochrome monitor, and the award winning OmniKey/PLUS keyboard.

Plus, Northgate offers a full range of expansion options ... monitors, hard drives, tape backups, memory expansion cards, printers, modems, and more. Custom tailor your system!

Use it at office or home. Run the latest multi-tasking applications under Microsoft® Windows™ 3.0 or Northgate's OS/2®. SlimLine 320 is a perfect high performance terminal in a network environment, too.

SlimLine 386 System Features

- Intel® 20 MHz 80386 microprocessor
- 1Mb 32-Bit DRAM on motherboard (expandable to 8Mb)
- 40Mb 28 ms hard drive
- 80387 math coprocessor support
- Two high density diskette drives: 5.25" 1.2Mb and 3.5" 1.44Mb
- Five open expansion slots
- One parallel and two serial ports
- 12" high-resolution monochrome monitor
- Built-in 16-Bit VGA adaptor, 800x600 resolution
- Exclusive award-winning OmniKey/PLUS keyboard
- MS-DOS 4.01 and GW-BASIC software
- On-line User's Guide to the system and MS-DOS
- Reset and Turbo buttons
- LED Power and Turbo indicators
- FCC Class B Certified

And remember ... your Northgate SlimLine 320 is backed by expert technical support any time you need it. Call toll-free, 7 days a week, 24 hours a day. PLUS, free on-site service to most locations for one year if we can't solve your problems over the phone.

Of course, SlimLine 320 comes with a one year warranty on parts and labor; five years on the OmniKey keyboard. If a part fails, we'll ship a replacement to you overnight at our expense before you return your part.

Use a SlimLine for 30 days. If it fails to meet your expectations, return it.

ORDER YOURS TODAY! Call sales toll-free 24 hours every day. Ask about custom configurations, leasing and financing programs.

\$2,499⁰⁰ Complete System Delivered to Your Home or Office

EASY FINANCING: Easy payment options. Use your Northgate Big 'N', VISA, MasterCard or lease it. Up to five-year terms available.

Super VGA Color System!

Step up to a complete VGA Color System featuring 2Mb of RAM, with a super 14" VGA Color Monitor (800x600 resolution) and Microsoft Windows 3.0.

ADD ONLY \$500⁰⁰

Get a genuine Microsoft mouse for just \$39.95 more!

CALL TOLL-FREE 24 HOURS EVERY DAY

800-548-1993

Notice to the Hearing Impaired: Northgate has TDD capability. Dial 800-535-0602.



**NORTHGATE
COMPUTER
SYSTEMS**

"We hear you!"

1 Northgate Parkway, Eden Prairie, MN 55344

Prices and specifications subject to change without notice. Northgate reserves the right to substitute components of equal or greater quality or performance. All items subject to availability. ©Northgate Computer Systems, Inc., 1990. All rights reserved. Northgate, OmniKey and the Northgate 'N' logo are registered trademarks of Northgate Computer Systems, Inc. 80386 and 80386 SX are trademarks of Intel. Microsoft and Windows are registered trademarks of the Microsoft Corporation. All other products and brand names are trademarks and registered trademarks of their respective companies. *PC Magazine, December 26, 1989, reviewed the Northgate MicroStation 386/20. This system has been upgraded and is now named the "SlimLine 320."



C

haos and fuzzy

logic are ways of life. They

will be with us and won't go

away.

—Bob Noyce

THE BYTE SUMMIT

FLASHES OR SMASHES?

Which technologies do you think will change the way we compute in the 1990s, and which will be flashes in the pan?

BYTE: For example, ISDN, FDDI, optical computing, neural networks, fuzzy logic, and chaos?

Jack Kilby: I'm not sure any of those technologies you mentioned will be flashes in the pan. The trend is that technologies will exist side by side. The process in the past has been both serial and sequential. Newer ones are options. Fuzzy logic, for instance, isn't going to wipe out things that have gone before.

Gordon Bell: They're all components. I think those are all important components.

Grace Hopper: I think they're all part of our future development. We don't know where these things will fit in. They keep trying to say final things in too young an industry. It will be scattered all over, dispersed.

BYTE: Let's take them one at a time. How about ISDN?

Bill Stallings: ISDN, in a way, has kind of missed a window. It just took them too long to get the standards out. It took them almost a decade. So a lot of companies are going in other directions. They're using T1 and fractional T1, and satellite-based systems, and package switching, going into higher-speed package-switching networks. And so ISDN has just ended up being one of a number of options for companies. So, unfortunately, it's not going to end up being the universal solution that the planners had in mind.

Steve Leininger: Right now, everything I have seen suggests that it's too expensive. The fact that they're working on some standards there is encouraging.

Jonathan Titus: A number of different ISDN-type standards have sprung off from [ISDN], and those are incompatible. So, although it's touted as a standard, I'm not quite sure how much of a standard it's

really going to be worldwide over the next five years.

Rich Malloy: ISDN has good promise. The problem is it's moving so slowly. By the time it gets implemented, it may be surpassed by other high-speed systems. And I think the people involved in it should just get their act together and start working on a common standard.

Jonathan Titus: I'm not sure that ISDN will ever get to the point where it has enough critical mass behind it to propel it to the point where people just think about hooking into it as a second thought.

Doug Engelbart: ISDN. The pressure toward that kind of service is immensely high. Whether it was formulated appropriately for what the market and the need [are] going to be in a technology, I don't know.

Jim Manzi: I think ISDN is going to be incredibly important, and that's going to be very, very real.

Paul Carroll: I think that ISDN will happen, but I think it will be five years or more, five to 10 years probably, before it has any appreciable impact.

Dick Pick: ISDN, this is interesting. The whole thing is, nobody's really solved the problem of truly integrating voice and data—distributing data and voice around the network, and I think that's going to be one of the big hits in the next 10 years. Someone's going to do that. I don't know if it is going to be ISDN.

Bob Frankston: ISDN is a catchall phrase. ISDN itself has changed. The original conception of ISDN, back in the early days, was [that] one day we're going to throw a big switch and convert the whole phone network, because that's the only way to make change. What we've learned since is that you can do it piecemeal. It's really access to the information and services.

Nicholas Negroponte: Narrow-band ISDN (two 64K-bit and one 16K-bit line) will be a flash in the pan. In fact, I don't think it will take off. I think we will leapfrog it. Europe and Japan are paying more attention than the U.S.

Ken Olsen: Oh, ISDN's not bad. We love ISDN because our customers love ISDN. And we support ISDN. Very few really support ISDN, I mean in computers. But ISDN means many things to many people. One of the most important things ISDN meant was that you bring the thing to the desk, one wire, 62K bits of voice and 62K bits of networking for your desktop device. And 15 years ago, 10 years ago, that would have been wonderful. Now [it's] a joke.

Bill Gates: ISDN, I mean it's nice in a way, but its time frame for widespread use is way out there. Even the bandwidth you get out of ISDN isn't that much up for a normal line, even though it's in the right direction.

Gordon Bell: I think ISDN—when that comes, that's probably going to be a really remarkable kind of thing because you're interfaced. But on the other hand, I think what's going on now is pretty remarkable.

Ken Sakamura: I think ISDN is going to be extremely important. It's exactly what the market wants. It's going to be very big.

Stewart Alsop: I believe very, very strongly in ISDN, and I think it'll have to become a standard component in every computer. It's funny, because I'm not exactly sure how you do this. But I believe that local networking has to be a standard component as well, and maybe ISDN becomes a chip set that's made subsidiary to the local network.

Bill Stallings: I guess the only one that I have a really set feel about is ISDN. I see that, as we go over the next few years, as being one alternative to offer people for networking. I think the thing that would turn home users on is broadband ISDN, where you start to get video applications and more use of image.

Nicholas Negroponte: Broadband ISDN will happen. Whether it's called ISDN doesn't really matter. The whole notion of very, very massive—in some sense unusable—amounts of bandwidth into the home is going to happen anyway, no matter who does what.

Bill Stallings: I think there'll be a lot of niche opportunities in broadband ISDN.

I'm not quite sure what they will be, but when you get to the point where you've got wide-area networking capability in the hundreds of megabits per second, the carriers are going to be able to offer the basic, just raw, transport of that stuff. And they'll offer some value-added services. But it seems to me there's got to be a lot of different places that you can position yourself to take advantage of that.

Ken Olsen: You're not talking about broadband into the desk. ISDN is a typical telephone-company thing. When I first heard of it 10 years ago, I thought it was really clever. Now, that technology is ridiculous. Putting 62K bits on the desk and open wire sounded like great stuff. Now we're talking about 10, 20 times that.

John Markoff: I have real skepticism about ISDN. You have to plug it into the wall, which seems to me a real problem with the technology, and the bandwidth isn't that big. The political issues are almost more interesting than the technology issues.

Alan Kay: The Japanese say they're going to be 100 percent fiber into everything, including homes, in 2010. The projections I have seen for this country are 50 percent. The difference between 50 percent and 100 percent is not just half, because it's demographics. [Thus,] 50 percent penetration of fiber means probably 90 percent business.

BYTE: *What about fiber optics, specifically FDDI?*

Niklaus Wirth: One area that will certainly have influence is the even faster speed in communications through fiber optics. Whether that is really needed depends crucially on the kind of application you have.

Jonathan Titus: FDDI seems to be the strong one, and the one out in front at this point. I look to that for real strength in the future.

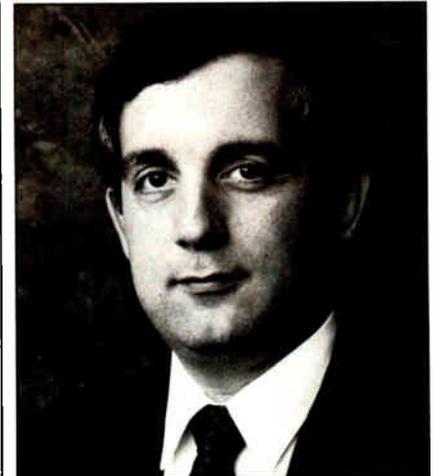
Paul Carroll: I also think that FDDI will happen. It just seems to me like it's a natural progression. I'm not sure that it'll happen in a big way for a while, because at the moment, you don't need that kind of bandwidth going from my PC to your PC.

Bill Gates: Use of optic-fiber networks in the office network will be very important. We actually will finally get some integration of the PBX system with the local

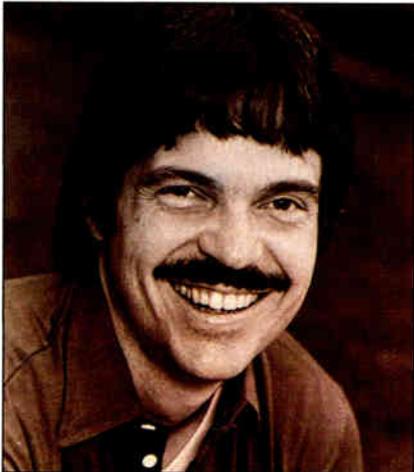
continued



Philippe Kahn is president and CEO of *Borland International*, which produces applications software and programming languages. He is a mathematician by training and studied for a time under Niklaus Wirth.



Mitchell D. Kapor is chairman and CEO of *On Technology*. In 1982, he founded Lotus Development Corp. and served as both president and chairman. He and Jonathan Sachs created the original version of Lotus 1-2-3.



Alan Curtis Kay is an *Apple* Fellow. His charter is to investigate new ideas in computing. He helped found Xerox PARC in 1970, where he refined the concept of the Dynabook and developed the Smalltalk programming language.



John G. Kemeny and **Thomas E. Kurtz** created the BASIC language and cofounded *True BASIC, Inc.* Kemeny retired last year from the faculty of Dartmouth College, where he was a former president and professor of mathematics. At one time, he was a research assistant to Albert Einstein. Kurtz is currently a professor of mathematics at Dartmouth.

computer network and some phone functions on the desktop with the computer.

Brian Kernighan: The thing that I would like to see happen more than it has is for better communications, reasonably high-speed communications, to people's homes, so that, in particular, the kind of central computing environment that I take for granted I could have better at home. The bandwidth is something that's already there because of cable, but it is hard to get at.

Jack Kilby: Fiber-optics technology is [a] hot area—as it goes into the home and office. People want high bandwidths for commercial applications. The great hope of fiber optics is that bandwidth is free and big. The big question is whether or not we get to use it.

Bill Stallings: With FDDI and some of the follow-on products, you're getting very high data rate local-area-network environments and server-based applications that would take advantage of that [high bandwidth] capacity.

John Markoff: FDDI will come very quickly because it's an evolutionary step up from Ethernet, but I think with processing power moving the way it is, FDDI will soon be seen as a bottleneck.

John Caulfield: Optical communication [is] clearly a very preliminary, early thing. What the industry uses and installs is always far behind the state of the art. And FDDI, the new standard protocol, is far behind the state of the art and is being implemented [in] various places. I expect FDDI to be with us throughout the next five or six years anyway, and maybe throughout the present century. Once we get used to that, we'll go to something far, far better. New standards will be introduced that will allow far better networks and will involve both wavelength division and time division.

BYTE: *The whole area of optical computing is an interesting subject. What kind of future do you see for that?*

John Markoff: Optical computing seems to still be a long way away. Lots of promise, but I think where it will come first is in the phone system. The switches are just so much more convenient with a fiber network to keep things in optical format all the way through, rather than switching it back and forth between them. So that's sort of logical.

John Caulfield: There are clear niches that belong to electronics, clear niches for optics. In the early stage, those companies that want to form will do well to stay out of the battles—to go where there is no competition. The goal is to build computers—not to build optical computers or electronic computers.

Rich Malloy: Optical computing, that's probably something that will be 10, 15 years away before we start using it to any degree. I think as that gets more feasible, the conventional ways of doing things will have advanced to the point where the advantages of optical computing will not be so great to justify the cost.

Ken Olsen: [Optical computing is] unlikely. There's an awful lot of logic in a chip. You see, light really doesn't go any faster than electricity. Well, it really does, but electricity in a vacuum goes about the same speed as light. Electricity on a wire goes about the same speed as light does. If you make it much bigger than a chip, you lose lots of speed, even if it's light.

John Caulfield: I would pick a task where it's possible to do the task optically, and it is essentially impossible to do it without optics, so that we are in no way in competition with electronics and yet benefit from all the advances that we anticipate from electronics. And then the problem becomes how you define those niches. And I think I can define some of them.

Doug Engelbart: So many things are going to shift. The optical thing is potentially that sort of shift in phenomena harnessing that may well pop up.

Paul Carroll: Optical computing—I think that's an interesting idea, but I don't think that even the proponents of optical computing think that anything at all will happen for three or four years. My guess is that it will be more like 10 to 15 years before there's even a chance that anything will happen.

Jim Manzi: I think optical computing is a long ways off. I guess the best work is being done at Bell Labs. They've demonstrated the concept very, very successfully. There is a long way to go there, obviously.

Charles Simonyi: Well, I don't think that optical computing is oversold. It is just [that] I see the promise as very uncertain—but then I don't think that, apart from some media hype, it is a serious issue.

John Caulfield: Optical computing, in my judgment, will only be real in well-defined niches. It will never replace electronics. It will be found to become merged with electronics. We let electronics do what it's good at and optics do what it is good at. Neither is replacing the other. There'll be niches that are ideal for electronics and niches that are ideal for optics.

BYTE: *Where do neural networks fit in?*

Bill Joy: Late in the decade, I think the real breakthrough will be if we can begin to use things like neural networks to take more analog input.

Paul Carroll: Neural nets I'm a little more skeptical about. That's kind of an interesting thing to play around with, but I have a feeling that [it] could turn out to be one of those technologies with a great past.

Jonathan Titus: Neural networks [are] an area that deserves a lot more attention, because I think if you read George Gilder's book *Microcosm*, he makes some excellent points about the fact that digital technology one of these days is going to run out of gas. Simply because we're trying to do the same old problems in the same old way, just dashing more bits and more bytes, and doing it faster and extending word lengths. But the way the eye works and the brain works is in the analog realm. He holds, and I agree, the analog realm will come of its own when we get into some more powerful neural-network-type chips and the software to control them.

Dick Shaffer: Neural networking is a possibility. I think it is potentially useful in the sensor area, and that's about all I see.

Niklaus Wirth: First of all, we do not really know what we want to do with [neural networks]. Secondly, we don't know how neurons work, so let's build them and combine them? Perhaps one aspect that is interesting there is if they are connected with sensors—*analog technology*.

Federico Faggin: I personally believe that [neural networks] will eventually change computation by adding a fundamentally new paradigm to the existing paradigm—not by replacing what exists, by adding something.

John Markoff: The neural-net stuff is very interesting, but I think it will come into play first in terms of interface issues—voice recognition and vision.

Dick Shaffer: I think neural networks might be useful in data reduction, especially in the area of vision. You look at an animal, for example, and you know from neural electric studies of the optic nerve there's a lot of data reduction that takes place in the back of the eye. Instead of sending a bit of information for all the thousands of points of light that strike the retina, you get reasonably reduced signals. Aha—something moved. Or, nothing moved. Or, something moved from upper right to lower left. A lot of reduction takes place. Neural networks for large arrays of processors could be useful in that.

Mitch Kapor: The commercial impact of the various biocomputing techniques, things that might emerge from neural nets or chaos or complex systems and so on, I think is more than a decade away, maybe more than 15 years away. It's still very, very preliminary, very interesting stuff, a whole different way of looking at the world and doing these sort of bottom-up intelligent systems, but I think that's still a long way away.

Federico Faggin: When you have to have machines that operate in the real world, in real time, then you will have to have both [traditional and sensory] elements in them. The sensory part, and the sensory processing, and the pattern recognition, and all of those things, will be done more readily with the neural networks. The logic processing will be done more readily with computers. In other words, it will be a little bit like left brain and right brain—you know, solving the problems together. Each paradigm is good for certain things and not very good for other things.

John Caulfield: Neural networks—big neural networks—will have to be optical. Small neural networks will almost have to be electronic.

Steve Leininger: You'll get me up on a soapbox [about neural networks]. I think the brain's a little more complicated than just what they are trying to do right now, maybe a lot more complicated. For a neural network to do something, you have to feed the silly thing.

Federico Faggin: The fundamental thing here is another way of learning how to manage parallelism—massive parallelism—but, however, applied to a class of problems that don't lend themselves to traditional programming. In other words, they only lend themselves to learning.



The real impact in computers is not the silicon.

It's not even the current software. It's the rethinking.

—Bob Frankston

Dick Shaffer: The idea of a computer learning from its environment I put about on a par with what I say about learning machines. Machines ought to come out of the box and do something useful. I don't want to have to send my computer to grade school. Programming is not teaching, and I don't want to confuse the two.

John Cocke: I don't think much of neural nets. I don't believe that that's going to be the answer to things.

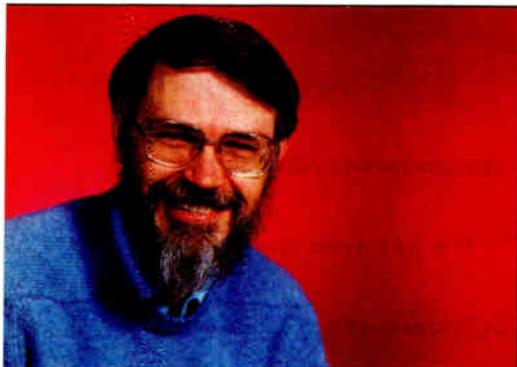
Ken Olsen: Oh, [neural networks are] something we love. I want to say yes, because we'd love to see it. It's a fascinating [subject] in the future. Good things come out of artificial intelligence, but not all of the things that are promised.

Stewart Alsop: I'm suspicious of things like parallel processing and neural networks. I'm a little bit suspicious of RISC computing. I guess I'd have to say I'm suspicious of things where I don't see the direct relationship between the technology and the result for the end user.

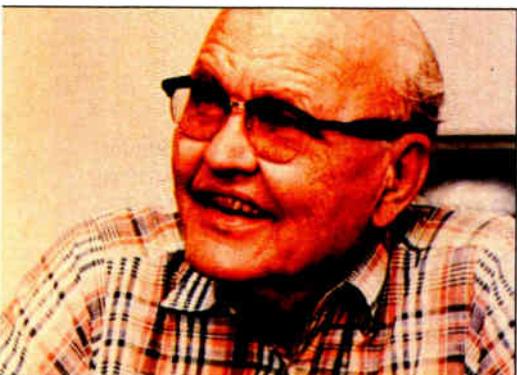
Terry Winograd: I think there are some interesting areas there. The notion [of] a huge industry there is false. I think they have potential, but different from what people think it is. I believe they are for niches like pattern recognition. I think they have long-term potential.

Robert Noyce: The areas I think are the

continued



Brian W. Kernighan is a member of the Computer Science Research Center at AT&T Bell Laboratories. With Dennis Ritchie, he coauthored *The C Programming Language*, which defines the C language.



Jack S. Kilby is currently an independent consultant. He and Robert Noyce are credited as independent coinventors of the integrated circuit. Kilby has been awarded more than 50 patents for his work in integrated circuits. Along with Noyce, Kilby received the first Charles Stark Draper prize from the National Academy of Engineering.

most interesting (and we'll probably look back on with pattern recognition) are the neural-net approaches to things. They will be extremely important. We will be solving the issue of doing tasks formerly better done by humans.

Danny Hillis: I think that people will be disappointed with how limited neural networks are in the short run. In the long run, I think the ideas of neural networks will get broadened out into other concepts, so I think it will lead to other stuff. I'm sort of a long-term optimist about that, even though I'm a short-term pessimist.

Federico Faggin: With neural networks, you will be able to build machines that combine both the traditional computational paradigm with this new computational paradigm. You will be able to solve problems from the traditional ones like speech recognition, all forms of image recognition, and so on, to even more important things [like] the application of very smart robots and autonomous intelligent machines.

John Caulfield: The ultimate application, without any question, in my mind is optical neural networks. Now, the trouble is, we know how to build them optically—we do not know what to do with them yet. They offer the hope of doing far more human-like activities than artificial intelligence. They are based on interconnections, and interconnections are the admitted great strength of optics. I can make more interconnections in and out of each neuron than can even biology. I could make a million things to each neuron optically; biologically, maybe 10,000 is what people think; and electronically, maybe 100. And so, the number of interconnections in and out of each neuron is much greater in biology than electronics, and much greater in optics than biology.

BYTE: *What about fuzzy logic and chaos? And while we're at it, could someone please give us a definition for each of these terms?*

John Caulfield: I would say [the definition of fuzzy logic is] "precise operations with imprecise data," because the actual controls or decisions that you apply are always extremely well defined. It's obtaining non-fuzzy outputs from, or fairly certain outputs from, quite uncertain inputs. So, it's certainty-increasing operations—a nice way of putting it. How do we live with the fact that there is more than certainty involved and more than probability? Fuzzi-

ness is not probability. Fuzziness is real. Some things are inherently not well defined. My wife is a pretty lady. I think so, but there's no quantitative measure of that. Am I an old man or a young man at 54?

Paul Carroll: Fuzzy logic is important, but there's a whole lot of work still to be done on that. All you have to do is take a look at some of the systems that rely on that at the moment to realize how far that still has to go.

John Caulfield: It's now becoming quite clear that there's at least one area in which fuzzy things work, and work extremely well, and that's in controls. The Japanese are significantly ahead of us in applying these, and their experience has been extremely positive. They control everything from trains to elevators. The primary government organization in our country that seems to realize the need for fuzzy controls first is NASA, and the fuzzy-control thing that we are working on for NASA applications is docking. Docking—[as with] a satellite. Only fuzzy stuff that can predict with certainty is going to be important as fuzzy controls.

Steve Leininger: [But] if you're doing accounting software, you probably don't want a fuzzy network. You probably want good old BCD arithmetic, so you don't have round-off error, and all that. Maybe part of that is going to be speech recognition, and visual recognition, and all this kind of stuff. They haven't convinced me that they're quite on the right path yet.

Ken Sakamura: Nobody's going to make a mainstream computer based on, say, fuzzy logic. Of course, some companies are already demonstrating fuzzy-logic household appliances, and we'll see these technologies used on a piece-by-piece basis where appropriate, but not as major competitors to the main technologies.

Robert Noyce: Well, chaos and fuzzy logic are ways of life, so they will be with us and won't go away.

John Caulfield: My definition of chaos is "the production of detailed unpredictable results from highly well controlled and predictable circumstances." Well-defined equations producing detailed unpredictable outputs—production of things that are unpredictable in detail from simple, easily described inputs. It is not garbage in and garbage out. It is good stuff in, garbage out.

continued

**“So, this punk comes up to me and says,
‘Is there anything you won’t do for a buck?’
And I say, ‘Sure. I won’t plug in my PC
without a Proxima product to protect it.’”**



“I may be crazy, but I’m not stupid.”

“When people tell me I take foolish risks, I say to them: ‘At least I assess the risks, and I always take steps to protect myself. Do you?’

“Take many microcomputer users. They’re cool and calm, just cruising along until – *wham!* – they’ve crashed. Lost all their data, maybe even burned out a motherboard. Yet they sit there, stunned.



Whether you’re operating a home computer or a technical workstation, there’s a state-of-the-art Proxima ProLine to match your needs.

They had no idea they were at risk.

“Or maybe they just thought it would never happen to them. Yet studies indicate that every AC outlet in America has a 97% probability of incurring at least one system-damaging event each year.

“Whether it’s a Proxima® ProLine™ Surge Suppressor that clamps down on incoming surges and spikes – or a Power Director® that protects against power problems and acts as a power control center – your micro needs ultra-reliable protection against the 101 power problems that threaten it.

“So check out the entire range of innovative Proxima Power Protection Products. And ask about the Proxima Lifetime Equipment Protection Policy. With the purchase of a ProLine 20 or 30, or a Power Director, it guarantees the survival of your hardware from a power problem – for life.”

Want to hear more about how to save the life of your computer? Just write, and I'll send you, free, "Five Ways to Stop Being a Computer Daredevil." Or call 800/582-2580 (800/582-0852 in CA).

Name _____

Company _____

Address _____

City _____ State _____ Zip _____

Phone _____

Return to: Computer Accessories Corporation, 6610 Nancy Ridge Drive, San Diego, CA 92121.

PROXIMA

by Computer Accessories Corporation

Power Director and Proxima are registered trademarks, and ProLine is a trademark, of Computer Accessories Corp. Computer Accessories Corporation will change its name to Proxima Corporation in November, 1991.

World Radio History

Circle 347 on Reader Service Card
(RESELLERS: 348)

Space-Saver Keyboard



Save an amazing 60% of the desk or counter space now taken by a standard keyboard and enjoy improved functionality at the same time. Actual size is 10.75" x 6.0" (273 x 152mm). The new MICROTYPE keyboard is rapidly gaining acceptance as a truly advanced alternative to the original IBM layout for many applications. Reliability of the MICROTYPE has been amply proven through extensive use in trading areas of the NYSE, The New York and Chicago Mercantile Exchanges as well as in many banks, brokerages, stores and at factory work stations.

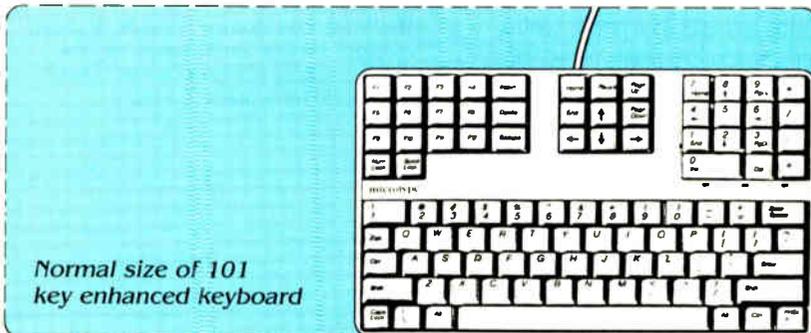
Space is saved by compressing rows (not columns) and eliminating wide borders. Re-arranging and elevating the auxiliary key clusters also saves space while improving accessibility with reduced eyescan and head movement. Keys have full travel with a light tactually responsive touch. All standard features such as auto-repeat, caps, num and scroll lock are included on the MICROTYPE.

PC XT/AT, PS/2 IBM and clone compatibility. Available in US and most European language versions. Made in USA with 1 year warranty.

... beautifully sensitive and handles both typists with light touch and those who really bang away ...
COMPUTER BUYERS GUIDE
 ... This could be the perfect layout for an enhanced keyboard that must fit into a small area ...
COMPUMAG

Order direct from stock with 15 day full return privileges. VISA, MasterCard, Eurocard charges accepted.

USA	1-800-DATALUX	Fax 703-662-1682	\$124.50 + 6.00 s/h	<i>Extra charges for PS/2 adapters, air shipments. OEM and reseller volume discounts available.</i>
CANADA	514-694-0870	Fax 514-694-0871	\$189.00Cdn + s/h	
EUROPE	44 + 306-76718	Fax 44 + 306-76742	£99.00 + VAT + P&P	



Normal size of 101 key enhanced keyboard

When it comes to saving space, there's no comparison.

DATALUX

DATALUX CORPORATION 2836 Cessna Drive, Winchester, Virginia 22601

It's that surprising aspect of chaos that's interesting. The other thing that is interesting is that what comes out and looks random, isn't completely random. The behavior is not predictable. This is the discovery of order. At a certain higher level, there is still order, even though it's of a disorderly type.

Bill Gates: Chaos—that's just a way of modeling things in physics. That doesn't impact computers.

John Caulfield: It is clear that chaos does, in fact, describe the real things that happen, and not just in the world at large, but in the technological world. Lasers and optical bistability and things like this often exhibit chaos. And lasers are useful in bistability issues. But is the chaotic nature of it useful? I'm not sure. I think it is too early to determine.

BYTE: So, basically, you're saying that these cutting-edge technologies are all things we can look for at some point in the not-too-distant future.

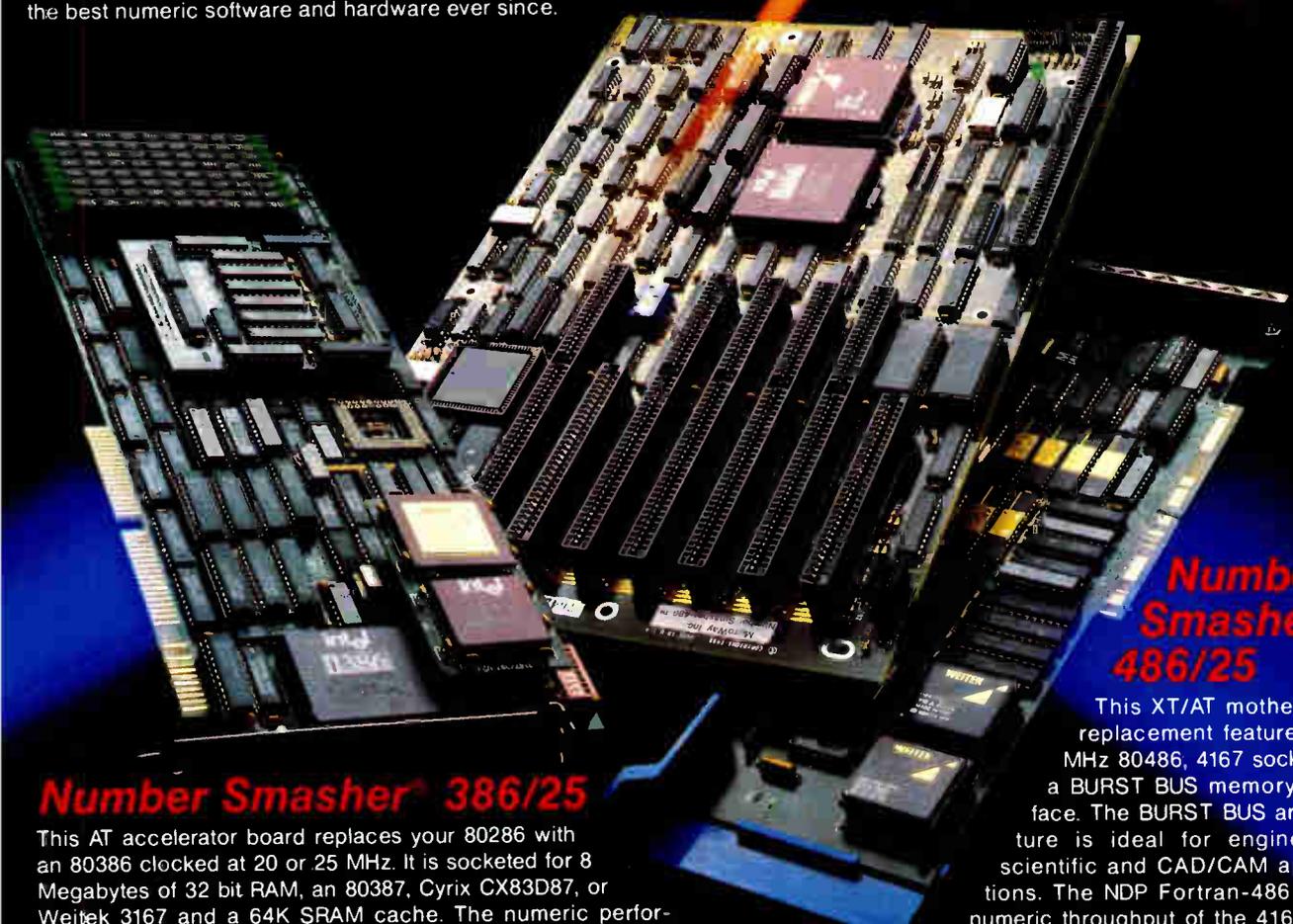
John Markoff: The lesson that I've learned from that experience at Xerox PARC is, here is all this great technology in the mid-1970s, and there's an eight- or 10-year rule on diffusion. And so, everything happens about a decade after you think it's going to happen in terms of it reaching the mass market. And I think that probably holds true for a lot of these things.

Jonathan Sachs: I like sort of trailing-edge technology. I get interested in it after everyone [is done] arguing about it—the pioneers have already introduced the stuff and then I get interested in it. I try to engineer things to actually be real. That's the section of the industry I fall in more than the leading edge and the far-out stuff.

Jim Blinn: I don't think any of [these technologies] are going to be flashes in the pan. I think that anything that's being developed is going to have a following and a niche. Maybe I'm sticking my neck out on this, but I might say it anyway. I think the Macintosh will be a flash in the pan. I think that all the good ideas in the Macintosh, either those that Apple invented or that Apple subsumed from what Xerox invented, will have percolated out into other computers. But I think the Macintosh itself will fade away, primarily because of the fact that it is so closed and rigid. Technically, it's an OK machine, but you can do a lot better, and PCs are going to bypass it, I think. ■

25 MHz 486 Speed For Your 286/386 System!

MicroWay manufactures a broad range of products that boost the speed and capacity of your current PC/AT. They include 386 and 386SX accelerators and 486 replacement motherboards. We also offer a complete line of Weitek accessories and stock all of the Intel, Weitek and Cyrix coprocessors. We created the PC numerics industry in 1982 and have been developing, selling and supporting the best numeric software and hardware ever since.



Number Smasher® 386/25

This AT accelerator board replaces your 80286 with an 80386 clocked at 20 or 25 MHz. It is socketed for 8 Megabytes of 32 bit RAM, an 80387, Cyrix CX83D87, or Weitek 3167 and a 64K SRAM cache. The numeric performance of the Number Smasher 386/25 is a strong function of your application and the coprocessor you choose. The 25 MHz NDP Fortran-386 driven Whetstones are 2.1, 3.7 and 5.5 MegaWhetstones running on the 80387, CX83D87 and 3167.

Number Smasher 486/25 Numeric Performance

	486	4167
Megawhetstones	5.9	13.0
Megawhetscales	4.1	9.9

MicroWay and Number Smasher are registered trademarks of MicroWay, Inc. 80386, 80387, 80486 are trademarks of Intel Corp., Cyrix and CX83D87 are trademarks of Cyrix Corp. Weitek, 3167 and 4167 are trademarks of Weitek Corp.

Coming in August: Number Smasher® i860

**Micro
Way**

Number Smasher® 486/25

This XT/AT motherboard replacement features a 25 MHz 80486, 4167 socket and a BURST BUS memory interface. The BURST BUS architecture is ideal for engineering, scientific and CAD/CAM applications. The NDP Fortran-486 driven numeric throughput of the 4167 is an impressive 13.0 Megawhetstones, which is 100 times the throughput of an 80287 equipped AT!

mW3167/MCA

Our MCA Weitek card runs in the IBM Model 70 and 80. At 20 MHz, its performance is 2 to 3 times that of an 80387.

NDP Fortran-486 and C-486 are globally optimized main-frame compilers that have been fine tuned for the 80486 and 4167. NDP Fortran-i860 and C-i860 are available in August.



World Leader in PC Numerics

Corporate Headquarters: P.O. Box 79, Kingston, MA 02364 USA (508) 746-7341
32 High St., Kingston-Upon-Thames, U.K., 81-541-5466 USA FAX (508) 746-4678
Germany 069-75-2023 Italy 02-74.90.749 Holland 40 836455 Japan 3 222 0544

Kemeny and Kurtz:

On BASIC

I think that there was an unfortunate start for BASIC in microcomputers. Earlier in this decade, it was implemented on really tiny microcomputers. It was a miracle they could implement anything, and I admire what they achieved, [but] I think some really bad versions of BASIC hit microcomputers.

I know when I first got an IBM PC, I loved the machine. But when I tried the BASIC that came with it, I was horrified. It was ugly and not at all [in] the spirit I thought BASIC should be. I think we've had an influence on that through the creation of True BASIC. I think our competitors have come out with much better versions [of their products]—I think under our influence. But I think that BASIC got enough bad publicity during that period that people have moved away from it.

I believe in two kinds of languages. When one really needs speed, one has to go to something like machine language, and I look at C as the modern version of machine language. So I can see writing some stuff in C, but [for] anything else, a language like BASIC—and I, of course, personally like BASIC. Good, structured BASIC, I think—and I know a lot of people at a lot of schools that feel the same way—is an excellent high-level language in which to [program]. And if in some parts of it you need extra speed, you switch to C.

In my experience, it is not the running time that is the overwhelming factor; it is the programming time that takes forever. And writing in a good, structured language just saves you enormous amounts on programming, and on finding bugs later on. —*John Kemeny*

I see a future for BASIC for those people who are going to be doing FORTRAN-type programming problems but who want a language that has an easier user interface to it. I think BASIC is here to stay. Whether it will constitute more than whatever the market share is right now, I don't know. I don't know what the trend is going to be.

Anybody who has a personal computer probably has a bundled BASIC. This really includes practically all IBM PCs, which have some form of BASIC bundled with them. (Of course, that's the line-number version. I'm amazed that people write programs with that BASIC.) And I think the conversion from that version of BASIC to a more modern version will be very, very slow. There doesn't seem to be any forces that are pushing the market to make that conversion. That'll be slow, but one by one, people will feel more comfortable with BASIC.

The reason I say that is that for many people who have to learn—I'm talking now about people who do programming—there still seems to be pretty much a place for writing programs in the engineering and the technical fields. You're writing programs all the time, so you need a comfortable programming environment. And so for those people, it's really asking too much for them to use Pascal or C.

So I think that BASIC is here to stay. We're in the process right now—in the final stages of an ISO-standard BASIC. It's based upon the ANSI standard; it's the same language. Again, I don't know what the impact of that will be. If there are any vendors in the world that are

planning to [support] standard BASIC, I don't know, because the people who use it don't constitute a strong marketplace. Educators—but they never spend any money.

What [Bill Gates] has done with his BASIC is to essentially turn it into Pascal. You've got a lot of the attributes of Pascal. You've got data typing; you can declare new data types. And true, if you can do that, you can get rid of some of the uglies that are a part of Pascal, and that's a sensible thing to do to a language that he wants as a systems programming language, an application programming language for applications on the DOS environment. So he can put anything he wants in, so that it will be especially targeted for that environment. And that seems reasonable.

We would love to do [that] to our language, to add things like data typing and record structures and so on, but we feel that it would mess it up so much that we'd lose the flavor of what we have. We're a different environment—we're a machine-independent language, so we cannot, [in] any appreciable way, put in features that are designed specifically to attack problems in the PC or the Mac. And it's perfectly clear that those two environments are completely different in terms of system development. That doesn't mean that you can't use True BASIC in those environments, but they have to be applications that don't require you [to] "bit twiddle" and don't require you to get at some specific hardware features.

—*Thomas Kurtz*

Editor's note:

See *biography*, page 270.

Jay Miner:

On Amigas in the Mainstream

It's the old question of which comes first, the chicken or the egg. Software people are not going to write good business programs for [the Amiga] as long as it's got the image of either a game machine or an artist's machine. When IBM first came out with their PC, they touted it as a business machine. At that time, the business programs on it were much worse than the ones that are on the Amiga now. Now, I think that's a very important point, because most of the Amiga business-type programs such as spreadsheets, word processors, and database managers are perfectly sufficient for 90 percent, 99 percent even, of small businesses around. Perfectly sufficient. And much easier to use and maintain than the ones on the IBM.

But unless Commodore starts targeting that market seriously, and calling it a business machine—which they are undermining their own possibility of doing every time they push it in other directions—unless they do that, the software developers are not going to do the software on it that they would like them to do. And that's where it's got to start. It's got to start with Commodore's marketing and advertising and how they image the machine, and how they get away from the image of the Amiga as a game machine, and, let's say, maybe artist's machine that it has now.

The [Amiga] 1000 was a compromise computer when it first came out, a compromise between the pressure mostly from me and my friends to make it more

of a competitor for IBM in those early days and make it hit the business market, and the people, including the investors and Amiga, who wanted it to be a game machine.

Commodore has solved the compromise now, with the 500 as a low-cost machine for those who want it for the home to play games and do a little word processing on, and the 2000 series—[and now] the 3000—that is more of a real computer, like I wanted to build in the first place. The 2000 is the computer I wished I could have built back then.

They have gotten it right hardware-wise, I think. The 2000 is a good machine, hardware-wise. It's very expandable. It will even take the Bridge board, which will run IBM software in an Amiga window—which is handy if you want to run two things. You can run one thing on your Amiga and another on your IBM at the same time on the same screen. So, I think they have done it right hardware-wise, and I am very optimistic that they are about to do it right marketing-wise. Multimedia is a good name for a field that Amiga has been doing a lot of for a long time. I think having the supplied-with-the-machine authoring system is very important, very useful. But I wish they would target the business market and declare it a business machine and not a hypermedia artist's machine.

Editor's note:
See biography, page 296.

Bill Joy:

On the Next (Human) Generation

I think there are a lot of really bright kids who [have] had computers, not in the school, but at home. Kids [who] grew up with these machines and are very, very—not necessarily literate in the sense that they can read—but creative.

So, there's this new generation of kids that are growing up who have had computers in their environment and can imagine solutions using computers and things to do with computers that those of us who are at the ripe old age of 35 have a little more difficulty imagining. So, I think there is going to be this sort of shock wave of these kids coming into the industry. And I'm not sure the shock wave has quite hit yet.

Those kids are all going to go and be creative. And I hope they do great things that will benefit society as a whole by taking this technology and making it useful, because it is not going to be done by one or two people. It's not just Lotus 1-2-3 or a word processor that's going to make this difference.

These kids will hit the work force in large numbers sometime in the nineties. There will be a lag time, but there will suddenly be a rush of great new things that are happening. I think that will be a big change. I expect [it] in the next three to five years. You might call them "Apple kids" or "Mac generation." It will be interesting. And these are the kids that are going to write the great software of the nineties, whose names we don't know, who are just graduating from high school or college—the John Stuart Mills of the late twentieth century.

Editor's note:
See biography, page 262.

Why Compaq will ne that simply

The way we see it, the so-so, the pretty good and the just plain average are things for someone else. Not for us. And most certainly not for you.



Before creating anything, we start with a clean slate, and talk to personal computer users like you.

That's the reason why every COMPAQ personal computer product ever introduced has been designed to deliver on a simple promise: to simply work better. It's what makes our high-performance PCs different from all the others.

The whole process starts with you.

Before we design our products, we sit down and talk with computer users like you. To see what you want. And what you need.

Then we take these ideas and combine them with the latest technology and our own innovative thinking.

The result is a line of PCs with the right performance for whatever you want to do. Performance that comes from more than just the processor. It includes features like high-speed disk drives and

VGA graphics. Room to customize and upgrade with expansion cards and peripherals. And the compatibility to work with the best of industry-standard technology.

This attention to detail is one reason why our PCs consistently earn the highest marks for quality from computer experts. And unsurpassed marks for satisfaction from PC users.

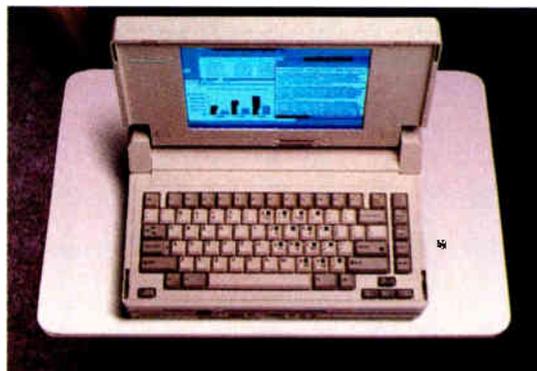


COMPAQ personal computers earn an impressive number of industry awards. But it's all the things you can do with our PCs that's really impressive.

You'll see this thinking in every COMPAQ PC system,

desktop, portable and laptop we introduce.

The new COMPAQ DESKPRO 386N and COMPAQ DESKPRO 286N are the first COMPAQ personal computers designed with specific



network features. They're optimized to work in combination with the COMPAQ SYSTEMPRO PC System

The new COMPAQ SLT 386s/20, like all our laptops, is designed to fit where you work. Whether you're on the 35th floor overlooking Manhattan or at 35,000 feet over the Rockies.

Ever introduce a PC works OK.

or powerful COMPAQ desktop servers.

The COMPAQ SYSTEMPRO brings an unprecedented combination of performance and

And for the ultimate in portability, the 8½" × 11" COMPAQ LTE and COMPAQ LTE/286 put the performance of a desktop personal com-



No matter what you do, there's a COMPAQ PC system, desktop, portable or laptop that will help you work better.

expandability to connected environments.

The new COMPAQ DESKPRO 386s/20 delivers power at the office without taking over your whole desk.



Every COMPAQ product is meticulously designed. Ideas that don't measure up will wind up here, not in your office.

The new COMPAQ SLT 386s/20 laptop lets you put that same high performance to work on the road or on your desk. Without compromising functionality or size.

puter in your briefcase. With room to spare.

All told, every COMPAQ PC ever introduced offers the difference between simply working OK and simply working better.

For more information and the location of an Authorized COMPAQ

Computer Dealer, call 1-800-231-0900, Operator 117. In Canada, 1-800-263-5868, Operator 117.

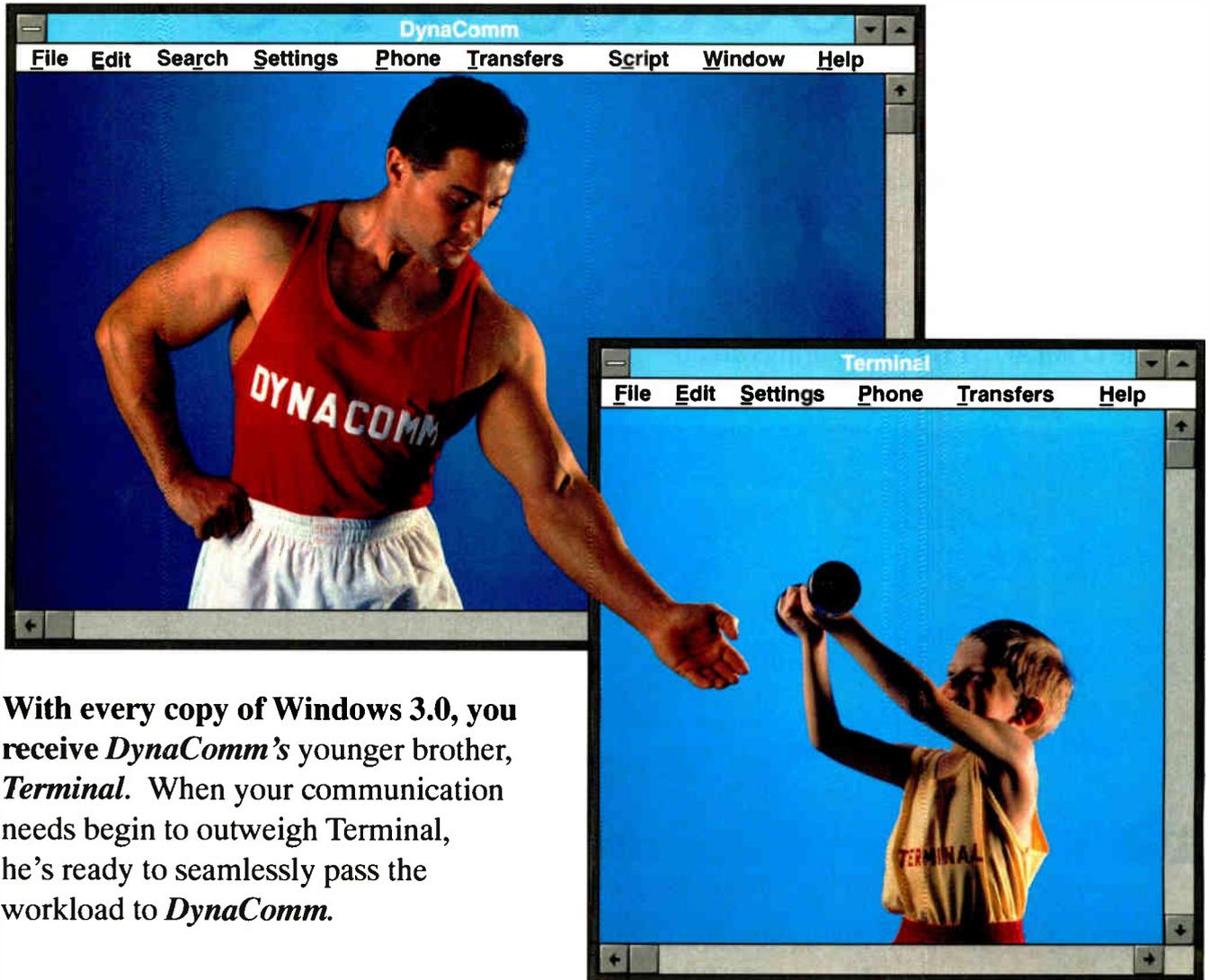


A worldwide network of Authorized Dealers is ready and waiting to help you.

COMPAQ

It simply works better.

All Gain. No Pain.



With every copy of Windows 3.0, you receive *DynaComm's* younger brother, *Terminal*. When your communication needs begin to outweigh *Terminal*, he's ready to seamlessly pass the workload to *DynaComm*.

- **Comprehensive LAN Support**
NetBIOS, Ungermann-Bass, Eicon Gateway...
- **Terminal Emulations**
IBM 3270, DEC VT100/220, IBM 3101
AT&T 605/1705, DG 470C, HP 700/94...
- **Power Scripting**
DDE, Dynamic Link Library Access...
- **Reconfigurable Interface**
Redefinable Menus, Dialogs, Function Keys...
- **Standard Protocols**
IND\$FILE, XModem/CRC, YModem Batch,
YTerm, Kermit, CompuServe B+
- **Built-in Multiple Document Editor**

When you're ready to gain micro-to-mainframe communications with power for all your needs, call Future Soft at 713-496-9400.

DynaComm[®]
Dynamic Communications

FS
E **Future Soft**
Engineering, Inc.[®]

1001 South Dairy Ashford • Houston • TX 77077 • (713) 496-9400 • FAX (713) 496-1090

DynaComm is a registered trademark of Future Soft Engineering, Inc. Other trademarks are the properties of their respective owners or licensees.

Circle 480 on Reader Service Card (RESELLERS: 481)

World Radio History

THE BYTE SUMMIT

OBSTACLES TO OVERCOME

What is the biggest obstacle to major new breakthroughs in computing?

Tom McWilliams: I think that software development is the biggest obstacle we have. Programming languages today are fairly low-level. You look at things like C, FORTRAN, and so forth, [and] there's a tremendous amount of continually rewriting low-level code. I think that the thing we need to do to make the biggest advance in computing is to figure out more efficient ways of programming these machines.

Dennis Ritchie (*see biography, page 336*): One of the [C] language is that it doesn't help much in doing large projects (i.e., it was not designed with big monolithic programs in mind). It was designed in an environment of multiple small programs that interact only by fairly restrictive means.

Jerry Pournelle: One of the biggest obstacles to the future of computing is C. C is the last attempt of the high priesthood to control the computing business. It's like the scribes and the Pharisees who did not want the masses to learn how to read and write.

Terry Winograd: I would say the big problems are more on the software side. We understand how to build things that go faster than we can use.

Jack Kilby: Well, my background, basically, is in hardware. And so that leads me to believe [that] any basic limitations are in software. I think in hardware, we can do most anything.

Bob Noyce: Oh, I think clearly software is where the action is. Not the hardware. I think again, we finally may go back to a new architecture. I think the major breakthroughs will have to be in software.

Dick Shaffer: Yes, software development. Hardware is the easy part. I don't see any major areas to increase power within machines. Machines will continue to get cheaper, faster, better, and the software gap will not only continue but it will get worse.

Michael Slater: More fundamentally, I think that the packaging and system design is a limit to the speed today. The chips themselves, running today at 40 and 50

MHz, and ECL chips running today at 70 and 80 MHz, and we'll see CMOS chips at 50, 60, 70 MHz before long. The packaging is a real problem today. There's on the order of 5, 6 nanoseconds essentially wasted in the delays associated with the pins of each individual package.

Alvy Ray Smith: I haven't heard of anything yet that limits them, so I don't see any reason why we won't see these speeds. And there are technologies lying in the wings for when the current ones run out of speed. I don't think that is going to be the problem. I think the problem is how we actually use them.

Andy Bechtolsheim: At the system level, you will have to package things much smaller and more carefully than before, because the limits of the speed of light really come into play at those kinds of frequencies, and people will probably use very advanced tab- or chip-on-board-type technologies to get the size of these machines way down.

Tony Hoare: I'm sure there is [a technological limit] around some corner. In fact, as a software man, I sometimes feel that I wish it would come sooner, because the increasing speed of the devices, first of all, detracts attention from the remainings. Look, it creates the illusion among the users that it's going to solve problems of complexity in software, and it's quite the reverse.

John Markoff: I think the pace of software development is going to continue to be the principal bottleneck. And that's because you can't manage the development of software in the same way that you can develop the management of hardware. I met with Charles Wang, who's the president of Computer Associates, and he said something that was very funny. He said when a software program is running behind schedule, what he does is he takes people off the project. In his view of software development as an art form, he looks for people who are good musicians and philosophers to develop the software as well as being good programmers. If it's an art form, then it is not subject to traditional engineering

continued



The inertia

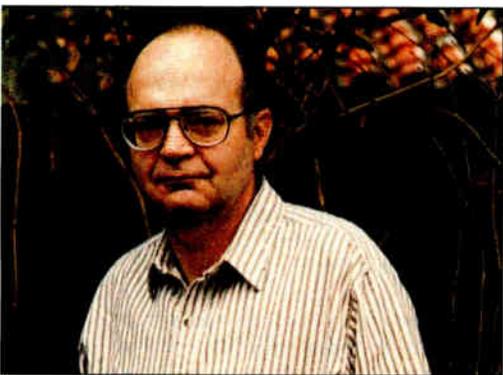
of the whole PC market

cannot be underestimated.

—Michael Slater



Gary Kildall is founder, chairman, and staff technical advisor at *Digital Research, Inc.* He created the CP/M operating system.



Donald E. Knuth is professor of the art of computer programming at *Stanford University*. He is the author of the renowned series *The Art of Computer Programming* and of the T_EX typesetting language. Knuth received the A. M. Turing Award in 1974.

constraints. I don't think you can put hundreds and hundreds of people on a project and get anything but mushy software.

Dennis Ritchie: There clearly is a software crisis. Of course, there's always been a software crisis. We just don't know how to do big systems very well. It's not clear whether it could be fixed by fixing things at the small (i.e., better programming languages), or whether it's a matter of the design of the whole thing.

Paul Carroll: I very much believe that the biggest obstacle is software design. Software is at the point where the automobile was before Henry Ford came along, and there really is no Henry Ford or no assembly line in sight. I'd voice all the standard complaints: It's still too much artistry and not enough engineering; the tools still aren't adequate. The software developers need to really get out more and talk to the actual customers. Somebody also has to come up with some way of dealing with all the code that's already been written so that it's a bit easier to update it.

Mitch Kapur: There are three obstacles that I really worry about. The first is the time and expense of doing software development. It's still an incredibly labor-intensive process for skilled craftsmen. The equivalent of the assembly line for software just doesn't exist. A second obstacle to innovation and breakthroughs is the installed base drag. The more tens of millions of people you have using [a product], the less possible it is to do anything innovative, because [what] the customers want is refinements of existing stuff. A third obstacle is, I think, a lack of an adequate base of research funding from the government and the private sector. When the Japanese can spend \$50,000,000 a year on a national initiative [for] interactive 3-D graphics or virtual reality, if you will—most of it private—we're not doing anything on that scale or like that. It's very sad.

BYTE: *You mentioned the installed base. Does anyone else see that as an obstacle?*

Brit Hume: The installed base is of itself a major obstacle of a sort because of the need for compatibility. But I don't know how—it may be impossible to know for sure—how great an obstacle that is.

Stewart Alsop: There is a joke that people tell, and I'm not the source of it, so I don't want to take credit for it. It's a great joke, and the joke is that there is a reason that

God was able to make the world in seven days, and that was because he didn't have an installed base. It's not the fact that we have users, because that's wonderful. The biggest obstacle is our inability to perceive what the opportunities of the future were. We built into existing equipment fundamental obstacles to implementing this new stuff. We have a tremendous amount of equipment installed that fundamentally cannot be upgraded.

Bjarne Stroustrup: The more acceptance that technology gets, the harder it is to change. If enough people are stuck at the same level, they think it's the truth. So emotion is there, and inertia is always building up. I'm not just talking about languages; I'm talking about operating systems, hardware architectures, etc. It takes a greater and greater effort.

Gordon Bell: The software [for the Intel platform] is like nothing we've ever seen before that has this inertia associated with it, because you put value on the software, you put so much value on your data. Some of it, I think, is valuable. Some of it isn't. A lot of times, I think people would be better throwing the whole damn thing off and starting over again.

Bjarne Stroustrup: My professor from Cambridge, David Wheeler, claimed that the time needed for an idea to come from the lab to be generally available had always been increasing. A couple of years ago, he claimed that the median delay was 15 years. By his law, it should be almost 20 years now. When things work, all the good aspects and the less good aspects mingle in a general inertia that makes it harder to change.

Alan Kay: So the biggest barrier is actually resistance to change. And McLuhan had this great quote. He said, "Innovation for the holders of conventional wisdom is not novelty, but annihilation." That's the biggest problem. Of course, the Japanese don't seem to be particularly threatened by novelty. They put it on like a suit, and it doesn't affect their identity.

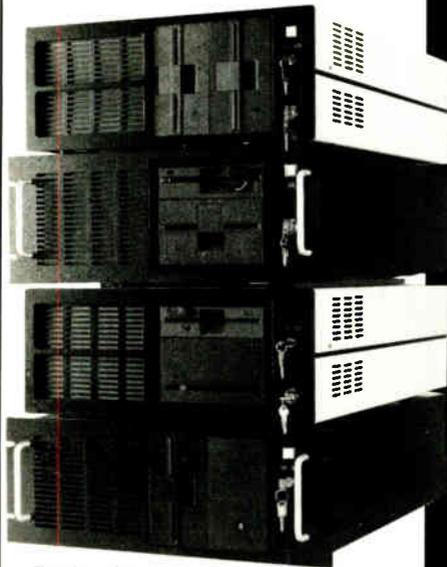
Doug Engelbart: Our cultures evolved in given environments in which change was not a very large factor. It's only been, say, the last 100 years, and much less, even, for the really rapid change.

Danny Hillis: I think it's in the ability of the users to absorb change. I think that

continued

Rack & Desk PC/AT Chassis

Integrand's new Chassis/System is not another IBM mechanical and electrical clone. An entirely fresh packaging design approach has been taken using modular construction. At present, over 40 optional stock modules allow you to customize our standard chassis to nearly any requirement. Integrand offers high quality, advanced design hardware along with applications and technical support *all at prices competitive with imports*. Why settle for less?



Rack & Desk Models

Accepts PC, XT, AT Motherboards and Passive Backplanes

Doesn't Look Like IBM

Rugged, Modular Construction

Excellent Air Flow & Cooling

Optional Card Cage Fan

Designed to meet FCC

204 Watt Supply, UL Recognized

145W & 85W also available

Reasonably Priced

Now Available

Passive Backplanes



INTEGRAND

RESEARCH CORP.

Call or write for descriptive brochure and prices:
8620 Roosevelt Ave. • Visalia, CA 93291

209/651-1203

TELEX 5106012830 (INTEGRAND UD)

FAX 209/651-1353

We accept Bank Americard/VISA and MasterCard

IBM, PC, XT, AT trademarks of International Business Machines.
Drives and computer boards not included.

OBSTACLES TO OVERCOME

sometimes the technological possibilities have gotten tremendously ahead of the users' ability to put them to work. And I see that as the limiting factor in technology development.

Ken Olsen: There are major breakthroughs all the time. Unbelievable ones, you know. Computing changes so much. But almost nothing happens suddenly out of the sky. Almost everything is engineering. It takes time—sometimes a short period of time, like we're seeing in the computer business today.

Doug Engelbart: The biggest impediment is the perspective people have about what can be done, what's a candidate for change, how much value there'd be, how much change there's going to necessarily be. Some of the attitudes about change that I remember—well, if the computers are so smart, why should I change?

Dick Shaffer: The people are the factor. I don't think we will have any more brilliant programs, any faster, useful programs, any faster than we've got now. I don't know why we should expect the computer to be any more useful for creating computer programs than we expect it to be useful for creating novels or painting pictures. Software creation is just as hard as any other kind of creation. There's only a certain amount the tool can do, and it's not the most important part.

Bob Frankston: The biggest limitation is the failure of imagination that people tend to project. Actually, the biggest obstacle is marketing surveys, is people projecting from what we have now, the people trying to meet felt needs. It's the unmet needs that are always the exciting ones. You've got to have a leap of imagination, and the biggest obstacle is change of paradigm. The real impact in computers is not the silicon. It's not even the current software. It's the rethinking.

Rich Malloy: People get used to doing something in a certain way and have a great deal of difficulty trying to do something different, even though it's better. It has to be much, much better to get people to change products. Getting people to break out of their traditional ways of doing things may be more of a problem than getting them to use computers in the first place.

Nicholas Negroponte: I think it's people. I think that the breakthroughs we're going to see in the next decade will come from ap-

plications—they're not going to come from fundamental material science. Really, a lot of applications are going to push most of the breakthroughs.

Steve Leininger: I think that one of the things that's going to limit progress is the difficulty to do something new now basically requires a corporate commitment. You are talking about serious design dollars—serious cash outlays. So, a lot of the innovative stuff isn't going to be accidentally designed in a garage anymore.

Lee Felsenstein: The high cost of capital in the U.S. has resulted in significant distortions of the development process. Venture capitalists require a 20-to-1 payback in a few years or else they'll can you, ditch the project. When you have that kind of evolutionary imperative going on, everybody goes to work on what is supposed to be really high paying-off projects. And all the projects that will pay off reasonably well over a reasonable period of time, die. As a result, we have evolved the industry into a real Las Vegas scene: Everybody is walking around talking big and doing nothing but gambling.

BYTE: Will the relationship between hardware and software change in the 1990s?

Michael Slater: I think it will change, to some degree. What the software industry has had to struggle through in the last five to 10 years are rapidly evolving microprocessor architectures. You look back when we were 10 years ago with the 8086 architecture, and then having gone through the 286, and on to the 386. The 8086 architecture really was not adequate for developing sophisticated software. It did not have enough addressing range. It had the segmented address scheme. Then the 286 imposed a memory management scheme that was fundamentally ill-conceived. Now that the industry is moving on to the 386 architecture, I think you won't see that same sort of painful discontinuity introduced, in that the 386 architecture, I believe, can last (from the software point of view) for another decade. The 486, for example, implements really the same architecture as the 386.

Tom Kurtz (see page 270): The hardware vendors are not going to stop inventing better and better hardware. They're getting involved with distributed stuff—it's even more complicated. Most of the applications that are written now are monoprocessor applications. They're not designed to serve

Total Reliability

for critical workstations, file servers, and peripherals

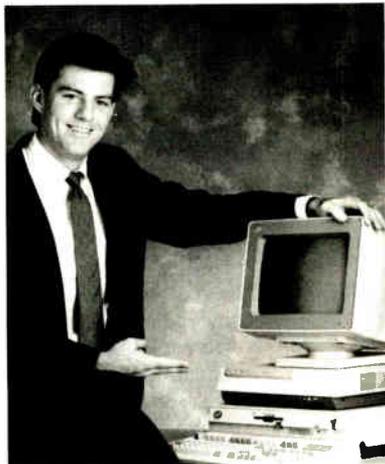


CAD/CAM systems, high-end workstations and file servers are sensitive to power fluctuations. A 25 MHz 80386-based machine can execute as many as 2.5 million unprotected instructions during a single dip too short to notice.

The PS4.5, PS6.0 and PS8.0 deliver 450VA, 600VA and 800VA of Zero Transfer Time, on-line power protec-

tion. Surges, spikes, brown-outs, blackouts and noise cannot affect your system because power is continuously regulated and conditioned.

Data is too valuable to risk losing—and the PS Series is the best way to provide low-cost on-line protection for your critical application workstations and network file servers.



With its small footprint, the PS Series UPS is designed for PC desktop operation, fitting conveniently between the monitor and the CPU.

UniPower[®] PS Series

U P S

SPECIFICATIONS	PS4.5	PS6.0	PS8.0
Input Voltage	120V+10%/-20%	120V+10%/-20%	120V+10%/-20%
Output Voltage	115V±5%	115V±5%	115V±5%
Output Frequency	60Hz±0.5Hz	60Hz±0.5Hz	60Hz±0.5Hz
Output Waveform	Sine Wave	Sine Wave	Sine Wave
Output Power	450VA / 300W	600VA / 400W	800VA / 540W
Weight	28 lbs	33 lbs	37 lbs
Transfer Time	None	None	None
Support Time (286/386)			
Typical	10-20 min	15-20 min	15-20 min
Full Load	6 min	6 min	5 min
Cable & Interface Options	UNIX/XENIX, Novell, Banyan, 3Com, Altos		
Certification	UL, FCC, CSA, Novell, IEEE-587		
Support Products	VAP, NLM, UPS Software Interface for Novell UPS Monitor Board for Novell UNIX/XENIX Interface Software		

FEATURES

- On-line Continuous Power, Zero Transfer Time UPS
- Fully Regulated Output
- Pure Sine Wave Output
- Remote Control via Telephone
- Emergency Keyboard Lighting
- Slim-line Design for Small-Footprint CPUs
- Both Visual and Audio Power Failure Signals
- UPS Monitoring Interface (PS6.0 and PS8.0)
- Full One Year Warranty
- Novell Labs Tested and Approved
- UL Listed, CSA and FCC approved

UNISON

Zero Transfer Time Uninterruptible Power Supplies

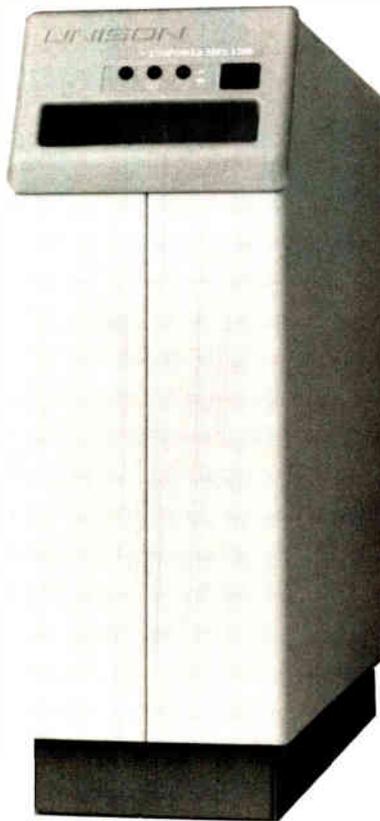
Total Reliability

for larger workstations, multiple servers, and multiple user systems

UNIX/XENIX systems, high-end workstations and file servers are sensitive to power fluctuations. A 25 MHz 80386-based machine can execute as many as 2.5 million unprotected instructions during a single dip too short to notice.

The MPS1200 and MPS1500 deliver 1200VA and 1500VA of Zero Transfer Time, on-line power protection. Surges, spikes, brown-outs, blackouts and noise cannot affect your system because power is continuously regulated and conditioned.

Data is too valuable to risk losing—and the MPS Series is the best way to provide low-cost on-line protection for your critical application workstations and network file servers.



Advanced technology has made the UniPower MPS half the size of comparable continuous power systems.

SPECIFICATIONS

	MPS1200	MPS1500
Input Voltage	120V+10%/-17%	120V+10%/-17%
Output Voltage	115V±5%	115V±5%
Output Frequency	60Hz±0.5	60Hz±0.5
Output Waveform	Sine Wave	Sine Wave
Output Power	1200VA / 840W	1500VA / 1050W
Weight	56 lbs	61 lbs
Transfer Time	None	None
Support Time (286/386)	60 min	70 min
Half Load	22 min	22 min
Full Load	10 min	10 min
Cable & Interface Options	UNIX/XENIX, Novell, Banyan, 3Com, Altos	
Certification	UL, FCC, CSA, Novell, IEEE-587	
Support Products	VAP, NLM, UPS Software Interface for Novell UPS Monitor Board for Novell UNIX/XENIX Interface Software	

FEATURES

- On-line Continuous Power, Zero Transfer Time UPS
- Fully Regulated Output
- Low Output Distortion
- Input Power Factor Correction
- Dynamic Bypass
- Excellent startup capability without bypass
- Pure Sine Wave Output
- Remote Control via Telephone
- Both Visual and Audio Power Failure Signals
- UPS Monitoring Interface
- Full One Year Warranty
- UL, CSA and FCC

UniPower[®]
MPS Series
U P S

800-345-9299

UNISON
TECHNOLOGIES, INC.
23456 Madero, Mission Viejo, CA 92691

UNIX is a registered trademark of AT&T. XENIX is a registered trademark of Microsoft.

Circle 545 on Reader Service Card (RESELLERS: 546)

POWER PROTECTION



"Every file server should be protected by an on-line UPS. Standby power systems have several inherent drawbacks."

- Novell System Reliability Report © 1988

UNISON
TECHNOLOGIES, INC.

as the headquarters for a distributed application.

Jonathan Sachs: But what's happening, interestingly, even now, [is that] the hardware technology is already pretty firmly in the next generation beyond what anyone is using in PCs now, with some of the RISC chips and Intel i860 and MIPS and Motorola 96002. None of these chips will run any of the existing software that we have now. If this were 1980, then those chips might very well form the backbone of PCs going forward. But this is 1990, and there are 10 years of 68000s and 8086s out there, and an applications buffer that's built up, and operating systems and everything else. I think we are getting into a situation where the hardware is going to get pretty far out in front of the software—much more than it is now.

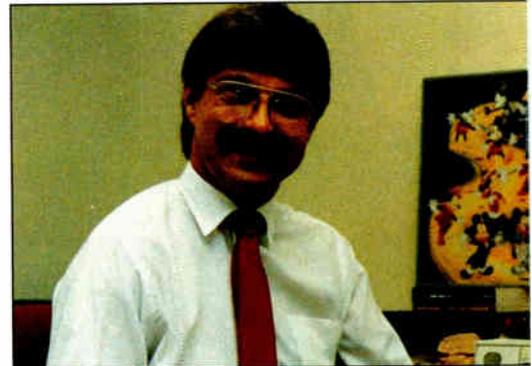
Rod Canion: I think what we're seeing now is the hardware changing at such a rapid pace that we're going to be in an era where software is the pacing item for some period of time. I just think that operating

systems, Windows 3, OS/2 for the 386, and the applications that take advantage of those—those are going to be years in the making, and the hardware is going to continue advancing at a rapid rate in the meantime. So, we're going to see hardware out in front of software for quite a while.

David Evans: Well, we do know some little things. We know that some of the things we have done in software are simply too slow, too weak, or whatever. It's a moving boundary, and these functions perform, and you have to decide how to do it. The tools that are being used for designing chips, for example, are very much patterned after the software tools.

Tony Hoare: We will see quite clearly that the same kind of errors and confusions that arise in the software field could very easily be reproduced in the hardware development field when the complexity of the hardware begins to rival that of the software.

Gordon Bell: I guess I don't see much of a
continued



Steve Leininger is president of *Adaptive Plus*. He was the inventor of the TRS-80 and chief architect of Tandy's Model II, Model III, and Color Computer. He is also involved in the Center for Computer Assistance to the Disabled.

This is as low as fax gets: \$195

\$195 9600-bps PC fax board! Wow!

New money-saver: Voice and fax on one line. Retrieve your new faxes from any fax machine in the world!

Put the Frecom FAX96 in your PC and get high speed 9600 bps performance that's fully compatible with Group III fax machines. Send faxes quickly. Receive faxes even while you're doing something else on your PC.

It's Revolutionary! Now you will have over 12 million remote printers for your PC!

You have total control.

Read incoming faxes on your monitor before you decide to print, save or junk them.

Feature package includes:

- automatic redial
- automated phone directory
- broadcast and timed send
- the world's simplest, easiest-to-use software
- multiple file send

Installation is quick and easy. So to start faxing from your PC, just call, have your VISA or MasterCard ready, and we'll ship you a Frecom FAX96 complete with a **100% money-back guarantee**. For \$195!

Available Now! The Hottest New Product in Fax Boards!

Frecom 1-Liner[®]: Save hundreds of dollars every year. Put fax, telephone and answering machine on a single phone line. Eliminate fax-switch boxes forever! With **FarFetch Fax** fetch your important faxes from any other fax machine in the world. Includes FAX96.

Only \$295

The Best Buy!

Order phone: 415-438-5000

Dealer inquiries: 415-438-5016

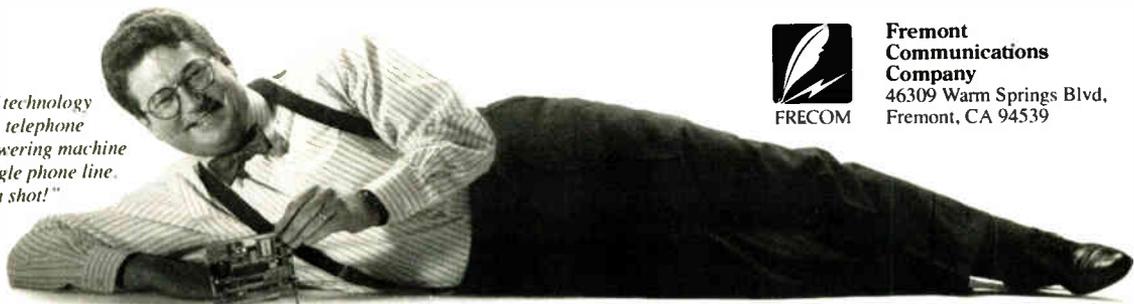
FAX: 415-490-2315

*Patent applied for.



Fremont Communications Company
46309 Warm Springs Blvd,
Fremont, CA 94539

"A lot of technology gets fax, telephone and answering machine on a single phone line. Give it a shot!"



Paul Masters, UC Berkeley MBA and Northern Telcom alum, is President of Fremont Communications



Rich Malloy is editor in chief of *BYTEWEEK*, a newsletter covering the personal computer industry, and associate managing editor of *BYTE*, where he directs the news department.

The biggest barrier

is resistance to change.

—Alan Kay

change. I think software people have gotten really quite independent of hardware at this point, and they are off in their world. And the bulk of the software is not going to change much at all, to sort of buffet where there's a lot of change required when you work on these parallel machines. Why, then there is some interaction. You need that separation so that they can both evolve quite independently.

Doug Engelbart: I think [software's] going to get more and more important.

Carma McClure (see page 292): Yes, I think software is going to start catching up,

and I think there are lots of reasons for that. First of all, CASE brought it on and started the whole thing, and now, we have hardware vendors interested in developing software tools, and so we have the momentum, the money, the recognition, and the technology that we never had before to support it. Also, artificial intelligence techniques are now a little easier and more practical to use and embed in our tools. So I think you are going to see some changes, but first of all, we have to attack the integration problems, building integrated tool environments, and an important segment of that is the issue surrounding repositories.

Brian Kernighan: I think that in some ways the thing that's likely to change computing is somebody's got a better software idea. For example, you couldn't have windows on your screen very effectively until you had a fairly high-resolution screen, and then you could start to think about windows. And you couldn't utilize things until you had enough memory, and so it's clear that the hardware and the software drive each other. ■

R. MALLOY PHOTO: DAWN MATTHEWS

Mail smarter and save money on your PC using the One-Two Power Punch

ArcList[®]—your first punch—lets you professionally manage your list on your IBM or compatible PC with 640K RAM and a hard disk.

SAVE MONEY:

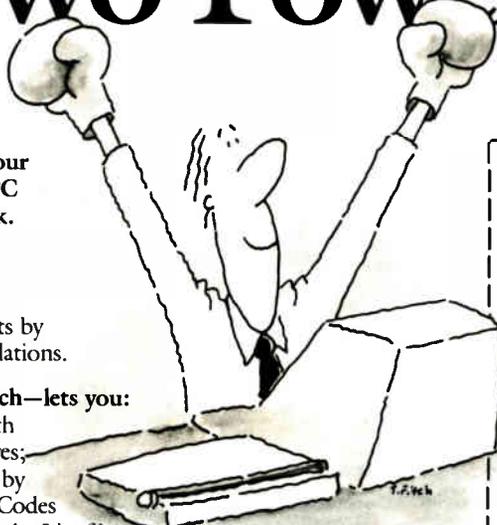
- eliminate duplicates from dBase[®], ASCII or ArcList files;
- take advantage of postal discounts by presorting according to USPS regulations.

AccuMail[™]—your second punch—lets you:

- easily knockout undeliverables with automatic address correction features;
- quickly knock down postal costs by inserting carrier route and ZIP+4 Codes into your existing dBase, ASCII or ArcList files.

Find out more about *ArcList* and *AccuMail*! For a FREE copy of "How to Manage Your Mailing List" call 1-800-368-5806 or write:

Group 1 Software, Inc.
Washington Capital Office Park
6404 Ivy Lane, Dept. P-BR70
Greenbelt, Maryland 20770-1400



Please rush me a FREE copy of "How to Manage Your Mailing List."

I'm ready to see ArcList and AccuMail in action. Please contact me at once.

Name _____

Title _____

Organization _____

Street _____

City _____

State _____ Zip _____

Telephone (____) _____

©1989 Group 1 Software, Inc.

GROUP 1[®]
GROUP 1 SOFTWARE

The Direct Marketing Software Company

P-BY90

Call for the dealer nearest you.

IT'S NICE TO KNOW WHEN

10 GATEWAY 386SX

- 2 Megs RAM
- 1.2 Meg 5.25" Drive
- 1.44 Meg 3.5" Drive
- 65 Meg 28ms RLL Drive
- 16 Bit VGA with 512K
- 14" 1024 x 768 Color Monitor
- 1 Parallel & 2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.01
- MS WINDOWS 3.0

\$2195.00

J 20MHZ 386VGA

- 4 Megs RAM
- 1.2 Meg 5.25" Drive
- 1.44 Meg 3.5" Drive
- 65 Meg 28ms RLL Drive
- 16 Bit VGA with 512K
- 14" 1024 x 768 Color Monitor
- 1 Parallel & 2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.01
- MS WINDOWS 3.0

\$2595.00

Q 25MHZ 386CACHE

- 4 Megs RAM
- 1.2 Meg 5.25" Drive
- 1.44 Meg 3.5" Drive
- 110 Meg ESDI Drive
- ESDI Cache Controller
- 16 Bit VGA with 512K
- 14" 1024 x 768 Color Monitor
- 1 Parallel & 2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.01
- MS WINDOWS 3.0

\$3495.00

K 33MHZ 386VGA

- 64K Cache RAM
- 4 Megs RAM
- 1.2 Meg 5.25" Drive
- 1.44 Meg 3.5" Drive
- 150 Meg ESDI Drive
- ESDI Cache Controller
- 16 Bit VGA with 512K
- 14" 1024 x 768 Color Monitor
- 1 Parallel & 2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.01
- MS WINDOWS 3.0

A 25MHZ 486VGA

- 4 Megs RAM
- 1.2 Meg 5.25" Drive
- 1.44 Meg 3.5" Drive
- 150 Meg ESDI Drive
- ESDI Cache Controller
- 16 Bit VGA with 512K
- 14" 1024 x 768 Color Monitor
- 1 Parallel & 2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.01
- MS WINDOWS 3.0

Being in the market for a new computer system is like being a spectator at a high stakes poker game. You're trying to pick the winner from the manufacturers gathered 'round the table. They're all betting as if they held five aces. So how do you tell who's bluffin' and who's got the winning hand?

Take a look at Gateway 2000's cards. Our royal flush consists of five fully-loaded, high performance machines (plus a 12MHZ 286 that wouldn't fit in our hand) at better prices than the competition's stripped-down models. For price, quality and service, Gateway 2000 has an unbeatable combination. Call Gateway 2000 and you're the winner. No bluffin'!



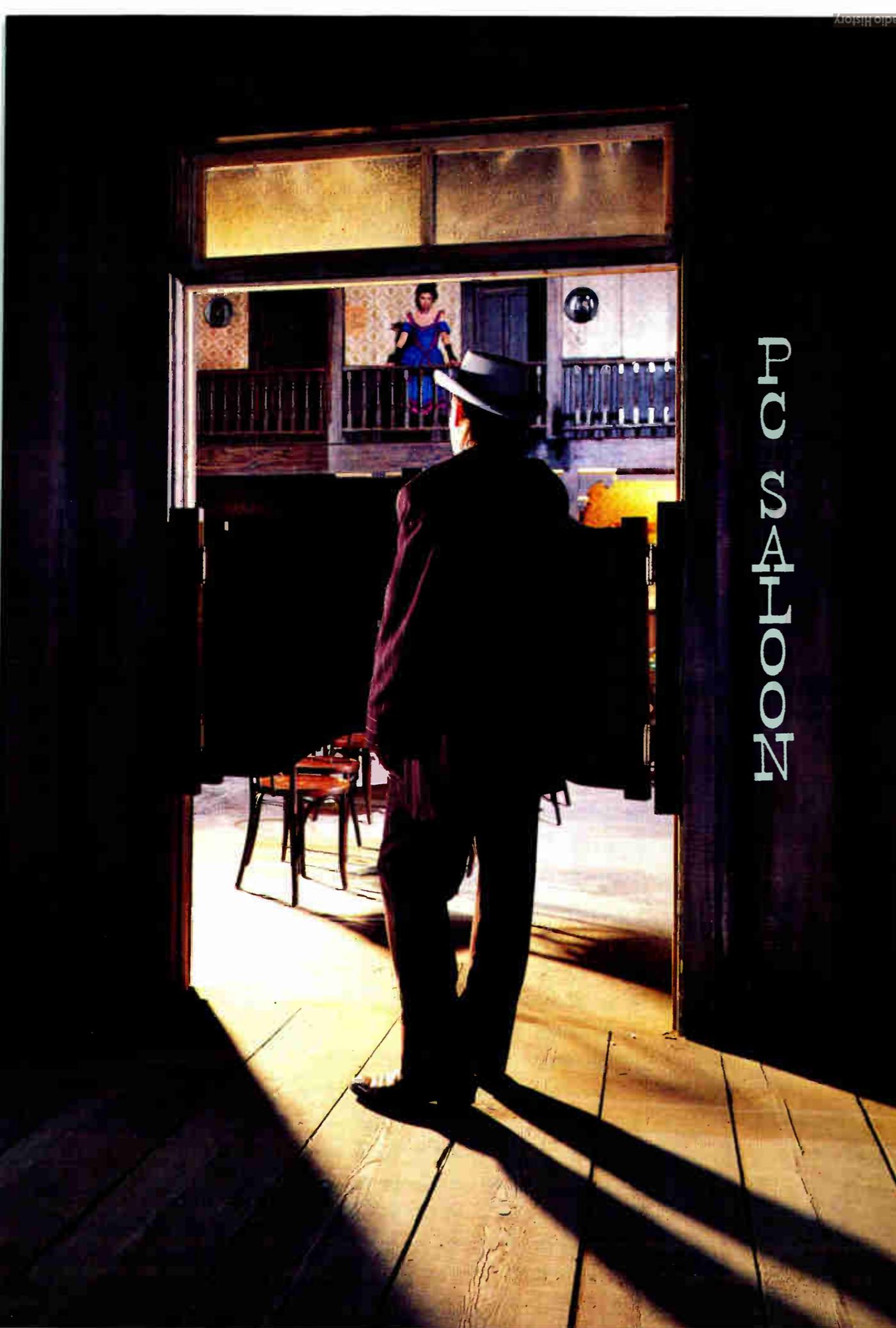
"You've got a friend in the business."

8 0 0 - 5 2 3 - 2 0 0 0

610 Gateway Drive • North Sioux City, South Dakota 57049 • Telephone 605-232-2000 • Fax 605-232-2023
Due to the volatility of the DRAM market, all prices subject to change

IN THE HIGH STAKES GAME OF

NOON SAHOON



HAVE A WINNING HAND!



World Radio History

PERSONAL COMPUTERS...

Now With
WINDOWS 3.0



GATEWAY 2000'S STANDARD FEATURES AND SERVICES

TWO DISKETTE DRIVES

Gateway 2000 machines come standard with both a 5.25" 1.2 Meg Floppy Drive and a 3.5" 1.44 Meg Diskette Drive.

AMPLE HARD DISK SPACE

Our systems come standard with high capacity/high speed hard disk drives and controllers.

TWO MEGS RAM—MINIMUM

Gateway 2000 systems are loaded with RAM—2 Megs standard for 286 and 386SX systems, and 4 Megs standard for 386 and 486 machines.

HIGH RES COLOR GRAPHICS

All Gateway 2000 systems come with a standard 1024x768 VGA display.

CUSTOM CONFIGURATIONS

If our standard configurations don't fit your needs, we'll be happy to custom configure a system just for you.

GUARANTEE

Thirty-day money back guarantee.

WARRANTY

All Gateway 2000 systems come with a one-year warranty on parts and labor.

TECHNICAL SUPPORT

For the life of your machine, you can call our technical support staff toll-free for expert assistance.

OVERNIGHT PARTS

If a part must be replaced, you'll have it overnight via Federal Express free of charge.

BULLETIN BOARD

Gateway 2000 owners have access to bulletin board technical support.

FREE ON-SITE SERVICE

If unusual difficulties arise, we provide free on-site service to most locations in the country.



"You've got a friend in the business."

8 0 0 - 5 2 3 - 2 0 0 0

610 Gateway Drive • North Sioux City, South Dakota 57049 • Telephone 605-232-2000 • Fax 605-232-2023

YOU HAVE A WINNING HAND!

Wolfs Radio History



PERSONAL COMPUTERS...

Now With
WINDOWS 3.0



GATEWAY 2000'S STANDARD FEATURES AND SERVICES

TWO DISKETTE DRIVES

Gateway 2000 machines come standard with both a 5.25" 1.2 Meg Floppy Drive and a 3.5" 1.44 Meg Diskette Drive.

AMPLE HARD DISK SPACE

Our systems come standard with high capacity/high speed hard disk drives and controllers.

TWO MEGS RAM—MINIMUM

Gateway 2000 systems are loaded with RAM—2 Megs standard for 286 and 386SX systems, and 4 Megs standard for 386 and 486 machines.

HIGH RES COLOR GRAPHICS

All Gateway 2000 systems come with a standard 1024x768 VGA display.

CUSTOM CONFIGURATIONS

If our standard configurations don't fit your needs, we'll be happy to custom configure a system just for you.

GUARANTEE

Thirty-day money back guarantee.

WARRANTY

All Gateway 2000 systems come with a one-year warranty on parts and labor.

TECHNICAL SUPPORT

For the life of your machine, you can call our technical support staff toll-free for expert assistance.

OVERNIGHT PARTS

If a part must be replaced, you'll have it overnight via Federal Express free of charge.

BULLETIN BOARD

Gateway 2000 owners have access to bulletin board technical support.

FREE ON-SITE SERVICE

If unusual difficulties arise, we provide free on-site service to most locations in the country.



"You've got a friend in the business."

8 0 0 - 5 2 3 - 2 0 0 0

610 Gateway Drive • North Sioux City, South Dakota 57049 • Telephone 605-232-2000 • Fax 605-232-2023

Alvy Ray Smith:

On Graphics in the 1990s

What does it mean to be able to talk with pictures, instead of words? I think that's what people want to do. I think it's the natural form, the widest bandwidth implementation. So far, computers have been highly constrained in making pictures. The reason they have been highly constrained is real simple: They just haven't had the horsepower. The revolution that is happening, starting now, will be wide open by the year 2000 when that horsepower has finally arrived on the desktop. This is easy for me to see, the year 2000—all the professional-quality images we'll be handing each other, as casually as we hand PostScript-printed black-and-white pages to each other today.

What has to be put in place is the story of the nineties. PostScript is a good example of a piece of the infrastructure of computing that got put in place to handle black-and-white, geometry-based picture making. What remains to be put in place? Well, there has to be a 3-D, full-color infrastructure put in place. Of course, Pixar's RenderMan is a piece of that infrastructure. [It is] to color and 3-D what PostScript is to black and white and 2-D. And that's on the geometry side of things. And somewhere another piece of infrastructure that is going to be put in place is the color standard, so that people can wheel and deal color and get the same color out on all the different output devices that exist now, and will exist in the year 2000. It's a very difficult problem, but it will be solved within the next few years. That will be in place by the year 2000. (When I say infrastructure—I guess that's an OK word—what I mean by that is what you get on your desktop when you buy a machine, stuff that's as-

sumed to be there, that you don't have to go out and buy—part of the basic stuff that you buy when you buy a computer in the year 2000.)

When I look at the desktop marketplace right now, the big gaping hole of applications, the big missing set of applications, are those that deal with color. And I mean real color. Photography, color printing, full-color presentations, video production, full multimedia production, film production, [and so forth]. I think a lot sooner than 2000, but they will be strongly in place.

It's hard to see it right now. It is still fairly difficult to do full-color pictures, single pictures, but when you have 1000 MIPS—wow! You can start doing real-time image rotations. I don't mean simple, several-thousand-line polygon images, I mean several million sample-point—full-color, each sample point. You'll be able to rotate those things, drawing into perspective, or rescale them without loss of quality in real time.

I've seen all the work, but I still can't believe we'll be able to do that in no time on our desktop computer software by the year 2000. But that's what we'll be able to do. So, it will be easy to do pictures, movies. That's what I'm trying to say, that those things will all be possible by the year 2000. What is hard to predict is how that's going to change how we deal with each other. I think it is going to have a massive impact on everything.

The key thing—concept—that will describe how people will deal with pictures is spatial editing. What does that mean? What we mean by the word *editing* in film and video is the placement of segments of film or video in time. An

artist called an editor comes in and arranges the sequences in time. [The] big change in the next decade will be that the same freedom will be granted, hopefully, to arrange things in the space of a picture.

I don't know if you have ever tried to model a 3-D picture, but it's very hard. So, one of the class of applications that there is going to be a lot of [is] modelers. But I think what is going to happen [is,] instead of handing people over the modeling process, we'll hand over models to them. In other words, the marketplace will be catalogs of premodeled objects or prescribed textures. Instead of me, as the user, having to sit down—I've got this desk in front of me, my books, telephone, paper—instead of having to model each one of those things in order to [create] a picture of it, I would just take the catalog, an electronic catalog, off the shelf here, plug it into my desktop computer, and pick off that particular lamp and that particular set of books. The stuff is already done. I, as a spatial editor, can go in and place those objects in my [rendering] at my discretion. I can change their relative sizes, and I can change the colors maybe, and I can map different appearances onto their surfaces, customize their look. But my job as a picture maker will be more like editing than constructing.

I'm just convinced that that's the future that we'll see unfold here. What I am describing is the RGB full-color marketplace of the nineties. There will be a host of companies that are required to make products available to fill this market up.

Editor's note:
See biography, page 352.

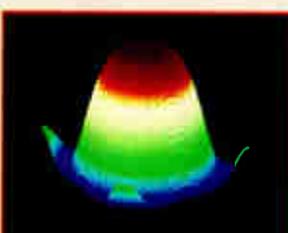
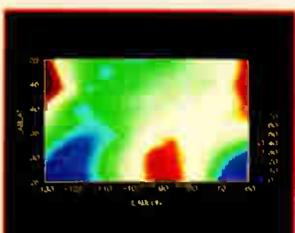
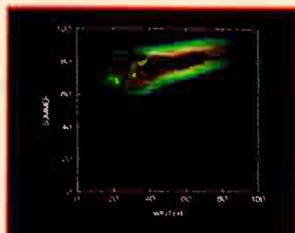
The best got better.

SYSTAT 5.0's new menus make the top-rated statistical program even easier to use.



v 4.1

SYSTAT is the *only* package to receive these three awards.



New Features Menus or commands — your choice • Rewritten documentation includes statistics tutorials • Fast, built-in drivers for SYGRAPH • Global mapping and many new plots • Multi way repeated measures • Means model for missing cells designs • Post-hoc tests • Interactive stepwise regression.

Statistics Basic statistics, frequencies, *t*-tests, post-hoc tests • Multi way crosstabs with log-linear modeling, association coefficients, PRE statistics, Mantel-Haenszel, asymptotic standard errors • Nonparametric statistics (sign. runs, Wilcoxon, Kruskal-Wallis, Friedman two-way ANOVA, Mann-Whitney U, Kolmogorov-Smirnov, Lilliefors, Kendall coefficient of concordance) • Pairwise/listwise deletion of missing values, Pearson correlation, SSCP, covariance, Spearman, Gamma, Kendall Tau, Euclidean distances, binary similarities • Linear, polynomial, multiple, stepwise, weighted regression with extended diagnostics • Multivariate general linear model includes multi way ANOVA, ANCOVA, MANOVA, repeated measures, canonical correlation • Principal components, factor analysis, rotations, components scores • Multidimensional scaling • Multiple and canonical discriminant analysis, Bayesian classification • Cluster analysis (hierarchical, single, average, complete, median, centroid linkage, k-means, cases, variables) • Time series (smoothers, exponential smoothing, seasonal and nonseasonal ARIMA, ACF, PACF, CCF, transformations, Fourier analysis) • Nonlinear estimation (nonlinear regression, maximum likelihood estimation, and more).

Graphics Overlay plots • Drivers for most graphics devices • *Two-dimensional:* Error bars • Scatterplots • Line and vector graphs • Vector, dot, bubble and quantile plots • Bar graphs (single, multiple, stacked, range) • Box plots (single and grouped) • Stem-and-leaf diagrams • Linear, quadratic, step, spline, polynomial, LOWESS, exponential smoothing • Confidence intervals and ellipses (any alpha value) • Smooth mathematical functions • Rectangular or polar coordinates • Log and power scales • ANOVA interaction plots • Histograms (regular, cumulative, fuzzy) • Stripe and jitter plots • Gaussian histogram smoothing • Scatterplot matrices • Voronoi

tesselations • Minimum spanning tree • Maps with geographic projections (U.S. state boundary file included, county and world boundary files available) • Chernoff faces • Star plots • Fourier plots • Pie charts • Contour plots on regularly and irregularly spaced points • Control charts and limits • *Three-dimensional:* Data plots • Smooth function plots • Vector plots • Linear, quadratic, spline, least squares surface smoothing • Typefaces that print in perspective.

Data Management Import/export Lotus, dBase, and DIF files • Full screen data editor • Full screen text editor • Unlimited cases • Missing data, arrays, character variables • Capability to process hierarchical, rectangular or triangular files, irregular length records • Character, numeric, and nested sorts • Merge and append large files • Unlimited numeric and character variable transformations • Subgroup processing with SELECT and BY • Value labels and RECODE statements • Macro processor with programming language, screen control, file manipulation, applications generation, and report writing.

SYSTAT operates on IBM PC's® and compatibles, MS-DOS®, VAX®/Microvax and Macintosh®. Site licenses, quantity prices and training seminars available. No fees for technical support.



SYSTAT. Intelligent software.

For more information call or write: SYSTAT, Inc. 1800 Sherman Avenue, Evanston, Illinois 60201-3793 Tel: 708.864.5670 Fax: 708.492.3567
For international representatives call: **Australia** 61.3.4974755, **Canada** 416.424.1700, **Finland** 358.0.6923800, **France** 33.1.40935000,
Germany 49.61.265950, **Italy** 39.587.213640, **Japan** 81.3.5902311, **New Zealand** 64.71.562675, **Norway** 47.3.892240, **Sweden** 46.8.110620,
Switzerland 41.31.416611, **The Netherlands** 31.3402.66336, **UK:** Letchworth 44.462.482822, London 44.81.6926636, London SE 44.0753.841686

Circle 538 on Reader Service Card



THE BYTE SUMMIT

POWER PLAYS

What do you think of the reassertion of power by data-processing and MIS departments?

People say that standards stifle innovation, and in communications, that's not true. Standards enable communications.

—John Warnock

Stewart Alsop: It infuriates me. Somehow, the notion goes, in order to implement these new technologies that have multimedia and effective networking and groupware and host connectivity and buzzword, buzzword, buzzword, we have to have more complex computer systems. And if we're going to have complex computer systems, then we have to get DP and MIS back into the loop, because they understand this stuff, and those "poor dumb users" don't. And the "poor dumb users" are going to screw up the computers. So we need DP and MIS to protect the computers from those "poor dumb end users." And it's like, what year is this? Back to the Future, Part 15.

Steve Leininger: To me, I think some of that control is just sort of natural. I don't think people who've been in charge of just the small microclusters or the stand-alones have been necessarily responsive to the needs of a much greater organization. So, I guess I think it's OK.

Jerry Pournelle: It's negative, and it won't happen. It won't last. You may remember that Pournelle's Law [is] one user, at least one computer. That was Pournelle's First Law.

Jim Blinn: One of the nice things I find about the PC environment, one of my fundamental philosophies of life, is [that] I don't like concentrations of power—anywhere, for any purpose. And the fact [that] the PCs are very generic and spread the power out, I think is good. Any sort of organization that tries to coalesce it in one place, I'm not too happy about.

Jonathan Titus: You know, maybe I'm completely wrong. Maybe the idea of bigger servers is the way things are going to go, but I think if you look at things traditionally, you find that large things tend to fragment rather than to coalesce. I think that's what will happen with the large concentrations of computer power within companies.

Tom McWilliams: I think that there is a very strong role for larger machines to support machines on the desktop. I see the machines on the desktop replacing the tradi-

tional dumb terminal with very intelligent boxes that provide [a] very good user interface and do local computing for jobs that sit on those machines.

John Markoff: In my company, I really see the struggle going on. There's a tremendous amount of tension that's a direct consequence of this sort of clash of the mainframe view of the world versus the desktop view. And clearly, one of the consequences of networks is that there will be a reassertion of centralized control. But I think that there are certain aspects to personal computer technology that are just genies out of the bottle and they're never going to be able to put it back. There are some companies now, there seems to be a trend to actually do away with MIS: Some places here in NYC, there are no more MIS departments. Some companies in the Valley have done away with mainframes and are going to entirely distributed computing models. There's more freedom.

Bill Stallings: I think there is a flavor of trying to hold all the strands together from a central location so that you have cooperative computing—but, at the same time, not centralizing procurement or even all the ownership of data, because that tends to inhibit things, and particularly in the micro area. [You need a] true distributed system that is integrated. There's sort of a tension there of trying to balance central planning and central integration—distributed cooperation—and the thing that allows this sort of a balancing act is the standards.

Jonathan Titus: Well, I think we're seeing, these days, actually a fragmentation of service departments like that. And we'll continue to see it. I think the reemergence has come only because we're finding we need network servers, and the network servers tend to be controlled by the MIS departments because they're a big box and they're connected into a lot of different places.

BYTE: *How do you think it will affect the microcomputer users and their companies?*

Terry Winograd: Stand-alone computing
continued



Jim P. Manzi is president and CEO of Lotus Development Corp., where he directs corporate strategy and the overall operation of the company.



John Markoff is a reporter for the *New York Times*, where he covers computers and technology. Markoff has also been a West Coast technical editor for *BYTE*.



Carma L. McClure is an independent author, lecturer, and consultant specializing in software methodologies, tools, and law and project management. She is a leading authority on CASE.

will get more limited. I think networking is inevitable.

Steve Leininger: As long as you don't hook yourself onto the network, you're OK.

Tom McWilliams: I don't actually see that larger central machines are at odds with machines on desktops. I think that you need both.

Dennis Ritchie: One of the aspects of any kind of PC, using it as the generic term, is that this is a box that you own. You may not understand everything that goes on inside it, but, in some sense, you have control over it. Whereas, if you're dealing with a computer center or an MIS department, there's a definite lack of control. The other side of that is that as systems get more sophisticated, the amount of work involved just to do your own administration is increasing, and things are getting more complicated. They're getting harder to understand. You have to understand more in order to use them effectively.

Jonathan Titus: I hope it has as little effect on the end user as possible. In effect, they may not even know where their server is, or specifically what's in it. And I think, too, that the computers will become so powerful that the idea of a central server may, in fact, disappear. It may be, with all these computers linked together, one is a controller but bits and pieces of what I'm working on may be stored across a lot of the different systems in the network.

Tony Hoare: I think it's a sad step because, again, it gives you an advice and consultancy bottleneck where people can't do what they want until they can get the attention of an expert who will tell them how they can do it. The promising sign for the personal computer is that people can develop their own application and then perhaps integrate later as the need for it becomes apparent. And that has tended, I think, to break down the centralized power structure of data-processing departments, which can be a significant barrier to progress—particularly when, in these very progressive times, things are changing so rapidly.

Jim Manzi: But fundamentally, all [that the users] want to do is get data, do something with the data, share it with somebody, and send it off, and get it updated. And a forward-thinking IS manager wants the same thing to happen, because the concept of end-user computing is obviously proven. I view it less as a conflict and more

as a conversion.

Ken Olsen: Oh, I think it's very good and very important. Having a bunch of people using their own microcomputers is obviously unwise if they do the wrong thing. And they have no communication with the world. The things you do most of the times in the office involve everybody else. Almost anything you do should be integrated.

Dick Pick: It's going to have to come. The point is, if you're going to run an organization that uses computers, you've got to have some centralization to it. I have the same problem. I've got the equivalent of an MIS department, [but] it's only one person. You've got to have somebody who takes ownership of the corporate database, and that traditionally has been the MIS department. I don't see how else they're going to tie all these PCs back together into a corporate tool as opposed to a personal tool.

Steve Leininger: What made the personal computer great is the apparent speed of having all that horsepower dedicated just to you, for word processing or other data manipulation. If you're talking about a big company, they can't afford to have the information that runs the company—today's inventory, this kind of stuff—scattered all over the place.

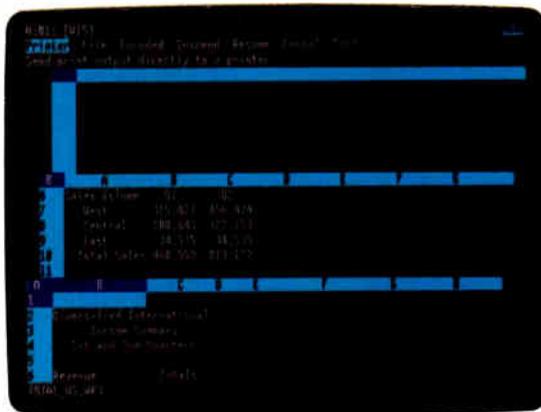
Dick Shaffer: I think it's essential for large organizations. As the computer becomes more important to companies, you have to have some kind of control over it.

Charles Simonyi: Actually, I think that it is a good thing. I think what really is happening is the embracing of the computer by the MIS people as more than a control. You can't control the personal use of computers. I don't think there is any issue there.

BYTE: *Is this a positive move or a negative one?*

Gordon Bell: It's only negative if it starts impeding things. I don't think it's going to do that. I don't think they can. There's no way that they can get in the way of progress. I mean, just maintaining the network I don't think is any more harmful than the fact that in every company you have a telephone czar taking care of the telephone. I don't see that as any different. What gets harmful is when you rule out certain kinds of machines.

Paul Carroll: It has positive and negative
continued



*According to Lotus' technical support, you cannot view a graph while in perspective mode in 1-2-3.

Borland's Quattro Pro vs. Lotus' 1-2-3®

Quattro Pro is radically different from Lotus' 1-2-3.* Even if you use Quattro Pro's menu builder and load the optional 1-2-3.MU demo file as shown above.

More than 300,000 spreadsheet users have now switched to Quattro Pro. They prefer its innovative features, including advanced graphics with slide show capabilities, complete drawing program, mouse support, linear programming, huge spreadsheet capacity afforded by its unique VROOMM™ technology, and its ability to read existing 1-2-3 files. And much more.

Quattro Pro has won every significant "best spreadsheet" award and product review to date:

Quattro Pro Awards

- Technical Excellence Award
1989—*PC Magazine*
- Spreadsheet Product of the Year
1989—*InfoWorld*
- Software Product of the Year
1989—*InfoWorld*
- Top-rated, High-End PC Spreadsheet Review
1990—*InfoWorld*
- Most Valuable Product (MVP)
1989—*PC Computing*
- Award of Distinction
1989—*BYTE*
- Best Buy & Top-Rated Spreadsheet
1990—*PC World*
- 1989 Software Product of the Year
PC User (UK)
- High-End Spreadsheet Editor's Choice
1990—*PC Magazine*
- Best Numeric Business Application Award
1989—*Software Publishers' Association*
- Top-rated, Consolidation Spreadsheet Review
1990—*PC Week*
- Readers' VIP Award, Spreadsheet Category
1990—*BYTE (tied for first)*

At Borland, we believe in software craftsmanship and are fighting for your access to *real* innovation.

*Quattro Pro's default menu structure is CUA- and SAA-compatible like most of the new software that you'll buy in the '90s. Thanks to Borland's revolutionary VROOMM technology, Quattro Pro sports a modern graphical user interface and runs on today's hardware.

Judge for yourself

If one screen isn't enough, compare the rest of them.

That's why we're offering Quattro Pro to any 1-2-3 user** for only \$99⁹⁵.

We'll send you the complete package (regularly \$495⁹⁵) with our customary 60-Day, Money-Back guarantee. We'll even bill you later if you'd prefer.

Order your own copy now and judge for yourself.

Call NOW 1-800-331-0877.

Also available at participating software dealers, or by mailing this coupon to:

Borland Quattro Pro Offer
1800 Green Hills Road
Scotts Valley, CA 95067

YES, send me Quattro Pro for only \$99⁹⁵!† I'd like to see for myself the product that Lotus is so worried about.

Format: 3½" disk 5¼" disk
Payment: Bill me Check enclosed
 Amex Visa MC
_____ Exp. _____

Name: _____
Company: _____
Address: _____
City: _____
State: _____ Zip: _____

**Proof of ownership—an original manual page or disk—is required. Offer good in United States and Canada only. †Suggested retail price. ‡Add \$5⁹⁵ shipping & handling plus local taxes where applicable.

Code: MQ83

B O R L A N D

Makers of Paradox®, Quattro® Pro, Turbo C® ++, Turbo Pascal® and SideKick®.

Quattro Pro, Paradox, Lotus, C, Turbo Pascal, and SideKick are registered trademarks and VROOMM is a trademark of Borland International, Inc. Lotus 1-2-3 is a trademark of Lotus Development Corp. Copyright © 1990 Borland International, Inc. All rights reserved. BI 1300.

Circle 463 on Reader Service Card (RESELLERS: 464)

World Radio History



Thomas M. McWilliams is a vice president at *Amdahl Corp.* He is a pioneer in the design and development of computer-aided engineering systems.

attributes. It's very important for companies to be able to hook all these machines together in a network, and somebody's got to do it, so it might as well be the MIS types. More and more, the business types will become involved in the development of applications for their computers and in the use of the computers. And I view that as very much a positive development.

Doug Engelbart: Somebody in the organization needs to start being responsible for the larger system, of harnessing the capabilities of this. So, if not the DP/MIS people, who?

Lee Felsenstein: [I agree.] Somebody has to take that role. It would be nice to develop networks that can be self-managing. That, in microcosm, is really the problem [that] we've got with industrial society as a whole: working out those technologies—using a broad sense of technology—through the operation of which it becomes sort of natural as to how to organize things.

Ted Nelson: Corporations legitimately



contend that the

purpose of computers is

human freedom.

—*Ted Nelson*

want to standardize and regulate, in a sensible fashion, the use of personal computers and especially databases throughout their corporations. However, more illicitly, what is also happening is that data-processing managers are fighting back, trying to recapture lost territory; trying to keep the mainframe necessary is the hub of this, and trying to become the sovereigns once again. This is quite unfortunate, and I don't think it will be that sweeping. But who knows

continued

Neural Networks are Solving Real Problems

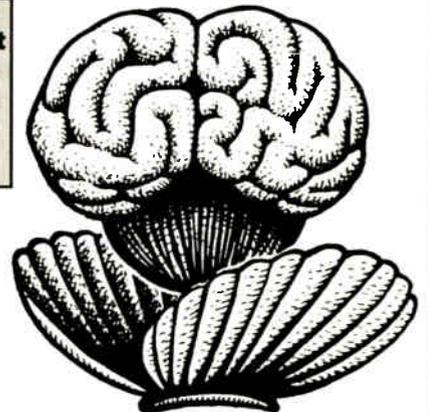
Circuit board problem diagnosis • Psychiatric evaluations • Stock market predictions • Sales forecasts • Oil exploration • Optimizing biological experiment results • Price forecasts • Analysis of medical tests • Optimizing scheduled machine maintenance • Predicting student performance • Horse racing picks • Factory and shop problem analysis • Optimizing raw material orders • Spectral analysis • Selection of criminal investigation targets • Employee selection • Process control • Product quality control and much, much more.

Since *NeuroShell* learns by example, handles fuzzy logic, can give tight data fits, and doesn't try to capture knowledge in rules, it is also being used as an alternative in many cases to expert systems, the ID3 algorithm, and regression analysis.

Now anyone can use neural networks

NeuroShell is ready to use for real problems on your IBM PC or compatible, and still only \$195. No programming or Ph.D. required! Free telephone assistance (including setting up your problem). Free shipping by mail in US, Canada, and Mexico (\$12 elsewhere). Add 5% tax in MD.

Ward Systems Group, Inc.
245 West Patrick St.
Frederick, MD 21701
(301) 662-7950 FAX (301) 663-6656



NeuroShell™

NeuroShell is a trademark of Ward Systems Group, Inc. IBM PC is a registered trademark of International Business Machines



Sometimes it's just not practical

to run a cable from a computer to a printer.



For those times, there's this.

Meet a genuine breakthrough: the Verran AC Datalink. It lets you connect virtually any computer to a printer. Or a modem. Or a plotter. Or a terminal. All *without cables*. The connection takes place through your building's electrical wiring and works at distances of 300 feet or more.

Think of it. No more torn-up offices, expensive wiring solutions, or cabling headaches. The Verran AC Datalink is the perfect answer for quick connections between computers and peripherals—even if they're in different offices.

The applications are numerous—from office moves to demonstrations to special needs for temporary staff. You can even connect extra terminals to a larger computer without cabling—a feature which can be invaluable when additional programmers come on board.

There's no software required. A pair of AC Datalinks is all you need. Just connect one to your computer and one to a peripheral. Then plug each into a standard electrical outlet. That's it. You're up and running in minutes.



The AC Datalinks take care of everything: error correction, translation when needed, even adaptors for parallel (Centronics) or serial (RS-232) connections. So you can enjoy virtually universal compatibility between computers and peripherals—even use a parallel printer from a serial port! You can also select an encryption code for each pair of AC Datalinks, providing a high level of data security.

And here's another breakthrough from Verran: the AC Datalink DPS (Dedicated Printer Sharer) which allows up to *seven* computers connected to AC Datalinks to share the same printer. It's like having a printer for each computer—at a fraction of the cost.

Status and queuing information is provided by the AC Datalinks, so you'll enjoy more efficient printer use than ever before. The AC Datalink DPS is suitable for any printer with a parallel port.

Want to free yourself from the ties that bind? See your local computer dealer to learn more about Verran AC Datalink products. Or contact GEC-Marconi for more information.

VERRAN AC DATALINK/DPS Cable-Free Computer Connection

From GEC-Marconi Software Systems
Suite 450, 12110 Sunset Hills Road
Reston, Virginia 22090
703-648-1551

Circle 482 on Reader Service Card

AC Datalink just \$345.
AC Datalink DPS just \$395.
(Suggested retail prices.)



Jay Miner designs medical instrumentation for *Ventritex, Inc.* He was principal designer of the Amiga computer and creator of the Amiga custom chip set. He also designed the chip sets for the Atari VCS and the Atari 400 and 800 computers.

J. MINER PHOTO: MEL LINDSTROM

politically? Politically, many different things can happen.

Carma McClure: I think you might find that everybody goes off on their own and then they say "wait a minute, wait a minute. We are stepping on one another's toes here, we're not doing what we should be doing, and so let's get back together and have some sort of control and management." So I think that it will go full circle like that.

Rod Canion: I think it's a necessary thing. What we saw was a pendulum swinging from one extreme to the other, [from] where MIS had all the power to the point where the users themselves had basically almost all the power. The unifying force is the networking of PCs and workstations together [so] that no longer can an individual really take full advantage of his PC by himself. He needs to have other people involved. So you need a group like MIS. I think what we're going to see in the next several years is a medium being reached—a balance being reached between the user

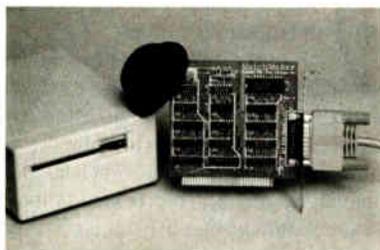
community and MIS working together to solve these problems.

Wayne Ratliff: There are positives and negatives to it. Yes, I do see it happening, and neither side is going to gain control. I don't think. The microcomputer people are the ones who dared move away from the mainframes. And they thought it was an exciting environment. So, we have this little pendulum effect going in the computer business—it will swing back and forth forever probably.

John Warnock: I think all of these sociological changes in the industrial portion of our society go in cycles. There's sort of a centralization, decentralization, centralization, decentralization—and as far as I can see, in the computer business, I've seen about three of these cycles. I don't see any reason to see that stop. You need to have a more global view of this and say, "Hey, that's a behavior of that overall social system and not something that has any long-term effect." You just have to ride the current trend. ■

Read Mac Disks in a PC MatchMaker

— the best way to share data between a PC and a Mac. The **MatchMaker** card lets you plug a Macintosh floppy drive into a PC.



- Easy-to-install half-size card.
- Use any external Macintosh drive.
- DOS-like command software included.
- 1 year warranty, Made in USA.
- Also available; **MatchPoint-PC** to read/write Apple II disks.

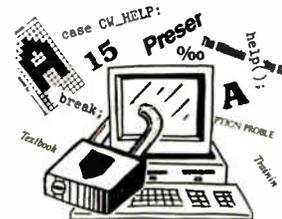
"...by far the most cost effective solution..." *PC WEEK*

MicroSolutions
Computer Products

132 W. Lincoln Hwy.
DeKalb, IL 60115
(815) 756-3411

The Open & Shut Case for MicroGuard Data Protection.

PROTECTS YOUR DATA AT ALL LEVELS.



SHUT

OPEN

to unwanted intruders. **MicroGuard** protects your data at all levels: Access to hardware devices, to software functions and to disk areas. You tailor access precisely to your security needs

to virtually every program on the market. **MicroGuard** is designed specifically for the PC* and compatibles, and is transparent to the user. DOS and applications run freely.

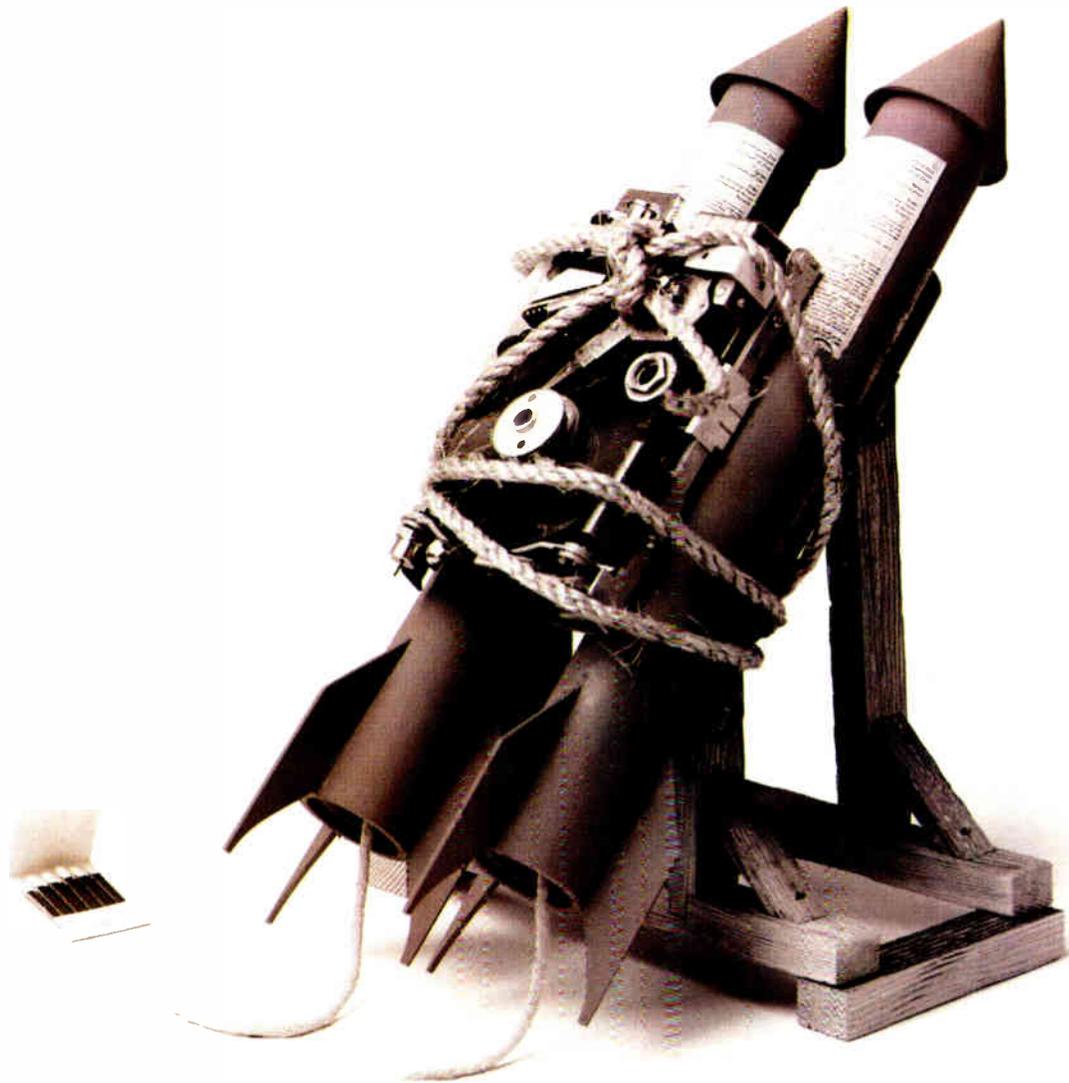
Optimize data protection

If you've ever been afraid a fired worker will damage data... If you know your competitors would love to peek into your files... **MicroGuard** is the answer. In every instance, the savings in time and money are substantial, and often - immeasurable.. Find out more today.

Dealers welcome.

8 Abba Hillel St., Ramat Gan, Israel
Tel. 972-3-7511982 Fax. 972-3-7512304

SPEURITY INDUSTRIES (1989) Ltd.



THE ONLY WAY COMPETITIVE DRIVES CAN GO FASTER THAN 9MS.

With effective access times as low as 9ms, the Plus Impulse® AT® Series, hard disks don't need rockets to fly. They're the perfect match for today's disk-intensive applications.

Impulse isn't only fast, it's affordable. Compare it to any other disk drive in its class and you'll see how competitively priced it is.

Impulse isn't only fast and affordable, it's compatible with all leading 286/386 PCs. And it's available now. In 40, 80, 105, 120, 170 and 210 megabytes (330 and 425MB shipping soon). With integrated IDE-AT or SCSI controllers.

Get in touch with your Impulse reseller today. For more information, call 800-624-5545 in the U.S. and Canada.

Leave the rockets to them. And the flying to Plus.

Plus 



I M P U L S E

© 1990 Plus Development Corp. Plus Impulse and the Plus logo are registered trademarks of Plus Development Corp. AT is a registered trademark of IBM.

Circle 526 on Reader Service Card

Genuine 486™ System... Amazing 386™ PRICE!

Yes, full powered 80486 computer systems with all the traditional Northgate features and performance.

And a price that says "BUY NOW!"

\$5,895⁰⁰

Delivered to Your Home or Office

YOU CAN'T IMAGINE WHAT SPEED REALLY IS until you have Northgate's new Elegance 486 under your fingertips. Feel the power! It delivers everything a 486 should do ... **AND MORE!** Applications—even CAD—appear on the screen almost before you release the keys. Gone is the aggravation of waiting!

Sizzling performance requires the hottest components ... and that's what Northgate delivers.

486 processor combines the capabilities of an enhanced 386, fast 387 math coprocessor, an advanced cache controller and 8K of supporting static cache memory. **Result? Incredible processing speed!**

Now add in Northgate's new proprietary motherboard. Unique design maximizes the power and features of the 486 processor.

And look at this! A Maxtor 200Mb hard drive. Breaks performance barriers with 15MS speed ... yet doesn't make a peep.

Impressed? There's more. 4Mb of RAM (expandable to 16Mb). And 64K of 25NS read/write-back cache (expandable to 256K). Of course, it comes with a Northgate *OmniKey*™ keyboard—your choice of PLUS or ULTRA models.

PLUS, Northgate has a full range of expansion options! Monitors, hard drives, tape backups, memory cards, printers, modems, and more. Custom configure the system that's right for you.

Use a Northgate 486/25 for 30 days. If it fails to do everything we say, just return it.

Special 486/33 Upgrade Offer

Buy your Elegance 486/25 now. And when you need more processing power, we'll upgrade it to a 486/33MHz for just **\$1500.00!**

ORDER TODAY! Be sure to ask about custom configurations, leasing and financing programs.

CALL TOLL-FREE 24 HOURS A DAY

800-548-1993

Notice to the Hearing Impaired: Northgate now has TDD capability. Dial 800-535-0602.



"We hear you!"

1 Northgate Parkway, Eden Prairie, MN 55344

Financing: Use your Northgate Big 'N' revolving credit card. We have millions in financing available. We accept Visa and MasterCard, too. Lease it with Northgate, up to five-year terms available.



Includes
Microsoft®
Windows™ 3.0
and Microsoft
Mouse

Elegance™ 486/25 system configuration

- 25 MHz Intel 80486™ processor with 80387-compatible floating point coprocessor
- Industry Standard Architecture (ISA) bus
- 4Mb of 32-bit DRAM (expandable to 8Mb on the motherboard; total system RAM expandable to 16Mb with an optional memory card)
- Proprietary, U.S.-made motherboard
- 200Mb Maxtor hard drive with 15 MS access time
- 64K SRAM read/write-back cache (optional 256K cache available)
- High density 1.2Mb-5.25" and 1.44Mb-3.5" floppy drives; also reads, writes and formats low density disks
- Eight expansion card slots; one 32-bit, six 16-bit and one 8-bit
- Weitek numeric co-processor support
- Two serial and one parallel ports
- 14" monochrome monitor
- Hercules compatible video controller
- MS-DOS 4.01 and GW-BASIC software; Smart Drive disk caching software
- On-line users guide to system and MS-DOS 4.01
- 220 watt power supply
- Elegance 7 drive-bay custom tower cabinet pictured (desktop style available)
- Clock/calendar with 5 year battery backup
- Your choice of exclusive award-winning *OmniKey* PLUS or ULTRA keyboard
- Park utility
- Front mounted controls for high/low speed operation, system reset, and keyboard lockout
- Total compatibility with all of your existing AT peripherals and I/O boards
- FCC Class B Certified

Superior Northgate Support

Famous 30-Day Performance Guarantee. Northgate backs every system with our famous no-risk policy. If you aren't 100% satisfied, return it—no questions asked.

Warranties. Your system is covered by a 1-year limited warranty (5 years on keyboard). If a part fails, we'll ship a new one overnight at our expense—before we receive your troubled part.

Industry's Best Unlimited Toll-Free Technical Support. February 7, 1990, *BYTE Magazine*, Dr. Jerry Pournelle,* on Northgate technical support ... "has become the standard that other mail order computer companies must match."

Our system consultants are on duty 24 hours a day, 7 days a week to answer your questions. **On-site service** is available to most locations if we can't solve your problems over the phone.

Prices and specifications subject to change without notice. Northgate reserves the right to substitute components of equal or greater quality or performance. All items subject to availability.
©Copyright Northgate Computer Systems, Inc., 1990. All rights reserved. Northgate, *OmniKey* and the Northgate TV logo are registered trademarks of Northgate Computer Systems. 80386 and 80486 are trademarks of Intel.
All other products and brand names are trademarks and registered trademarks of their respective companies.

Circle 515 on Reader Service Card
World Radio History

The Pocket LAN Adapters: Lap To LAN In One Award-Winning Connection.

Now Supports
DECnet-PCSA



Why all the excitement? Because Xircom lets your laptop access a network wherever, whenever, and however you need it. Whether it's Novell, 3-Com, Banyan or most other operating systems running on Token Ring, Ethernet or Arcnet, the Pocket LAN Adapter gives PC users a quicker, easier LAN solution.

Our philosophy of universal connectivity combined with innovative technology has earned the Pocket LAN Adapters industry-wide recognition in a very short time. It all adds up to a faster, simpler LAN solution for laptop users. By connecting through the parallel port, a Pocket LAN Adapter gives you the freedom to choose whichever laptop fits your needs. It means no more slot problems, no address or interrupt conflicts, and no jumpers to configure.

And with practically every protocol and operating system supported with certified drivers, there's a Pocket LAN



Adapter that will fit your laptop and your pocket with its competitive price. So call (818) 884-8755 for an award-winning solution to your connectivity needs.



Xircom

LAN solutions for laptops.

22231 Mulholland Highway, Suite 114 • Woodland Hills, CA 91364 • 818/884-8755
Frankrijk 28 • 2000 Antwerp, Belgium • 32(0)3 225.22.91

Circle 550 on Reader Service Card



THE BYTE SUMMIT

SOCIAL PRESSURES

To what extent will computer literacy stratify society in the 1990s?

I don't know if it's computer literacy that's going to stratify [society] so much as it is just economics.

—Jim Blinn

Charles Simonyi: That is an interesting question. I believe that computers are a very positive force, and computer literacy endows the literate person with some added powers. And, just like literacy, it makes the person more powerful. Of course, it is possible to view any sort of power as something that distinguishes people that have it [from those who] don't have it.

Rod Canion: I think that's not something that's going to happen. I think there's some of that today, but it probably won't get any worse than it is today. I think during the decade we're going to see computers become easier and easier for more and more people to use. So computer literacy is going to be less of a factor as computers become more straightforward and a simpler mechanism to use.

Mitch Kapor: I believe that those people who are comfortable in the operation of computers are going to enjoy certain advantages over those who are not. That is, in part, a class-related distinction. What I think is unfortunate is that it [wouldn't be] necessary in a slightly better world. The issue of computer literacy would be much less of an issue because computers would be substantially easier to use.

Charles Simonyi: Whether or not it is easy to become computer-literate, I think it is totally within the means of practically everyone. It is certainly that much less expensive than a set of encyclopedias, but more importantly I think people recognize its importance.

Gordon Campbell: Well, I think you're going to see two things happening again. I think there will be a continued push for higher and more competent levels of computer literacy. The other side of the coin is that I don't believe it's going to be that major a problem in our society because I think we will compensate by having all these extra MIPS. And the extra MIPS will provide more friendly user interfaces—less efficient ones, but more user-friendly ones. Even people that aren't computer-literate will be able to use [them].

Ken Sakamura: This is why intelligent objects will become so important. Rather

than make society more stratified, I think future computers will be power equalizers. An intelligent object is something that anybody can use; it doesn't take the kind of special training or education that PCs today require.

John Caulfield: It's very interesting, and my judgment is that computer literacy will increase. And I'm looking forward to the end of the century to a lot more human-oriented interaction. We're beginning to see this in artificial reality. It sounds hokey and like it could only have arisen in California. But, having said that, it's also real and useful. And I think less computer literacy will be needed. The trend of the Mac will continue, and so "computer literacy" as we mean it now, in my judgment, will be irrelevant 10 years from now. Everybody will be able to use them.

Jerry Pournelle: I think if you can't use a computer 50 years from now, you will be in almost exactly the same position as a person who cannot read or write now. The difference is that I think using the computer will be easier 50 years from now than it is to learn to read and write.

Alvy Ray Smith: To me, it's just like, in order to be a person within our society, you're going to have to learn how to use the tools.

Grace Hopper: I think there will be some people who don't need computers at all. The others will make use of them.

Ryoichi Mori: The more computer literacy distributes into society, the less it will be valuable.

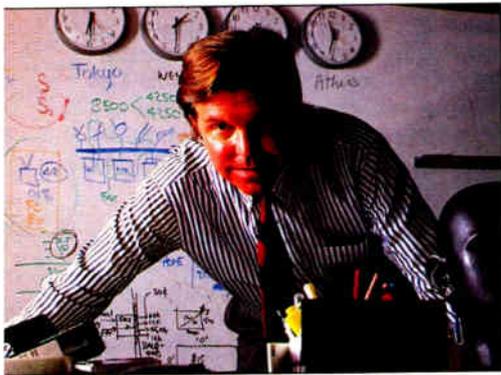
Gordon Campbell: I think when we have all these MIPS to burn and people will have the option just to talk to their computer, that will change a lot of things.

Donald Knuth: There is no universal way—there's not an easy, one-dimensional scale that's saying somebody is computer-literate or not, or anything like that. I see the need for a lot of different flavors of software for different people with different approaches.

continued



Ryoichi Mori is professor at the Institute of Information Sciences and Electronics, *University of Tsukuba*, in Japan. His primary interest lies in digital systems for the free distribution of electronic information, a concept known as superdistribution.



Nicholas Negroponte is professor of media technology and cofounder and director of the Media Laboratory at *MIT*. He oversees the Media Lab's research into new ways for people to interact with technology.



Theodor H. Nelson is the founder of the *Xanadu Project* and the developer of the hypertext concept. A subsidiary of Autodesk, Inc., Xanadu Operating Co. will ship the Xanadu server next year.

Jay Miner: More and more computers are being designed by computers, and the ability of the average person being able to afford a computer, let alone understand it and learn how to use it, is a very big problem. And the only people that will be getting good jobs will be those that can use computers. And it's a real problem, very big problem. It's stratification.

John Kemeny: I think it will be stratified, but I think it will not be those who have access and those who don't. I think it is more likely to be those who really understand how to use computers than those who don't. I mean, it is closely related to what you are saying, but it is slightly different.

Paul Carroll: I'm hoping that will become a non-issue. Nick Donofrio, who runs IBM's workstation operation, recently said that he thinks the current generation is as computer-literate as any generation from here on will have to be. I think he might be right. People are starting to get the idea that you really do need to make computers far, far easier to use.

Seymour Papert: We must make computation democratic, or there will be an elitist atmosphere and more haves and have-nots. It would be disastrous. I think there is a worldwide movement against elitism.

Federico Faggin: I think that it is going to be similar to what has happened in the past. People [who] have access to education versus people who do not causes the same "stratification." I don't know if I like that word. But, people [with] an appropriate education are able to live in society and function in society naturally better than the people who don't have one.

Dick Shaffer: I think computer literacy is a non-issue. We are moving toward the point where understanding how computers work will be regarded as about as essential to life as understanding how cars work.

Robert Noyce: I think with the increasing capabilities of microcomputers, we will be able to use them [more easily], and more and more people will be able to use and have access to them.

Rich Malloy: I think the process of using a computer will simplify itself to such an extent that it won't be much of a factor. Right now, you do have to know something about a computer to use it. But it could be the case that knowledge of how to use the computer will be as important 10 years from now as

knowledge of using a slide rule is today. It's just basically OK, interesting, but not really crucial. I think as interfaces get better, computer literacy will pretty much disappear as a topic.

Nicholas Negroponte: Let's take 10 years as a number. There will be no such thing as a person who can't use a computer. It's not computer literacy that we should be working on, but sort of human-literacy. Computers have to become human-literate.

John Markoff: I basically argue that machines are going to become human-literate faster than humans will become computer-literate. That just seems to be the dynamic, which I actually think is a very unfortunate trend, but it's almost done by necessity. America is not a very literate society. You look at the obvious things, like how many people know how to program their VCRs, and you realize that only 10 percent of the people can program their VCR. The battle's over. A small fraction of society will stay very computer-literate, and [for] the rest of society, they'll develop machines that are as easy to use as televisions.

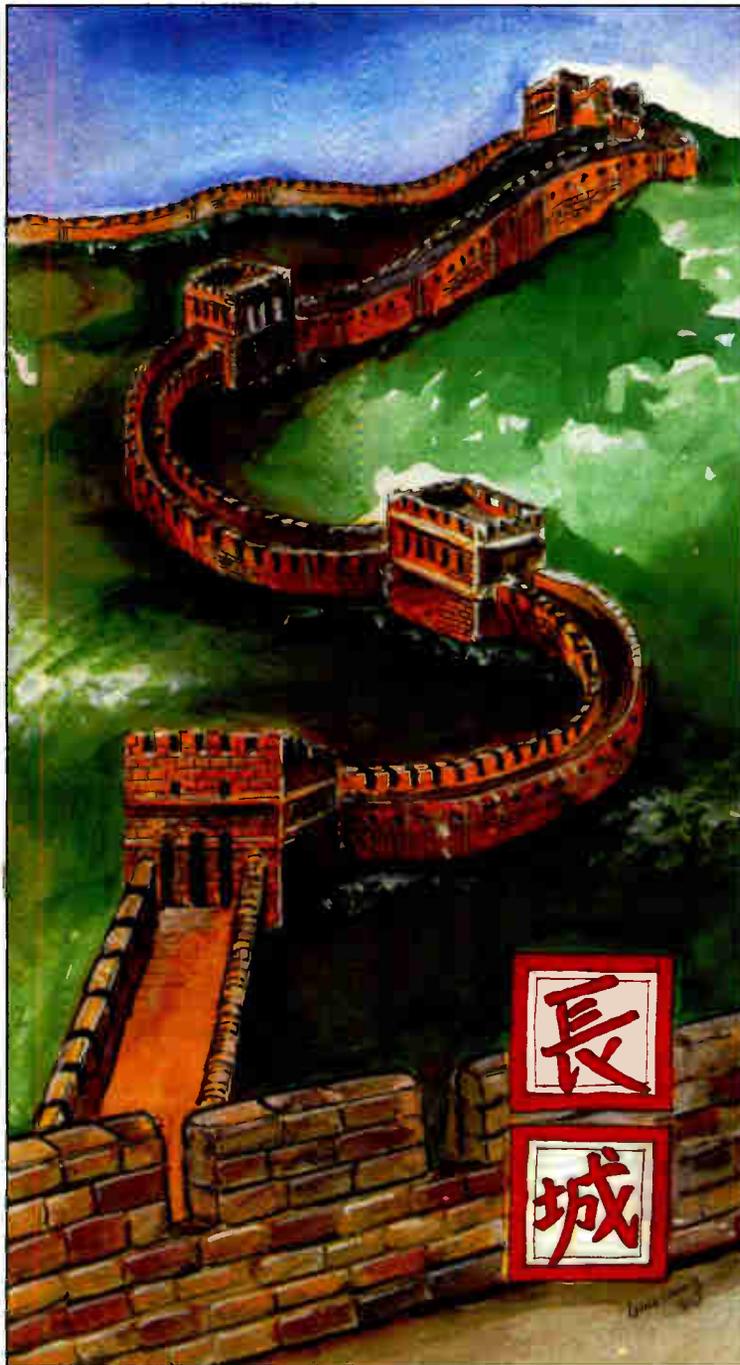
Jerry Pournelle: It's a leveler. It levels to some extent by intelligence, but it's the same as learning to read and write 2000 years ago. In Jesus' time, those who could read and write were [in] a different caste from those who could not. Nowadays, the high priesthood has sort of tried to take over the computing business. But small computers have a way of leveling things like that. These are great levelers.

Paul Carroll: I'm at least hoping, maybe naively, that from here on, people less and less will have to think of a computer as a computer and will be able to think of it more as something that I do my typing on or something that I do my analysis on or something that I do my homework on. They will get away from this idea that there's somehow a mystique attached to computers and we all need to know what the clock speed of our CPU is.

Dick Pick: It's not so much the computer knowledge as the fact of digital aptitude, and digital aptitude is related to smartness. It's not an equal world. And people who are cleverer and smarter always have a better opportunity to get by in the business world.

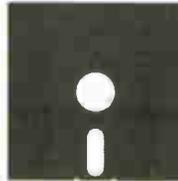
Jack Kilby: Just as literacy has had an effect on stratifying society, I think micro-

continued



Whether you're protecting frontiers and temples in Manchuria, or software and data on the PC or Mac, the Great Wall is a lesson Rainbow Technologies has learned very well.

Software developers must deal daily with the consequences of

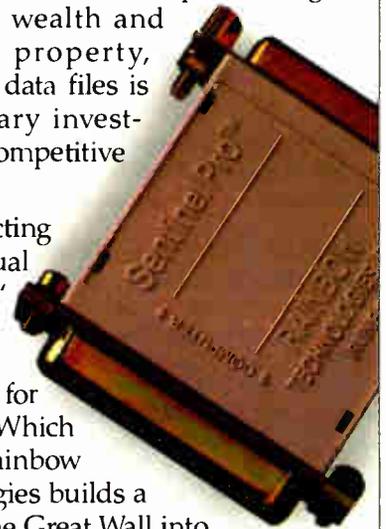


unauthorized copies and millions of dollars in lost revenue. At the same time, both individual and corporate users

must be able to make and distribute copies within legal guidelines.

Today's information-driven companies must secure their data files against theft and unauthorized access. No less than protecting personal wealth and tangible property, guarding data files is a necessary investment in competitive survival.

Protecting "intellectual property" is the security challenge for the '90s. Which is why Rainbow Technologies builds a little of the Great Wall into every key it makes.



For developers, the Software Sentinel™ family of keys protects IBM, PS/2 and compatible software, while Eve™ guards software for the Mac. Rainbow's DataSentry™ is the solution for PC data protection.

Software and data protection from Rainbow Technologies. Information on how you can have a little piece of the Great Wall to protect your software and data worldwide is as close as a toll-free call.

Copyright ©1990 Rainbow Technologies, Inc.

Times Change. The Need To Protect Doesn't.



9292 Jeronimo Road, Irvine, CA 92718
 TEL: (714) 454-2100 • (800) 852-8569 (Outside CA)
 FAX: (714) 454-8557 • AppleLink: D3058
 Rainbow Technologies, Ltd., Shirley Lodge, 470 London Road
 Slough, Berkshire SL3 8QY. TEL: 0753-41512 • FAX: 0753-43610

computer literacy will have a similar effect—but possibly less. In the workplace, an increasing fraction of jobs will require more computer skills.

Brit Hume: Well, I'm not sure it will stratify; it's hard to tell, because the people I know who are computer-literate come from all kinds of different educational backgrounds. It's not the kind of thing that you associate with the word *stratification*. I know people who are basically blue-collar workers and electronics enthusiasts, and repairmen who are hunt-and-peck typists, and I've been in their basements and seen their systems. I find it the most democratic and accessible of technologies, and it's accessible to all kinds of people because it isn't very expensive.

Jim Blinn: Computers now are cheaper than stereo sets to a large extent. A cheap computer, to the level of being able to understand what you expect out of [computers], you can get for a couple hundred bucks.

David Evans: It seems to me that there'll be wide ranges of literacy, as there are with other things.

Dick Pick: Actually, I think it will be less than it's been in the past. I think that everybody is scared about technology as being evil, but once the data is out there, once the technology comes to this, I think it is going to have a tremendous impact on making the society freer. I think [that] in general, society is going to benefit from it substantially.

Jonathan Titus: Well, my read is that it doesn't matter, because I'm not necessarily telephone-literate, yet [I can] carry on a pretty decent conversation, and I'm not fax-literate, but I can send something almost across the world to somebody else's fax machine. I think that the computer applications will have to take into account the fact that unsophisticated people will use them, and be so easy and so intuitive to use that you don't have to worry about computer literacy. People don't care about how things are stored, or where they go, or what the connectors look like. They simply want it to hook up and do what it's supposed to do as quickly and easily as possible.

Andy Bechtolsheim: I read a survey that there are 6½ million people in the U.S. who have an M.S. or engineering or medical kind of degree—professionals—that should be using some reasonably advanced computers in their work. I would think that,

whatever job they do, what [people] will find out is that they're just that much more effective with the best computer support and tools.

Jim Blinn: I don't know if it's computer literacy that's going to stratify [society] so much as it is just economics.

Stewart Alsop: Computers are like automobiles. I don't mean in a technical sense, but in the sense that they have some significance to society in general. I guess you could make the argument that automobiles have stratified society, but fundamentally we all have access to the value that cars provide. I think computers are very similar in that respect.

Ken Olsen: What comes under the title of computer literacy usually is more harmful than good. Playing games doesn't make you literate. If you really were computer-literate, you would know that transportable software comes from having a language [that] is disciplined. The computer-illiterate person is one who thinks that to have transportable software, you get it from a pegboard, bubble-wrapped, in a computer store, and you play it in any PC. That's naive. Playing a video game in a drug store is not computer literacy. It's fun.

BYTE: *Computer literacy seems to be a topic that splits you just about down the middle. How about its effect on education?*

David Evans: I think we're going to learn a lot more about how to use computers as tools for teaching. I think we have a long way to go there. If you've tried to look up something in the *Encyclopaedia Britannica* lately, you can appreciate that maybe there is a better way of doing it.

Bill Joy: I'm not sure you can improve education by giving people computers. I think you need to improve education by doing other things. Give people pencils and paper and good teachers, and [a positive] attitude around education. Computers are, like, fifth on my list to address that problem.

Wayne Ratliff: Well, kids are a lot more adaptable than adults. Adults are the ones that worry about it. And I think it is going to happen naturally with kids. It will happen in schools. There will be some, well, stratification, because not every family can afford a computer, although they are going to get cheaper and cheaper. Maybe at some point, maybe in 10 years, they'll be at the point where it will be just like a car—you

can't live without it. Maybe if we get to a paperless society of some sort, then you just can't live without a computer, just the way you can't live without a car in California.

Dick Pick: Well, I don't think they're coming anywhere close to being used as they are going to be in education. I think they can change education overnight if there was good software that supported that function. I think to do it right is still pretty complicated. But I think that what's going to have a major impact is when they really start using computers in conjunction with human beings and education directly.

Ryoichi Mori: The consequences will vary widely. For young people who seek a good job, it can be a life-or-death experience. Quite significant portions of education will be spent to give better computer literacy.

Gordon Bell: You see, the problem I have with the computer [is,] I know what the impact could be. What bothers me is, I see the potential. I see what we actually realize, and it's 1/100 of its potential, in terms of being able to be, say, a universal instructor. I mean, what we have there fundamentally is something that can let any kid go off and do experiments in their own home. And that, to me, is the universal science lab. That's what we ought to be shooting for.

Federico Faggin: I think it is very important to put a lot of emphasis on education. Not just because of the computer, but because we have already seen what happens if education is not a priority in society.

Gordon Bell: There's potential with the computer to do some fairly outstanding things by being able to use a machine in the educational process. But so far, the educators, I think, have really shunned the machine. To me, that's a "socio" problem more than a computer [problem]. It may be an economics problem, too. I haven't really looked at it. We ought to be able to lift the whole educational system up very rapidly if we sort of say everybody has to be able to understand at this level.

Dick Pick: The only way you can really get people to build educational systems is if you entrepreneurialize the education system, and that means getting rid of the way it works now, and putting it into a business environment. Then it would happen. I don't see that happening in the near future. It will happen. It will happen out in the universities, but it's not going to happen as

continued

To the naked eye, disc drives haven't changed much in the past few years. While the visible aspects have remained the same, the parts you can't see have improved dramatically. What used to be megabytes are now gigabytes. And Seagate is at the forefront of this technological revolution.

We've not only increased capacities, but we've found ways to make drives faster and more reliable. For example, Zone Bit Recording™ is a recording technique that permits higher capacity and faster average data transfer rates than conventional recording methods. Our straight-arm actuator has 60% less mass than most other designs, giving our Wren™ and Sabre™ families lightning-quick access performance. And by increasing spindle rotation 50% to 5400 RPM, we've significantly increased the transfer rate and reduced the latency in our 1.5 GB Elite™ drive.

As a result of these and other technological improvements, Seagate now offers drives from 20 MB to 2.5 GB in the widest range of form factors and interfaces imaginable, for almost every conceivable application. And we're not through yet.

Like the artist who spends years perfecting his craft, Seagate has spent the past decade mastering the fine art of disc drives. For more information, contact Seagate Technology. In the USA, call 408-438-6550. In Europe, call 44-628-890366, or Telex 44-851-846218 SEAGAT G.

 **Seagate**

Zone Bit Recording, Wren, Sabre and Elite are trademarks of a wholly-owned subsidiary of Seagate Technology, Inc.
Seagate and the Seagate logo are registered trademarks of Seagate Technology, Inc.
©1990 Seagate Technology, Inc.

*Neon Sculpture by
Lili Laskich
Los Angeles, California*



A Complete 386/33 MHz Cache System For Under \$2000.

Finally, you can afford to put the fastest 386 computer at your fingertips to enjoy the performance that once only belonged to the ranks of File Servers, Multi-user Host Computers and CAD/CAM/CAE Workstations.

Other manufacturers with their simple-minded direct-mapped cache architectures were obsessed with churning out the best benchmark numbers. We, however, were not convinced DOS and Power Meter 1.3 is any example of a typical real life application (registering at 8.003 MIPS, we are not too shabby either). With Two-Way Set Associative Cache capability, our 386 is also more attuned to run the emerging multi-tasking operating systems like OS/2® and UNIX™, where modular code sizes (of less than 32K) and frequent code-switching are the norms. Worrying about compatibility? Both IBM® and COMPAQ® endorsed the same INTEL® 82385 Cache Controller. Furthermore, we

enhanced it with page-mode and interleaved memory in the event of a cache miss. It is the closest to a true 0-wait-state implementation on the market.

Nobody does it better. Nobody!

Configuration Chart Options	Mono	VGA	S-VGA
80MB/28ms MFM	\$2,640	\$3,135	\$3,335
150MB/23ms ESDI	\$3,090	\$3,585	\$3,785

4MB RAM Upgrade **Add \$400**
 64K Cache Upgrade **Add \$150**
 Vertical Case **Add \$200**
 Vertical Mini Case **Add \$100**
CALL FOR ADDITIONAL CONFIGURATIONS

25MHz 486 w/64KB Cache	\$4,495*
25MHz 386 w/32KB Cache	\$1,895*
20MHz 386 Ø-Wait non-Cache	\$1,345*
16MHz 386SX Ø-Wait	\$ 895*
12MHz 286 Ø-Wait	\$ 745*

MIS 386/33 MHz

- INTEL® 82385-33 Cache Controller
- 32KB SRAM Cache
- 1MB RAM (Up to 4MB on Board)
- Expandable to 16MB of 32-Bit RAM
- 1.2MB 5.25" Floppy Drive
- 1:1 Interleave HDD/FDD Controller
- 12" Monochrome Monitor & MGP Card
- 101-Key Keyboard
- 2 Serial, 1 Parallel & 1 Game Port
- 80387 & Weitek Co-processor Support
- Regular Size AT Case & Power Supply
- 1 Year Limited Warranty

\$1,995

**30-DAY
MONEY BACK
GUARANTEE!**

* Basic Monochrome Systems with Single Floppy

2% surcharge on credit card purchases and are not submitted until shipping. CA residents add appropriate sales tax. Prices and terms are subject to change without notice. 30 days money back does not include monitor, keyboard and shipping charge. Personal and company checks require 2 weeks clearance. All names mentioned are registered trademarks of their respective companies. On-site service available.

MIS Computer Systems

P.O. Box 70897 Sunnyvale, CA 94086-0897

Order Now
1-800-733-9188



Office Hours: M-F 9:00 am-6:00 pm (Pacific Time)
 Circle 503 on Reader Service Card (RESELLERS: 504)

quickly as it could happen if it was a way to make money. People are in business to make money. That's the way it is.

BYTE: *And what about computer literacy in society as a whole? Will it have an effect there?*

Jonathan Sachs: It's kind of a fault of capitalism as a whole that it doesn't go after the very lowest groups and try to provide services of any kind to them because they can't afford them. I don't think it's going to be so much of an obstacle that divides people—more of a reflection of the way society is.

John Warnock: I think that that will definitely be the goal, that less-affluent people will be able to get them. The costs would come down, and the performance would be there at the low end of the market, where if they didn't get them by purchasing them directly, they would get them like they get cable TV. But, on the other hand, I know that there are very few people who can run a VCR. There are very few people who can run even the cable box that's on top of their television in any kind of a complete, functional way. The challenge of computers is to get [them] to where they are much more natural and easy to use.

Bob Frankston: We go back to a societal understanding of what computation is. Those on the wrong side are going to suffer. And it's not so much economics as trying to explain what education enables you to do in society. If you're uneducated, you don't even know how to fill out a welfare form. I'm not saying if you're educated you don't need to, but there's a lot of societal mechanisms to help out, and to the extent you understand how to use them and you have skills that are valued, you have an advantage.

Danny Hillis: I hope we're going to reach a point with computing where anyone who is literate will be computer-literate. And because I think fundamentally a computer is no more difficult to interact with than a book, in one sense I think computer literacy will become much broader. On the other hand, I think we have a real problem with literacy [as a whole]. And I think that there is a danger that we are heading toward a two-class society—computers are just a piece of it—that of the people who feel in control of their destiny, and people who feel not in control of their destiny.

Stephen Wolfram: I think it's up to the people in the industry to make sure that

there isn't such a segment. It's like asking what's going to happen to the segment of society that can't understand how to use more sophisticated telephones or whatever. The answer is, you try to build telephones where people can use them. Really, it should be the case that absolutely everybody should be able to use a computer. Now, I think there will be a bunch of different levels of computer usage.

Niklaus Wirth: On the one hand, [we] hear about unemployment, and on the other hand, we continuously experience that we do not get people for doing the work which should get done. And if you look at it closely, you have unemployment among the untrained and you have great demand for people in areas where some qualifications, particularly high qualifications, are re-

continued

Quarter Inch Data Cartridge Interchange

The QICPAK product range provides facilities permitting you to process and create 1/4" QIC data cartridges under MS-DOS on the PC or PS/2. Interchange cartridges with mini and mid-range systems using QIC drives, eg AIX, UNIX, VMS etc.

No longer is your 1/4" drive gathering dust until the next backup. Our VTAR utility creates UNIX tar compatible Backup cartridges and lets you interchange data the easy way. There's more. With QICPAK-II you can attach two QIC-drives to the system and perform an image copy of a cartridge with the VCOPI utility. This is vital when you have just spent hours waiting for that backup of your system. With QICPAK-III the sky's the limit. We supply you with the source code of all of our utilities enabling you to develop your own applications. Example sources: Microsoft 'C' ver 5.1 & Quick Basic, Turbo 'C' ver 2.0 & Pascal ver 5.0.

QICPAK-I \$695.00

QIC-02 controller for the PC-Bus or MCA with the supporting device driver. Software is provided for data interchange and tape positioning. The utilities & VTAR are all provided as executables and in source form. Additional examples are given in 'C', Pascal and Basic.

QICPAK-II \$995.00

QICPAK-I and a second PC-Bus or MCA controller. VCOPI in both executable and source with full documentation.

QICPAK-III \$1995.00

Includes QICPAK-II plus the QTAPE utility, giving the ability to extract data from the majority of popular tape formats, eg SYTOS, EVEREX, MAYNARD, MOUNTAIN, TAR, NCR TAR, APOLLO, IBM System/36 etc. For example you can directly convert from any of the supported formats and create a TAR or SYTOS cartridge. The source of QTAPE is not supplied.

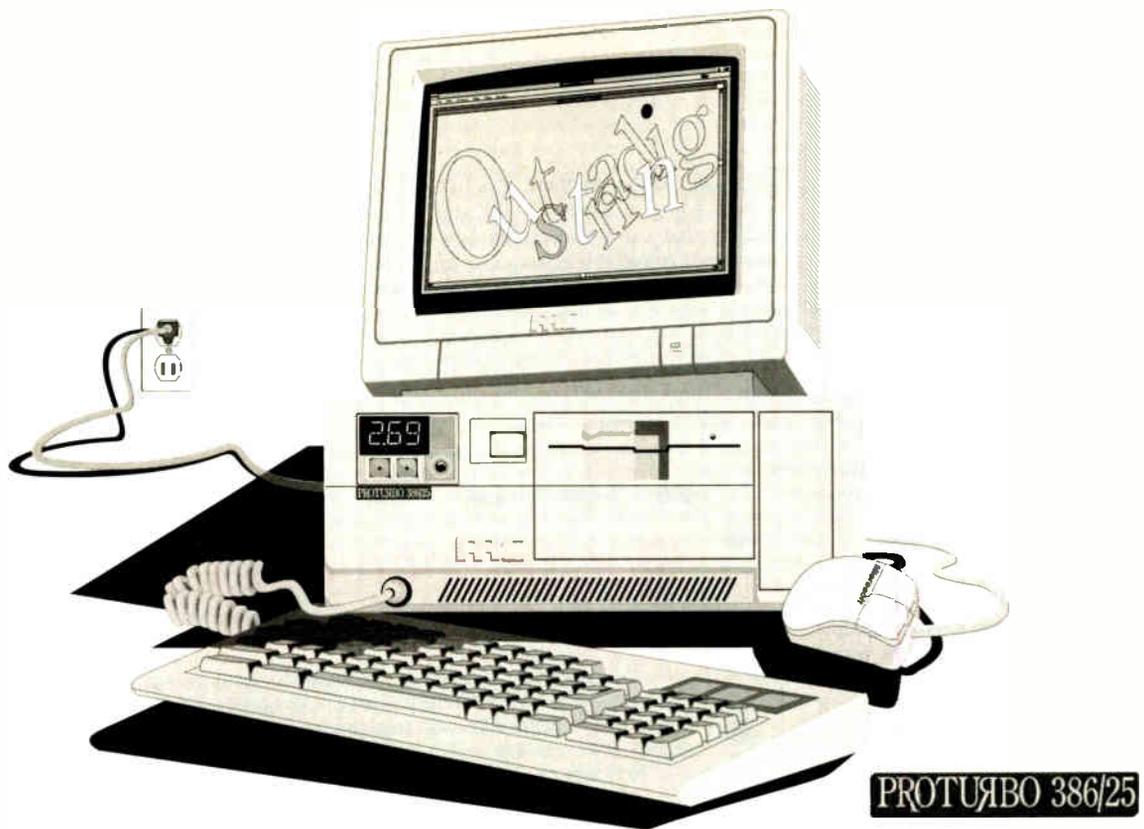
We can also provide complete subsystems with any of the QICPAK options. If you need help with 1/4" or 1/2" tape then we have almost certainly done it before, including data recovery from damaged 1/4" cartridges. All support is given directly by the development group.

TEL: 44 734 890042
 FAX: 44 734 890040




NO SURCHARGE FOR CREDIT CARDS

VOGON ENTERPRISES LIMITED
 94 Easthampstead Rd, Wokingham, Berkshire, RG11 2JD, ENGLAND



PROTURBO 386/25

Outstanding.

Even among product lines of exceptional quality, now and then one of them sur-



passes every expectation. The ARC Proturbo 386^M/25 delivers outstanding performance and value.

It's powerful enough to serve many users if your needs involve PC networks. Yet, with its small footprint and price tag, it can still be considered a personal computer. So, if you don't need

to share you can afford to keep it all to yourself.

The Proturbo 386/25 so perfectly fits such a wide range of requirements that it has become the most popular product in our 10 year PC manufacturing history.

386 is a registered trademark of Intel Corporation.

Before you buy too much or too little, visit your local ARC dealer and get a look at outstanding performance and value.



Austria 222-934212
 Bahrain 271-041
 Bangladesh 2-244179
 Denmark 31-304-500
 Finland 52-609100
 France 1-470-93636
 Greece 1-361-3500
 Hungary 1-667688
 Indonesia 21-380-4169

Iran 21-821-687
 Italy 2-481-8913
 Kenya 2-746-044
 Kuwait 242-1812
 Malaysia 5-511-882
 Norway 42-12560
 Pakistan 21-521529
 Papua New Guinea 257-477
 Peru 14-419860

Philippines 2-818-9329
 Philippines 2-817-1882
 Portugal 1-562-459
 Spain 1-416-9412
 South Africa 11-805-3163
 Spain 1-416-9412
 Sri Lanka 1-574980
 Sweden 31-658-551
 Switzerland 22-785-1000

Taiwan 2-917-5269
 Thailand 2-498-4552
 Turkey 1-169-0230
 United Arab Emirates 4-224261
 United Kingdom 1-6844144
 USA 213-265-0835
 West Germany 40-660051
 Yemen Arab Republic 2-207721

Circle 451 on Reader Service Card (RESELLERS: 452)

quested. I think that the computer, unfortunately, helps in widening the gap between these two categories and even among the people in the profession. That gap will widen between very competent ones who have mastered their subject and those who just do it as a job from eight to five.

Jonathan Titus: We still have a ways to go to convince the average person that there's a real, practical use for computers day to day, week to week, and month to month. Just as the telephone is almost indispensable these days, I think that in the next, let's say, seven to 10 years, the home computer, or some form of computing device in the home, will be almost indispensable.

Jim Blinn: It's just one of those things that you need to know how to do.

Bob Frankston: Computers force you to rethink. Once you learn a foreign language, you understand English better. Well, computer literacy is the foreign language of society. It makes you understand the other things you're doing better. And that's what I view as the core to computer literacy and where the value comes toward dealing with society.

Tom McWilliams: Actually, I think that in the nineties, we're seeing a great deal of increasing computing power per dollar. I think an awful lot of that computing power will go to make the user interface better. I think that in the nineties you'll see more voice input and more visual integration: imaging on the screen, so that you can mix things like live video on the screen with text and voice—if you can imagine, a very nice mail system where you could literally talk, type, or have a video in your mail. A lot of things I think will greatly ease the ability to use computers so that basically the computers will come more to the masses rather than the masses having to come to the computers.

BYTE: *What kinds of questions, then, does computer literacy raise for the future?*

Nicholas Negroponte: Will computers make your life better and your day more pleasant and so forth? My answer is, unequivocally, yes. In the old days, the very wealthy had servants, a maid and so on, who did things for them. Having a gardener or chauffeur didn't mean that you couldn't enjoy planting a garden or driving. But you did have at your disposition a retinue of servants who were there to make your life

much easier. If one thinks of that as a model for computers—there are these agents that do things for you, [like] don't let the telephone ring in the middle of dinner, and are so interconnected [that your computer] knows your flight to Detroit is delayed 2 hours, so it tells your alarm clock you can sleep a little later.

Terry Winograd: Is the question one of

technological determinism, or is it a piece in a puzzle? There are some people on each side: Some people who say it stratifies, and some people who say it empowers. What is the goal? To have a computer in every home? If so, computers will go one way. If it is for schools, computers will go another way. It is a mixed bag. Neither the utopian nor big-brother fantasy [will] play out uniformly. ■

SR. SOFTWARE DEVELOPERS & SYSTEMS ARCHITECTS

Let's Get Right To The Point

Central Point Software has become the world leader in PC Utility Software by providing our talented staff with a stimulating environment that has enabled them to produce such highly acclaimed products as PC Tools™. Our aggressive expansion plans have created a substantial number of immediate openings for skilled professionals to develop our next generation of software based on the new GUI interface for Windows and Presentation Manager.

We are seeking professionals capable of taking conceptual ideas and implementing them into products. You'll be challenged to develop superior MS-DOS and/or WINDOW software in a profes-

sional C, Assembler and/or C++ environment. Requires a BS or MSCS, EE or equivalent development experience, and significant expertise in product development in an MS-DOS environment.

Located just minutes from downtown Portland, in the beautiful and affordable Pacific Northwest, we offer exceptional opportunities for professional and personal growth in a casual work environment. Mail or Fax your resume to **Central Point Software, 15220 N.W. Greenbrier Pkwy., #200, Beaverton, OR 97006. (503)690-2221 FAX.** For questions, call Bob Clay COLLECT at (503)690-2217. Equal Opportunity Employer. Principals only, please.

Central Point Software™ INC.

Dennis Ritchie:

On Plan 9

In terms of the operating-system-related stuff, [we're working on] a new system called Plan 9. It's not Unix, although the interface is rather similar. It's not an attempt to re-create Unix as such. It's an attempt at a fresh go.

All the code is new. It's fairly highly distributed, and it's intended to be quite growable. A single configuration can grow gracefully into quite large ones by adding CPU servers and file servers and so forth. The computation tends to be split between both the terminal and CPU servers, [which] run a very similar version of the same operating system, and sort of talk to each other over some kind of a network.

The intent is to be able to produce systems that have a reasonable amount of CPU power nearby (within the display), that connect seamlessly to much larger sets of resources that are more remote (in particular, in rooms that can be air-conditioned and serviced by technicians instead of the user), and have this all done fairly smoothly so that you can't really tell by looking at it where something's being done. And second, [do this] in a way that doesn't have all of the barnacles and so forth that have grown up over Unix over the years.

The system itself is very much a research effort at this point. There's no thought certainly in the immediate future, or perhaps even the longer-term future, of having this [become a] product. It's very much experimental. In fact, it's not even the dominant platform for our own computation in the research group. It has some users, but [we're still] knocking off the rough edges and whatnot, so it's not universal. The terminal hardware that it runs on is very much like a diskless workstation. It has

extensive memory and a CPU and memory map and a network connection and a bit-mapped display, but the way in which it interacts with the rest of the world is more tightly coupled with the other resources.

The main problem at the moment—the main conceptual problem—is that it looks like the communications bandwidth it wants is a bit too large to be conveniently taken home. It works fine in the office. One of the things that we like very much about our current world is that the same facilities are available both in the office and at home. Moderate-speed phone lines are adequate for that.

[Plan 9] looks as if it's pushing the edge as far as the speed is concerned, even though we're very hopeful that the phone company, speaking generally, can provide some sort of more adequate bandwidth. ISDN is the next hope. On the other hand, because this thing is new enough, the amount of engineering and squeezing has not been done that might be useful. It works fine at T1 rates, a megabit per second, and that's very much achievable in local context. It's also achievable at home, but it's expensive. It's not as if you needed to be on an Ethernet. A tenth or a twentieth the speed of the Ethernet is sufficient. But that's still a bit rich for really far away, where you actually have to rent stuff from the phone company. And things like ISDN, those experiments should be coming fairly soon.

[Plan 9] starts out afresh, makes some fresh assumptions about interfaces and design.

Editor's note:
See biography, page 336.

Nicholas Negroponte:

On Future TV

There are a lot of things about the future of television, but one of the things we can say, unequivocally, is that it will be digital. And once it's digital, you can start doing a great deal more than our current sort of analog, rather outdated systems. I think that the merger, or combination of television technology and computer technology, is going to happen within the next decade.

Quite curiously, you have TV manufacturers right now who are putting more and more computing into the TV set, and you have every computer manufacturer you can name putting more and more video into their computers. And these groups are really not talking to each other yet.

I think what will happen is that people who are putting computing into TV sets—I think they'll fail, because I don't think the market is going to help them very much. What's going to happen is that computing people who have started putting more and more video into their computers will find, 10 years from now, that they are the de facto TV set.

Editor's note:
See biography, page 304.

Ed Yourdon:

On the Future of Software Development

We are building very different kinds of systems than we built in the 1970s. For one thing, there's obviously much more emphasis now on the user interface.

I've heard Bill Joy of Sun Microsystems say that a typical software system today (you know, a windows, graphic-user-interface kind of world) has 75 percent of the code tied up in the user interface, and only 25 percent doing number crunching. You know, most of the earlier methodologies provided no assistance—no guidance at all—for the user interface side of things, and it is such an obvious candidate for object-oriented design.

Also, [earlier methodologies] provided almost no emphasis on reusability, which many of us are now beginning to think will be one of the big solutions to the productivity problem. [Earlier methodologies] had a little bit of notation for showing a library module in the structured-design approach. But this whole object-oriented concept of inheritance and subclasses and so on really, I think, causes a profound difference in the way that people approach problems.

If you watch your typical programmer or software engineer who's grown up using, say, my methodology or any of the other comparable ones, you'll see that the way they approach a problem is by taking out a clean sheet of paper or a blank CASE tool and trying to invent a system from first principles, as if it had never been done before, because that's how they have been taught. Whereas, if you watch a Smalltalk programmer, given a new problem, he will immediately say to himself, "This must be a specialization or a slight variation on something that already exists. Let me browse through my library and invent some new subclass that inherits a whole bunch of stuff from existing class structures."

So the person who works with a good, strong, object-oriented set of tools inevitably will look at a problem as a design by exception or design by refinement process, which is a whole different way of looking at problems. So I think that [object orientation is] terribly, terribly important.

Editor's note:
See biography, page 366.

New!

"The World's Most Accurate Mouse"



Sleek, dependable and compatible. The PC Mouse III from Mouse Systems.

Pin-point digitizer accuracy using patented M5 optics. Supports Microsoft[™], MSC, and PS/2 protocols. 100% hardware and software compatibility guarantee. *True lifetime warranty.* Get your hand on the world's most accurate mouse today!



Special Introductory Offer

Buy a PC Mouse III and receive a free copy of Power Panel[™] the ultimate DOS utility shell. (PC Magazine Editor's Choice, June 12, 1990.)


MOUSE SYSTEMS

47505 Seabridge Drive
Fremont, CA 94538
(415) 656-1117

The following are trademarks of their respective companies: PC Mouse III, Power Panel, Mouse Systems Corporation; Microsoft, Microsoft Corporation; PS/2, IBM.

Circle 508 on Reader Service Card →



Buy our IBM-compatible color printer and get this Mac-compatible color printer free.

The new Phaser PX Color Printer from Tektronix.

Only \$7995

The price is as much of a breakthrough as anything else. The Phaser PX offers PostScript-language compatibility and 300 dpi thermal-wax color that's brighter and bolder than that of pricey competitors. And not only can you hook it up to an office full of PCs via serial or parallel, but it will also accommodate any

Macs that might come along. Automatically switching from port to port to keep everybody happy.

Add to that certified PANTONE** Color that can be printed on paper or transparencies, and you've got a color printer that will do more for less money than ever before.

So call 1-800-835-6100, Dept. 11J to find out how to get your hands on the new Tektronix Phaser PX. Then you can kill two birds with one color printer.

The New **Tektronix Phaser PX**[®]

*Pantone, Inc.'s check-standard trademark for color reproduction and color reproduction materials. Copyright © 1990 Tektronix, Inc.



Buy our Mac-compatible color printer and get this IBM-compatible color printer free.

The new Phaser PX Color Printer from Tektronix.

Only \$7995

The price is as much of a breakthrough as anything else. The Phaser PX offers PostScript-language compatibility and 300 dpi thermal-wax color that's brighter and bolder than that of pricey competitors. And not only can you hook it up to an office full of Macs via AppleTalk, but it will also accommodate the PCs and

workstations that might come along. Automatically switching from port to port to keep everybody happy.

Add to that certified PANTONE** Color that can be printed on paper or transparencies, and you've got a color printer that will do more for less money than ever before.

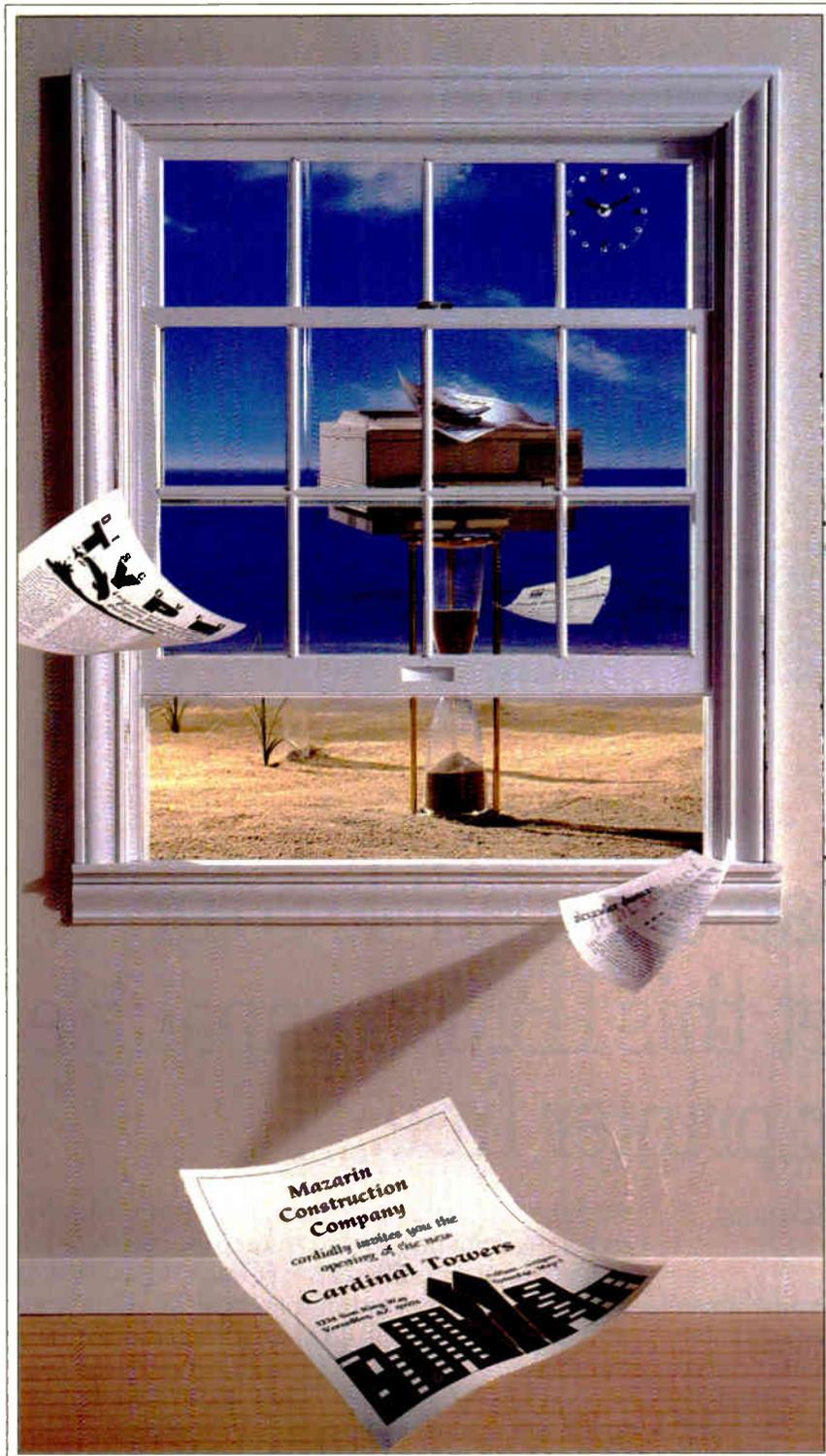
So call 1-800-835-6100, Dept. 11J to find out how to get your hands on the new Tektronix Phaser PX. Then you can kill two birds with one color printer.

The New **Tektronix Phaser PX**[®]

All rights reserved. Phaser is a trademark of Tektronix, Inc. All other trademarks mentioned herein belong to other companies.

Circle 539 on Reader Service Card (RESELLERS: 540)

Scalable fonts in a cartridge. No longer just a dream.



Imagine how your documents would look if you could substitute ordinary printer fonts with typeset style fonts. Instead of Times®, you could use distinctive CG Palacio®. Or add flair with Letraset® Revue™. Imagine choosing from up to 51 different fonts, including CG Bodoni®, CG Palacio, Shannon™, Revue and ITC Bookman®, that can be scaled to any size, in quarter point increments from 0.25 to 999.75.

You've dreamed about such things for your Hewlett-Packard LaserJet™ III. Pacific Outlines® make the dream real.

These easy-to-use cartridges eliminate the need for soft fonts, accelerating your work and saving disk space. Pacific Outlines offer quality scalable type from Agfa/Compugraphic, and ready-to-use software drivers for several major software applications.

Offered at a price that won't cause nightmares. To learn more, call or write: Pacific Data Products, 9125 Rehco Rd., San Diego, CA 92121, (619) 552-0880. FAX: (619) 552-0889.



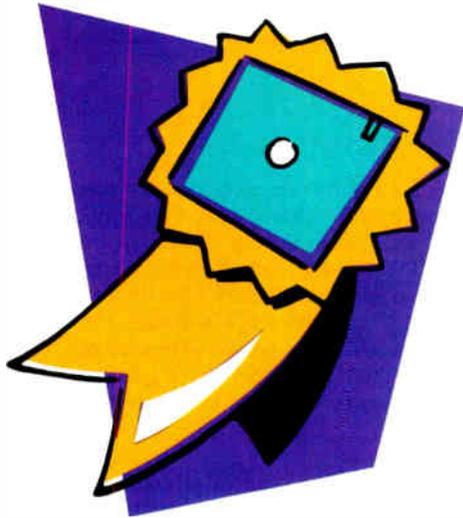
PACIFIC
DATA PRODUCTS

© 1990 Pacific Data Products, Inc. Made in the U.S.A. Pacific Outlines is a trademark of Pacific Data Products, Inc. LaserJet is a registered trademark of Hewlett-Packard Company. Scalable type outlines are licensed from Agfa Corporation, Agfa Compugraphic Division. CG Bodoni and CG Palacio are registered trademarks and Shannon is a trademark of Agfa Corporation. Letraset is a registered trademark and Revue is a trademark of Essette Pendaflex Corporation. ITC Bookman is a registered trademark of International Typeface Corporation. All other company and product names are trademarks of the company or manufacturer respectively.



Circle 520 on Reader Service Card (RESELLERS: 521)

World Radio History



An application

**isn't any less life-changing if
it only changes a few
people's lives. It still
changes them as
profoundly.**

—Jonathan Sachs

THE BYTE SUMMIT PICKING A WINNER

What do you think will be the next "big one," the next huge success, in the software world?

Charles Simonyi: I don't know. What will it do for you? If it doesn't do something that the people are doing right now in great frequency, it couldn't possibly be that important.

Brit Hume: I must say that I do kind of root for some of these interesting new programs that they're developing to run under Windows and OS/2. There's a lot to be said for that kind of interface. It is easier to learn and use. But so far it's hard to see that there's going to be a massive migration any time soon to that sort of thing.

Bob Frankston: The next step is that my windowing system will have animation as a fundamental capability. We know what we want to do, we know how to do it—we're just waiting for the prices to come in line. The challenge is always to do things a little more before most people realize they're economically feasible.

Bill Stallings: Animation. That's something that takes advantage of the capacities available, and the advances are being made in image processing and video processing. And applications that'll involve [animation] can be things like training. It's kind of the next generation of presentation software—systems that would make it easy to put together animation. I think that that could have a really big impact in business.

Jerry Pournelle: It'll be integrated multimedia stuff—make use of glass disks and visual images and music and sound.

Tom McWilliams: If I had to speculate off-the-cuff, I would say the integration of live video and voice into some sort of tools to help you do your office work. There are a lot of companies that still have a tremendous paper mill, which is very inefficient. So I think that the computing horsepower is going to be there—and the network bandwidth—to help you really automate the office. We ought to get rid of interoffice mail. I think you can do it much better. The enhancements of video and voice on top of written text is a very powerful communication mechanism.

Doug Engelbart: Multimedia hypertext. I think it's going to be *the* way in which the electronic document, so to speak, is going to emerge, and it's going to be hyperdocuments. That's going to put a tremendous amount of pressure on standards for intercommunicating for the document that won't have it—a much more challenging era of standardization than I know of that we've done before, because of the diversity of the forms of what we call a document.

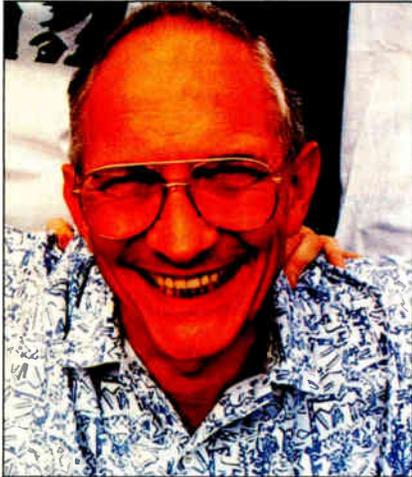
Bill Gates: Group productivity, advanced mail stuff—a lot of opportunity there. And everybody recognizes that. The idea of dealing with heterogeneous information, the type of stuff you get in personal information management—I still don't think anybody's done a very good job there. Particularly as we get these notebook machines with handwriting and the graphics interface, there are some real opportunities to advance that.

Dick Pick: Certainly, there is sort of a revolution going on now in the general area of visualization CAD/CAM. That's what's driving all those workstations out there, I would imagine. I would say that's the one that's kind of hot now.

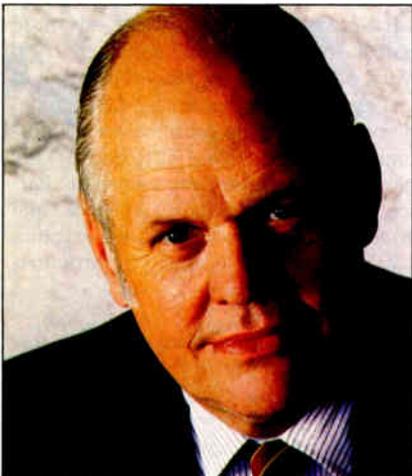
Doug Engelbart: I think [it's] the evolution of portrayals and symbologies that we haven't really harnessed very effectively through all the decades and so haven't been a part of our general way of externalizing our thoughts and our communications. That's the part of the augmentation area that I think is just really, really [exciting]. It's like the means by which we can actually transfer from our head into some kind of external model of what our concepts [are] and the communication we're trying to do and attitudes and feelings and the portrayal back to us, whether it's by sound, smell, anything else (vision, three-dimensional, dynamics, others)—sensory immersion and virtual realities and all of that.

John Markoff: I don't think I could name the exact application, but I think it's going to have to be in the communications area.

continued



The late **Robert N. Noyce** was president and CEO of *Sematech*, and vice chairman of *Intel*, which he cofounded. He and Jack Kilby are credited as independent coinventors of the integrated circuit. Along with Kilby, Noyce was the recipient of the first Charles Stark Draper prize from the National Academy of Engineering.



Kenneth H. Olsen is founder and president of *Digital Equipment Corp.*, the nation's second largest computer maker. He precipitated the movement toward smaller, interactive computers with the PDP-1, the first minicomputer, and has led DEC to a leadership position in networked computers and systems integration.

It's going to have to be something that can make communications extremely transparent. And whatever the software is, it's got to be an order of magnitude more convenient than terminal-emulation programs or communications programs today.

Bill Gates: In this client/server thing, the idea of seeing corporate data graphically, being able to browse around it very easily, and have it sort of remember what stuff you like to see and make it easy to call up. That whole way of seeing your corporate data—nobody's really done very well with that. That's a big area. Some people call it database front end, but that's just because they're using the old label on a new thing.

Grace Hopper: Ever since the early days of COBOL, something has disappointed me. I thought that when we designed COBOL, if you remember, we designed the ability to use the library—the subroutine. And I thought the Insurance Association would immediately get together and write all the subroutines necessary for insurance companies to meet government needs. It's never been done. Then banks never wrote that subroutine that would provide for all the reports. And those libraries don't exist. That libraries ability in COBOL has never been used the way it should have been. It should have been one subroutine.

BYTE: *Do you think there will be any other "killer" applications, like word processing and spreadsheets, that dramatically increase microcomputer usage?*

Grace Hopper: Oh, yes. We haven't yet thought up all the things we can do with this technology, and how to match them together.

Jim Blinn: We seem to be entering in the world of generic things, generic entertainment, generic music, and generic software. The one thing about the PC area—it's not necessarily IBM PC-type things, but other sorts of machines, Macintosh and whatever—is the fact that you can get lots of different software from lots of different places that can work together and can talk to each other, and the output of one can be used as the input of the other. This is a fairly remarkable thing from the computer end.

Jonathan Sachs: I think there is a limited number of generic product categories. A spreadsheet is a really nice generic tool. A word processor is probably the ultimate generic tool, because almost everybody writes at some point in their life. But I

think it's a really rare event for a new product category like that to come into being. I think we've seen the big generic applications. I think we've seen the specific applications—you know, the sky's the limit. An application isn't any less life-changing if it only changes a few people's lives. It still changes them as profoundly. I guess the answer is yes, but not for everybody at once.

Tom Kurtz: The chances of coming up with a product that will somehow take off the way the spreadsheet took off are really small.

Dick Shaffer: I think stylus-based systems have the potential for important applications. But you have to build a whole new class of machines before you can even get to that level of applications. I'm talking about the computer that takes the place of your notebook, takes the place of your diary, your calendar, your phone book. It is no heavier than the paper book you carry around, and it is more useful than that. It is your basic digital life organizer. I can see that as reasonable. At least three [companies] in the U.S. [are in this field], and in Japan, every major vendor of computer systems has a project in that area.

Wayne Ratliff: But any breakthroughs you can't predict. Is there room for breakthroughs? I suppose so. I mean, if someone could make speech recognition reliable—really working—that would do it. I think speech recognition is going to be what turns the corner on computers. As soon as they get as good as the HAL 9000, that number is going to squish to about 90 percent. It's going to do a flip-flop. It's going to become the inverse, the complement of what it used to be, in very, very short order.

Rich Malloy: I don't know. I would say a product that would be a little different than what we're using now. A lot of products on computers allow us to do more work, but they also require more on our part. And what would be interesting is some kind of software that would allow us to do a lot of work with very, very little work on our part, sort of a work amplifier.

Brian Kernighan: We have made progress in getting programs that are better, that run better, that have fewer errors, and so on, when we've been able to get machines to write them for us. Now, I don't see automatic programming, where you simply say to the machine, "OK, I need a program to

continued

DR DOS 5.0. WE COULDN'T HAVE SAID IT BETTER.



So what's all the hoopla about?

MemoryMAX™, for one thing. A breakthrough in memory management that can give you more than 620K so you can run today's memory-intensive applications, including, for example, dBASE IV, on Novell NetWare™.

In fact, John Dvorak calls MemoryMAX nothing short of "amazing."

The Press goes on to mention that because DR DOS 5.0 is fully DOS compatible, you can run all your current DOS applications. And because it is easy to install and requires no hard disk reformat-

ting, upgrading to DR DOS is simple. Since DR DOS 5.0 also includes ViewMAX™, a graphical interface, DOS is easier than ever to use.

Now if we could just get a word in edgewise, we would simply like to add that DR DOS 5.0 is available now. Call us at (800) 848-1498 Dept. DR-44 today.

DR DOS 5.0

 Digital Research®
WE MAKE COMPUTERS WORK

For Laptop and Notebook manufacturers, DR DOS 5.0 is fully executable from either RAM or ROM. And, it's available with BatteryMAX™, a battery-saving feature that can increase battery life 2-3 times (dependent upon OEM implementation).

Digital Research is a registered trademark, and the Digital Research logo, DR DOS, MemoryMAX, ViewMAX, and BatteryMAX are trademarks of Digital Research Inc. Copyright © 1990, Digital Research Inc.

Reprinted from PC Week May 14, 1990. Copyright © 1990 Ziff Communications Company. Reprinted with permission from The San Francisco Examiner. Copyright © 1990 The San Francisco Examiner.

Circle 476 on Reader Service Card
World Radio History

do this," and lo and behold, out it comes. But I think what we will see more of is places where people understand some corner of activity well enough that they can go from a specification of a solution to a working program to do it fairly quickly. I don't think we're ever going to get to the point where the machine will write all our programs for us, but we can do better than we're doing now.

Jim Blinn: The one main software innovation that I've been most impressed with in the past 10 years, I think, is object-oriented programming—the fact that it enhances the stability, it could take little bits and pieces of a program—device drivers, interrupt stealers, this type of thing—written at different times by different people, and have them still be able to be plugged together, if it's done carefully.



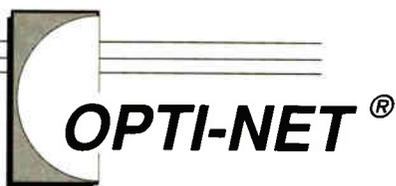
e haven't yet

**thought up all the things we
can do with this technology.**

—Grace Hopper

Paul Carroll: I don't think that there will be a next killer application, in the sense that spreadsheets, word processors, and databases were. There are some very powerful things that will become available. Multimedia is important, electronic mail is extremely important, handwriting recognition, and then maybe a decade after that, voice recognition will be important things. Groupware is also very important. It does not seem to me that any one of those things will be an isolated app in the way a spreadsheet is. I think electronic mail will become a part of everything. I think groupware is a concept that will be folded into things. I think multimedia is a technology that will find its way into different things.

Brit Hume: I think that it's interesting that we've had to wait so long for a major new application, and there hasn't been one in a very long time. And you see the efforts that people have made to develop something truly new, and what tends to happen is, we have glorified utilities being passed off as new applications. But when you get right down to it, it's not really an application, it's a housekeeping program. And I think the same can be said for some of the communications software that has been loaded up with all kinds of wondrous bells and whistles. But when you get right down to it, a communications program in a sense is really a utility. It is not something you use to create work. It is simply something you use to move something from one place to another. Important, indeed indispensable, but it is not like a spreadsheet, a database, or a word processing program, something that can itself be the substance of your work. And we haven't seen anything in some time that would be a brand-new way to use a computer to create work. The last really new application we had was desktop publishing. ■



The software solution for network CD-ROM access

OPTI-NET is the unique software-only solution for shared CD-ROM access for NetBIOS® and Novell®'s IPX®/SPX® based systems.

And, the new OPTI-NET VAP version allows LAN-wide access to CD-ROM drives installed directly on a Novell Advanced NetWare® file server or external bridge.

In addition, Online offers complete packaged solutions for CD-ROM networking. We're the exclusive distributor of the Grolier Electronic Encyclopedia™ network version, now with VGA images!

***"On the performance
side, OPTI-NET flies.
It's fast, and ...
it operates transparently."***

M. Keith Thompson, PC Magazine
February 27, 1990

Call Kim Mote or Cheryl McGarry at (800) 922-9204. In Maryland call (301) 428-3700. OEM, VAR, and distributor inquiries are invited.

11 WEEK

January 8, 1990

Highest Rating!

ONLINE Products Corporation

Sharing Information Through Technology™

A Reed International Electronic Publishing Company

20251 Century Boulevard Germantown, Maryland 20874 (301) 428-3700 (800) 922-9204 FAX: (301) 428-2903
Brand names and product names are trademarks or registered trademarks of their respective companies.

Which terminal emulation keyboard would you rather use?

A.



B.



We thought so too. The *PowerStation* is an exact VT200/VT300 layout keyboard that plugs into your PC. The *PowerStation* brings VAX applications to your PC without having to rely on messy labels.

Here's the opportunity to standardize on one keyboard throughout your department. The *PowerStation* keyboard has been designed to work on PCs, XTs, ATs, PS/2s, and the AT&T PC. And you can switch effortlessly between real VTs and the *PowerStation*.

The *PowerStation* eliminates keyboard remapping when you run PC versions of your favorite VAX applications, including EDT+, WPS-PC, WPS-PLUS/DOS, and nu/TPU. And the keyboard can be used with regular DOS applications.

The *PowerStation* keyboard comes with ZSTEM 240 or

ZSTEM 220 terminal emulation software for connecting to your VAX. ZSTEM 240 includes full VT241 emulation and complete VT340 16 color ReGIS & sixel graphics. If you only need text, ZSTEM 220 will give you fast, accurate and complete VT220/320 emulation.

With KEA's top-notch technical support and documentation, plus a solid warranty, you can be assured of quality products backed by quality people. Find out why Digital Review Labs says KEA's *PowerStation* is "a godsend." Call today!

KEA Systems Ltd.
3738 North Fraser Way, Unit 101
Burnaby, B.C., Canada V5J 5G1
Phone: 604-431-0727
Fax: 604-431-0818

Toll-Free Order Desk
1-800-663-8702



PowerStation, ZSTEM and the KEA logo are trademarks of KEA Systems Ltd. All other brand and product names are trademarks or registered trademarks of their respective holders. © Copyright KEA Systems Ltd., 1989. All rights reserved.

THE BYTE SUMMIT

I N S I G H T S

Bill Joy:

On the Longevity of Unix

I am always reevaluating what we should do to keep Unix evolving. The system is the only operating system that has been around for a long time—it's like 20 years old—that runs on micros.

The Mac system is maybe eight to 10 years old. OS/2 is a year old. And DOS, maybe 10 years old. So, [Unix] is the only one that has survived 20 years, and it has survived because it reinvents itself. It goes through cultural renewal.

I think we have a very healthy cul-

ture of constantly figuring out what to change to keep the system relevant. I try to be a rabble-rouser, I guess, to encourage people to continue to change the system. So, we've got a big intellectual investment in this sort of moving cloud of capability that the system has. I spend a lot of time doing that. That's sort of a social project as well as a technical one.

Editor's note:

See *biography*, page 262.

Grace Hopper:

On the Value of Data

Since 1943, when the first computers appeared, we've gone after hardware. We've gone after faster hardware. Everyone is worried about hardware. Along about '51, '52, John Mauchley came out with that first short code, and then came FORTRAN, then came COBOL, and we started the software world, and we developed the languages, and the user-friendly stuff, and everything. Nobody has yet looked at the data.

There are clearly two kinds of applications—two major classes of applications. The big scientific/engineering research, which is largely mathematical in nature, [and] then there is the large data-processing world, which is largely arithmetic in nature. So, we never really designed computers for either world, because we wound up building von Neumann computers. And until we look at the data, we will not come up with a new articulation.

I've been thinking about data flow and the different kinds of data flow. Now, sometimes data flows like rivers, sometimes it flows like that lava out in

Hawaii, sometimes it's like a marching company of marines: organized, disciplined. [And] sometimes it's more like the flow over the wing of an airplane, which gives the lift and has the turbulence to fly, too. We've never looked at the data, how it arises and how it flows.

I think as we build these systems to compute, we'll become more aware of the data flow and more aware of types of data. For instance, the scientific/engineering field doesn't give a hoot about an alphabetic character. It is largely binary and floating. In data processing, it's integers and add, subtract, multiply, and divide: only arithmetic and comparisons of those alpha-decimal characters.

We haven't looked at the amount of work being done on data. Long ago, in the earliest computers, we discovered that you could always go faster if you had more space, more storage. We've never looked at the value of the data, the value of an education.

Well, some of the stuff going through the computer is a heck of a lot more valuable to us than the other stuff is.

Nobody has even gotten a little bit philosophical about the value of information: All information is good; put it in the computer and run it over the lines.

We need to look at the stuff and what can we afford to lose, what can't we afford to lose. Part of it is leading us toward the future. Part of it's just a relic of the past, and so on. With just a narrow look, we've taken these lovely computers, faster transistors, everything under the sun, better language, more software—pile it in. We never think of what we're doing it on.

I think until organizations begin to look at the information, as long as they look only at the computers and telephone lines that they control, they're not doing their job. They're not looking at the information itself. They're not looking at the value of the information. They're not looking at who uses it and why, the kind of information, what it does, where it comes from. The value is a big thing we've never looked at.

Editor's note:

See biography, page 257.



t's an

**understatement, because
hardware is astonishing, and
software is primeval.**

—Ted Nelson

THE BYTE SUMMIT

THE SOFTWARE ANCHOR

Why is software so far behind hardware?

Bjarne Stroustrup: Why are we lagging so far behind? I'm not so sure we're lagging far behind. I think people are skewing their comparisons.

Niklaus Wirth: Well, first of all, I don't know whether software is so far behind hardware. It depends on what you mean, "behind." I guess what you mean is that hardware technology has made such vast improvements—they give you 10 times the power for 10 times less money now—whereas software seems to become more and more expensive.

Wayne Ratliff: As soon as computers are made bigger or faster, you can take advantage of them almost immediately. In that case, we keep right in pace with hardware. I guess overall, I don't agree. I think that software is actually outstripping hardware.

John Warnock: The systems are getting extremely large. The management of software and the management of innovation in software [are] extremely difficult. If you're looking at OS/2 and Unix and DOS, these are all 1960s operating systems. They don't have the concepts of really first-rate, advanced-technology operating systems. The industry has to figure out a way of abstracting itself out of the current mess it's in.

Wayne Ratliff: Actually, I kind of came to the opinion that software's exceeding, outstripping hardware fairly rapidly. Hardware is sort of always trying to keep up. We always need these 20-MHz and 33-MHz and 50-MHz machines to try to make software jobs that are already invented practical. I think [that] the biggest point where software isn't really keeping up is not software's fault. I don't know if it is anyone's fault. But it's the fact that users have so much invested, there is so much momentum in DOS. DOS has a 640K limitation, software limitation, ultimately. That is really holding things up.

Alvy Ray Smith: Well, it's very clear that we are going to have to tighten up our software act. I suspect that we'll have to do things like CASE tools and something equally important so that we can work together. My own strong vision of how it's going to turn out is that picturing will become a major part of what you see on the desktop. And by picturing, I mean any use of a computer to make pictures.

Jonathan Titus: I think it's just how we develop software. We tend to develop software the same way we did when I was programming PDP-8 minicomputers with 8K of memory. It's one instruction after the other. We really haven't yet gotten to the point where computer-aided software engineering or CASE-type tools help out very much. What we want to do is draw a grand picture of what we want to have happen, and work that down through our CASE tools.

Michael Slater: But I think there will always be an inherent couple-year lag in the software really taking full advantage, simply because it takes a long time to develop sophisticated software. I don't think there's really any way around that.

Stewart Alsop: That's a natural process. Software has to come after hardware. This is the chicken-and-egg conversation that people always have. Without hardware, software is nothing. Without software, hardware is nothing. But you've got to have the hardware first. You can't write the software until you've got the hardware, so there's always going to be a delay between hardware and software.

Jim Blinn: In the past, somebody comes up with some hardware, and the software people can't do a whole lot until the hardware exists. They can do some simulations and so forth on other computers, but once the hardware comes out, the software people go to town and start doing things. Meanwhile, the hardware people are making something new. Before the software people have a chance to really exercise the existing hardware for all it's worth, that hardware is obsolete, and the new hardware comes along. The thing that is going to change that is some stability in the hardware end, like systems of machines that are software-compatible, VAXes, for example, or PCs or whatnot, so that software development 10 years ago still is relevant to the hardware now. Even though the hardware might be able to do more, at least the stuff you did 10 years ago is still usable.

Tom McWilliams: First off, hardware at the level that the user sees [it], mainly at the instruction set and so forth—architectures—have made advances. But, the machines aren't radically different from what they were years ago. Most of the hardware

advances have been driven by the underlying manufacturing process technologies: the ability to make faster, smaller transistors and so forth, rather than revolutionary ideas in hardware. The problem is that to change the language people program in requires that you retrain all the people and you rewrite all the software.

Ted Nelson: In one sense, it's an understatement, because hardware is astonishing, and software is primeval. On the other hand, hardware that can only chase its own tail is an empty exercise. The brilliance [with] which hardware has been built is mindboggling. The dunderheadedness with which we have been unable to do decent software is also mindboggling.

Bjarne Stroustrup: Yeah, the hardware we have today is astonishing. I mean a pocket calculator can outperform the first digital computer. On the other hand, the user interface used to be, you took this paper tape and walked up to that monstrosity to feed it, and the output came on a printer or in some cases some dots on a screen that you had to convert back from binaries to something digital. And these days, the user interface to the average user is this point and click and there's pictures coming up and there's network software that allows me to get a message deposited in my friend's mailbox in Lund [Sweden] in about 1 second. I'm not sure software's behind.

Wayne Ratliff: There's certainly a lot of evolution and speed capability and capacity. I think that software, if anything, has gone through pretty giant revolutions. I mean, look at the GUI interface—that's just a dazzling thing that's happened in the last 10 years.

John Markoff: I guess I think it's because it's not an engineering discipline. Software is closer to the act of writing literature than it is to engineering. For that reason, you know, there's good art and bad art, and it has to do with human creativity. I think the reason there are too many different interfaces is, we don't understand how to do it right.

BYTE: *Do you think software's just more difficult than hardware? Is that part of the reason?*

Dennis Ritchie: I think that inherently it's simply more complicated. It's possible to put more structure into the software. Any physical object has a natural size, beyond

which you really can't push it. A microprocessor chip is a very, very complicated object. But, nevertheless, there is a certain size, and you know the size in advance. If it looks as if you can't achieve your objective within that sort of size bound, you simply say at some point, "We just can't do this." It fails. It falls over. It just doesn't happen. Either that or you keep it within the size. With software, there's always a tendency to believe that you can add more, and the complexity can simply grow almost without bound.

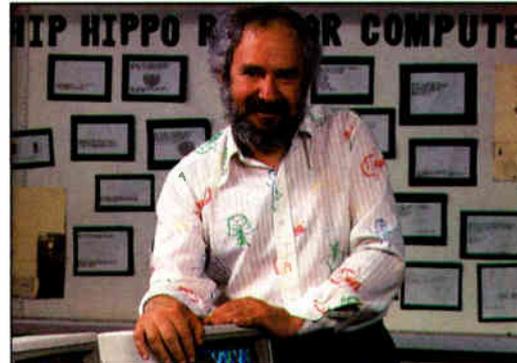
Rich Malloy: I think the problem is basically because the hardware is easier to do. It's much easier to get sidetracked in developing software and to get carried away in various features and to go off on various tangents that take away from the current project, the current goal. Whereas [with] hardware, you're pretty much limited by the size of the chip and by the complexity, and people are planning much more carefully about what the chip should do.

Stephen Wolfram: Software, in a sense, requires a much more sophisticated design than hardware in order to work properly. What your piece of hardware is supposed to do is fairly well understood. The details of the engineering of getting it to [work] quickly and so on and cheaply, that's a hard problem, but it's a fairly well defined problem. In software, things are a little less well defined. You take some general area like mathematical computation or something, and you have to design a system that can be effective in letting people do that kind of computation—that's pretty hard.

David Evans: I think that we're building more complex systems, more complex software systems, than we are hardware systems, for example. What's late now is the software—the systems stuff. And some infer that we don't understand it as well as we do the hardware, or it's more complex.

Bill Stallings: On the hardware side, as you get into more and more complex applications, what you need is a lot more speed, processing power, and a lot more throughput. And the transmission systems and the processing speeds, the storage capacity is continuing to expand at an extremely rapid rate. It's almost straightforward how you do that. You know that every x years you're going to multiply the storage capacity by a factor of 4, as far as things like RAM chips [are concerned]. And those are almost physics problems. But, on the software

continued



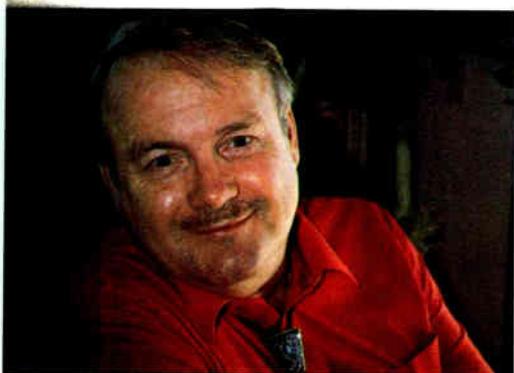
Seymour Papert is professor of mathematics and education at MIT. He is cofounder of the MIT Artificial Intelligence Laboratory, where his research led to the development of the Logo programming language.



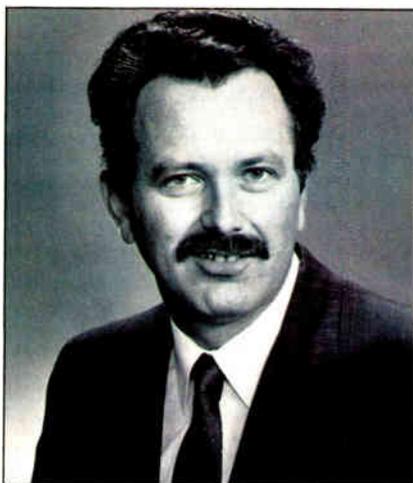
Charles I. Peddle is president of THStyme. He designed many of the more important and successful early microprocessors, including the 6800 and the 6502.



Richard A. Pick is president of Pick Systems, which develops and markets the Pick Operating System. He developed the underlying concepts for the Pick system while at TRW during his nearly 30 years in the computer industry.



Jerry Pournelle is a science fiction writer and a regular columnist and senior contributing editor for *BYTE*.



C. Wayne Ratliff is president of *Ratliff Software Production, Inc.* He is the creator of dBASE II and dBASE III, the most successful DBMSes for personal computers. In 1978, he wrote *Vulcan*, the precursor to dBASE II, on a home-built computer.

side, how do you go from using a mouse to using voice input? That's a qualitative difference, not just a quantitative difference. To keep driving to more and more sophisticated applications, you need quantitative improvements in the hardware and qualitative improvements in the software. And it's a lot tougher to do the latter.

Charles Simonyi: It might be the case that software is inherently harder than hardware, and the usual argument [is,] "How come you know a bridge can be built on time but the software cannot be built on time approximately?" The reason is that a bridge includes a lot of repetitive components, like all the rivets are the same, and in software every time you seem to be doing the same thing, you either create a loop or create a subroutine. In principle, you never do the same thing twice in software. That is why I think it is the hardest thing in the world, because you never repeat anything.

Brian Kernighan: It's too hard to write programs. It's incredibly hard to write programs. We have to tell the damn machine too much about how to do things. We often don't understand it well enough to spell it out in detail. When you spell it out in too much detail, you lose track of what's going on in the details. It just doesn't work. The field is just riddled with examples of things that are too big, not well thought out, don't work right anyway, or are years behind schedule, everywhere.

Dennis Ritchie: I think it's because software simply is able to grow in complexity and in size and without being easily predicted how complex and large it's going to be to do a particular job. And there is no special bound to the extra stuff you're tempted to add.

Donald Knuth: I think that software just has so many more problems to solve than hardware does. If you ask the hardware people to make hardware compilers or spreadsheets or whatever, they wouldn't be any better at it.

Bill Stallings: I think it's because you're no longer dealing with a small, sort of elite trained group of people using the software. You're trying to make functionality available to the people that are doing the work in an organization. And you're getting into issues like ease of use, and even more into issues like artificial intelligence to do that.

Brian Kernighan: I don't know. I suppose you could argue that part of the problem

with software is that it's, on the surface, so flexible that people get sucked into flexing it, spending all of their time changing, refining, and we'll just fix it up in the software thing. And you spend more and more of your time changing requirements for programs. Part of it is, perhaps, that it still seems to be an art form that everybody thinks they can do, whereas hardware is not an art form where everybody thinks that they're experts. Well, I guess it's partly natural. I do software, not hardware, so I think the software is necessarily harder. It's more macho to write software.

Alan Kay: The best new software things I've seen in the last couple of years, I've seen in Japan. Software is not any more difficult to do than hardware.

Stewart Alsop: We got into a particular situation where software got way behind hardware, because you can deal with hardware all you want, but you can't create standards without software. So, I'd say that over the next couple of years, by 1993, that we will have finally made our way through that transition. The gap between hardware and software will go back to a natural gap instead of the unnatural gap that we've had, of software being three and four years, five years behind the hardware, instead of just 18 months.

Bill Gates: There's just some reasons it fell behind. It won't be behind. It will be catching up.

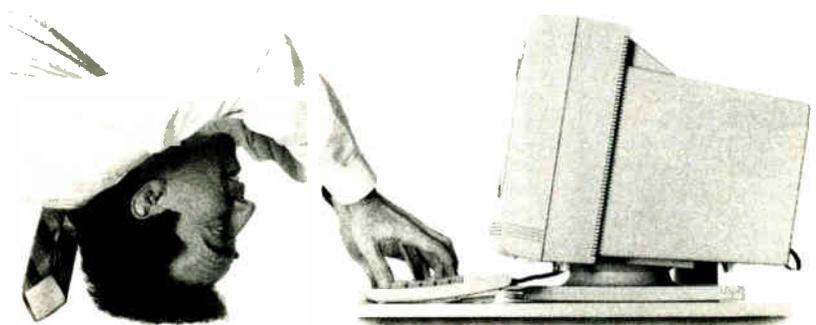
Stewart Alsop: The thing people forget is, this never has happened before. We have never had an industry like the personal computer industry. We've never had a product that was a multipurpose technology like personal computers. All other technologies before have been dedicated to a particular purpose. What makes PCs different is they can be configured to deal with lots of different things.

BYTE: *That does seem to shed some new light on the subject. Perhaps we're expecting too much of software.*

Doug Engelbart: [Software is] a different kind of challenge without the same bounds that the hardware thing has. And then, it's not as visible. To make an analogy, it's as though you were building something physical—you have a limited number of kinds of parts and ways to assemble them, etc. There's still a lot of room for cleverness and design. But in software, you've got a

continued

BENDING OVER BACKWARDS WON'T GET YOUR APPLICATIONS UP AND RUNNING



When your front-end tools fall short, don't get bent out of shape. Get JAM, the user interface management system that goes far beyond the front end tools provided by other vendors. JAM has everything you need to build **powerful, completely portable** applications **quickly and easily.** ▶ With JAM, you can create and link together the screens, windows, fields and menus that make up an application. The result is a working **prototype** that incorporates special features like extensive field edits and validations, context-sensitive help, pop-up windows and pull-down menus—all **without coding.** ▶ And if you're working with databases, JAM's database interface, JAM/DBi, links your applications to many popular databases. Access is implemented directly in JYACC's procedural language using SQL. ▶ JAM applications are **fast** because processing routines are written in standard third generation languages. And, you'll never have to worry about converting your applications to a new system, because JAM is hardware, operating system and database **independent.** ▶ So, if your development tools have you turned upside down, it's time you turned to the experts. JAM, by JYACC. Specialists in application development. ▶ To receive a **FREE** demo diskette and find out more about the JAM family of software products, call our toll-free hotline today!

☑ Supports MS/DOS[®], OS/2[®], XENIX[®],
UNIX[®], VMS[™], Primos[®], AOS/VS[®], VOS[®],
MPE/XL[®], IRMX[®]

☑ Links to Informix[®], INGRES[®], Oracle[®],
Rdb[®], Share Base[™], SQLBase[®], SQL
Server[®], Sybase[®], xdb[®]

800-458-3313

(In NY, call 212/267-7722 or FAX 212/608-6753)

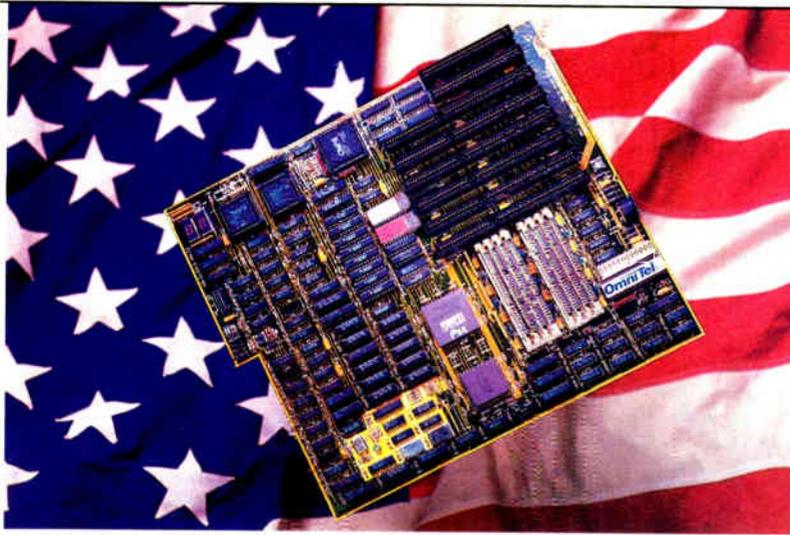
JYACC

JAM

Authorized Distributors: Australia: TUSC 03 899 0063 Belgium: meta logix 03 829 05 81 Denmark: Seven Technologies 01 32 55 77 England: Henley 0491 576 466 Finland: ETY Systems 0 452 3400
France: SQL Tech 01 46 38 31 31 Germany: Datenrevision 040 79 70070 Israel: RTS 02 811462 Italy: ATEL 02 25 52 65 2 Sweden: Sjölin o Sjölin 08 96 1010 Switzerland: Cyclope 021 825 35 85

Circle 494 on Reader Service Card (RESELLERS: 495)

World Radio History



OMNITEL 386-33MHz Motherboard

Setting the Pace in Performance, Reliability and Price!

- 32 MB on board memory using (4MB X 9) SIMM
- 8 layered PCB fab
- 64K (15ns) static RAM CACHE
- On board diagnostics

For A Local Distributor Call:
800-OMNITEL

OmniTel Inc.

Corporate Headquarters
3500 W. Warren Ave. Fremont, CA 94536 (USA)
Tel: (415) 490-2202 • FAX: (415) 657-4079



It might be that

software is inherently harder

than hardware.

—Charles Simonyi

limitless number of complements you can put together. It certainly needs more discipline and methodology and tools, but it's tough, a much [more] wide-open intellectual problem.

Charles Simonyi: Some of it is psychological, in that software people are very, very cognizant of the efficiency, or rather the lack of efficiency, in their product, whereas they are not very cognizant of the same in the hardware side. When we publish a product, we know how much it could be improved by extra effort. So, in a way, we always feel kind of ashamed that we haven't exploited the absolute maximum that is offered by the hardware. But for all we know, the hardware hasn't exploited its own potential. It is very frustrating how far the ideal in your mind is from the reality in the product.

Niklaus Wirth: The point is, if only hardware would make these advances and software not, then my question would be, why not put everything into hardware? The fact is we have software because the custom tailoring of the machines is so expensive that it is still much cheaper to use software than hardware.

Gordon Campbell: I think the fundamental limit is cost on the hardware side. I think it was Bob Noyce who somewhere gave an example a lot of years ago. He said that if the automotive industry had made the same kind of progress that the semiconductor industry had, that today we'd all be able to go out and buy Rolls Royces that would get more than 1000 miles per gallon and cost less than \$100. And somebody else added later that that's probably true, but the fundamental problem, if we'd approached it the same way as the semiconductor industry did, is that we could put 10 of them on the head of a pin. ■

G.W. Computers Inc.
ADCL 4 Eagle Square,
E. Boston, MA 02128
U.S.A.

Tel: **617-569-5990**
Fax: **617-567-2981**

System-IX (Networks) Ltd.
35 Bedford Court Mansions,
Bedford Avenue, London,
WC1B 3AD U.K.

Tel: **071-636-8210**
Fax: **071-255-1038**

MENU-IX, SYSIX, SYSTEM-IX for UNIX, XENIX & DOS

<p>Administration</p> <p>Ad Options</p> <ul style="list-style-type: none"> C Shell Bourne Shell Visual Shell Shutdown Startup Install Appli Remove Appli Kill Process Display Process Display TTY Modify TTY <p>Db Options</p> <ul style="list-style-type: none"> Sys-IX System-IX Csh-IX 	<p>Files</p> <p>File Options</p> <ul style="list-style-type: none"> Free Space Maintenance Create Dir Remove Dir List Dir Print Dir Create File Remove File Print File <p>App Options</p> <ul style="list-style-type: none"> Spreadsheet Wordprocessor Database Other 	<p>Backup</p> <p>Back Options</p> <ul style="list-style-type: none"> Backup Files Backup Filesystem List Backup Print Backup Restore Files Format Diskette Copy Diskette <p>User Options</p> <ul style="list-style-type: none"> Create User Remove User Create Group Remove Group Change Password Applications 	<p>Maintenance</p> <p>Mat Options</p> <ul style="list-style-type: none"> User Printer Invoice Letters <p>Print Options</p> <ul style="list-style-type: none"> Add Printer Remove Printer Enable Printer Disable Printer Start Schedule Stop Schedule Lp Status Print File Set Default Lp
<p>System</p> <p>Acct Options</p> <ul style="list-style-type: none"> Account User Account Group Account TTY Account All Enable Account Disable Account <p>Mail Options</p> <ul style="list-style-type: none"> Phone To User Send Mail Read Mail Write All UUCP <p>UUCP Options</p> <ul style="list-style-type: none"> UUCP Setup Dialcode System Devices UUCP Start Clear Log Remove Log 		<p>System</p> <p>Acct</p> <p>Mail</p>	

\$99.00

Scrollable-resizable Help

Everything onscreen is runtime interpreted from your own edited ASCII file
Online Hot Key dynamically scrolls movable context help from your ASCII file
Unlimited chaining through pull-down menus with ITEM status line help
Supports full system and multiple system calls, auto-minimize to 7k, under DOS
256 colours, highlight bars, unavailable items, All formats XENIX, UNIX, DOS
Edit ASCII file to translate entire runtime to any European language
Runs child system calls and script files, 120 page manual, Unbeatable value

Sysix From \$165.00

+++ MENU-IX +++

A Powerful and comprehensive MENU-ITEM capable of bringing all your programs and file-systems together under ONE user friendly interface. A MENU-ITEM calls either another menu indefinitely, or a program/script/batch file or process.

+++ SYSIX +++

Everything that is in MENU-IX, PLUS a flat file database system, enabling you to design forms/files, and create small database systems with integrated files. Comes with a free application setup; competing; Name & Address - integrated with - a Sales Invoice system - integrated with - a Ledger system. Generates Tax reports, monthly statements and various others.

+++ SYSTEM +++

All that is MENU-IX & SYSIX, PLUS a FAST HITREX index file-system capability for large file systems, and a rich set of utilities. Under DOS, comes with a UNIX 'C' SHELL, and UNIX like utilities such as awk, grep, etc. Includes a multi-window editor. All these systems include 120,300 and 400 page manuals respectively. Available on ALL standard formats.

+++ AUTHORISED INTERACTIVE RESSELLER REL 3.2/VER 2.2 +++ Also SCO Unix/Xenix & Macintosh

APPLICATION PLATFORM \$63.00 NETWORK PLATFORM \$375.00 WORKSTATION PLATFORM \$1435.00
APPLICATION DEVELOPER \$155.00 NETWORK DEVELOPER \$1435.00 WORKSTATION DEVELOPER \$1595.00

NO Compiling
NO Programming
NO Hassle
C Source code is available if desired

DESIGN YOUR OWN MENUS AND FORMS DATABASES WITH JUST AN EDITOR ON A TEXT FILE THAT GETS LOADED AT RUNTIME

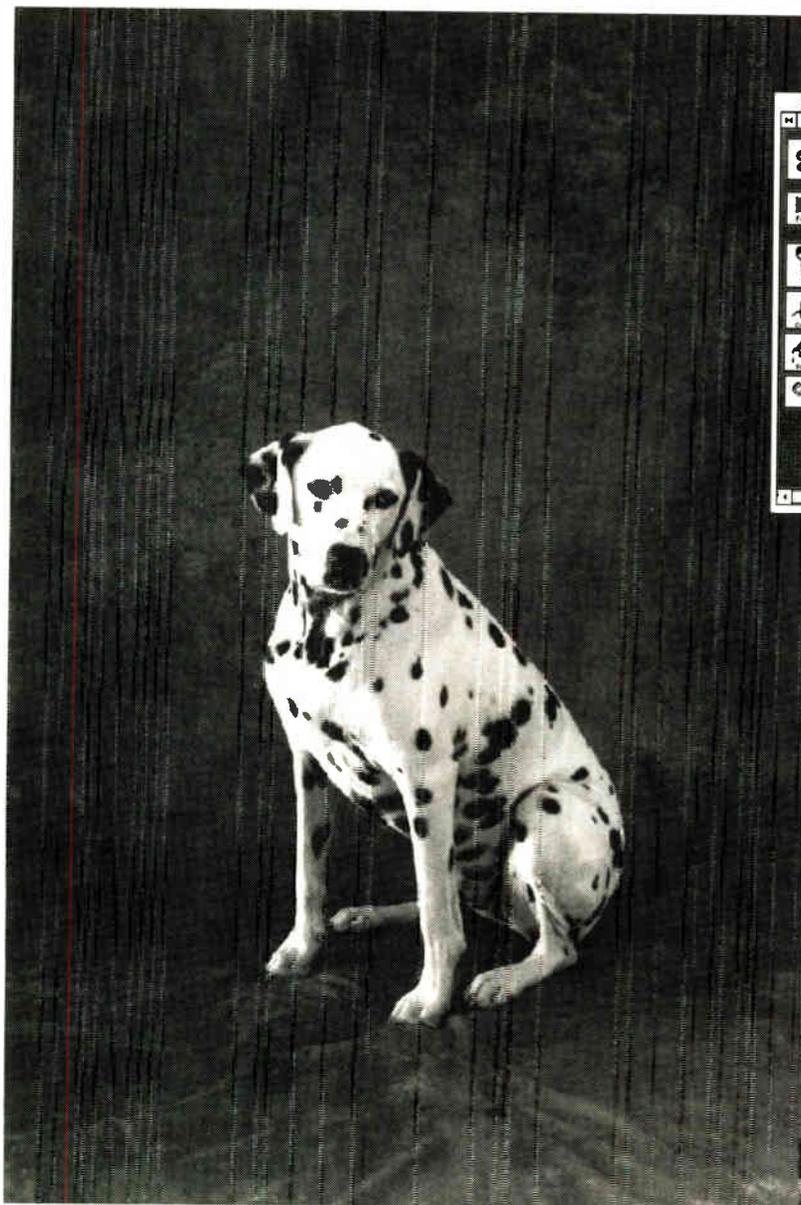
YOU ARE IN CONTROL OF EVERYTHING ON-SCREEN

MULTI LINGUAL RUNS IN STANDARD ASCII BASED LANGUAGES: FRENCH GERMAN SPANISH ITALIAN

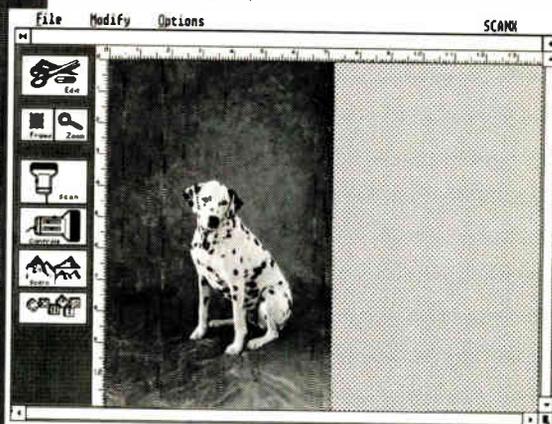
FOR DOS UNIX & XENIX

EXECUTES SCRIPTS PROGRAMS BATCH FILES SCREEN-SAVER TIMEOUT WITH OPTIONAL PASSWORD RE-ENTRY

THIS IS NOT A BLACK & WHITE AD!



This is a two hundred and fifty six shades of gray ad.



When it comes to photographic-quality scanning, NISCAN/GS gives you a shade more for your dollar.

A break-through in imaging technology provides NISCAN/GS with the same true gray-scale output as scanners costing five times as much.

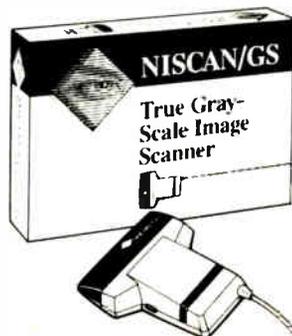
NISCAN/GS has an array of editing tools that can help you effect a subtle retouch or completely remake an entire image. All for \$369.00*.

So if you want professional image quality but you don't think it should cost more than your PC, give NISCAN/GS a try.

Call 1-800-245-SCAN for your nearest NISCAN/GS dealer.

NISCAN/GS Image

Output: Linotronic 300
DPI: 175 (25 - 400 Possible)
Screen: 100 Line
Shades: 256
Scale: 100%



**NISCAN/GS**
image is everything®

**NISCA Incorporated, 1919 Old Denton Road,
Carrollton, Texas 75006, 214-242-9696**

NISCAN/GS is compatible with most popular desktop publishing and paint programs. NISCAN/GS supports IMG, PCX, & TIFF compressed and uncompressed formats.

*Manufacturers Suggested Retail Price.

Circle 513 on Reader Service Card

Douglas Engelbart:

On Bootstrapping

I'm strongly embedded in a framework that I developed in 1960-61 and published in 1962 that's been underlying what I've been doing ever since. It's the concept of bootstrapping. If you're facing very, very complex organization or social or institutional changes, why not, as early as possible, get as far ahead in the computer age to support humans doing that? Which is why I call it bootstrapping—why not use the computer to help you make the transformations?

We're really trying to get that strategy going. That is leading to a lot of things. We're actually making headway in getting some large organizations interested in actually starting this kind of bootstrapping. The very first stuff of that is forming a common-interest community. It's an active, collaborative prototype.

I'm giving these three-day seminars, and here's all the stuff they go through, 200-something slides. It's leading to this whole bootstrap philosophy and saying organizational effectiveness is the goal, talking about paradigms and frameworks as being the basic problem, so any strategy for going after it has to accommodate these.

Also, the changes that are coming about are so many and so rapid. So we have to find new ways, because our old ways couldn't cope with that rate of change. In these new ways, things like pilot experimental groupings of people and new tools, that's going to be very important. There are so many dimensions to explore that cooperation among

different people is important to learn like that. The vendors are going to have to start realizing—as well as our user organizations—that the time it takes to shift the skills and the methods and all of that to fit the best one, given, profile of functions, that's where our expense and the time are going to be. So [organizations] want to have a lot more cooperation between the vendors and the user groups, and the user groups have to get more active.

There's a special role for some kinds of groupware in that if we push that ahead faster, that will just help make the whole process go so much better. That's [why] what I call an "open hyperdocument" system is something whose payoff will just be immense, and it should be pursued real rapidly. And the fact that users aren't getting experience in that yet, and vendors aren't, so the better thing [is] to try to generate an environment in which that kind of experience could get accelerated so you can know sensibly how to aim for products and standards and—whew! That leads to the bootstrap community and what we're trying to get launched.

In the strategy, we're just saying, if an organization really is interested, here would be a way to get started: Join this special-interest community. You'd have to get active enough in it. It would be sort of a prototype way of working in itself. Here's the best targets of activity to use in it. So we have eight to 15 companies of different sizes who are external organizations.

There was a voluntary organization of

a committee from among the representatives of companies who came to our seminar in January who said "Well, let's just draft a trial business plan." So now that is converging to a trial, so we're planning a meeting with any company that's interested enough—and government organization and university and vendor—to come together for a meeting to converge on some plan that sounds sensible enough and then go back home and see if it will [fly].

It's building up momentum in a good way. There's a rapidly growing movement in America on this total quality-management theme. Three years ago or so, the Department of Commerce announced [that] they were going to give an annual set of awards to organizations that best met the criteria they had been establishing for this quality management. More and more companies are saying, "Hey, we're going to go after that award." In the process, one of the [by-products] is a continuous improvement plan with lots of verifiable aspects. This strategy that I talk about wouldn't work unless there were some high-level, continuously present commitment in the company to make their changes. Otherwise, who's interested in talking about strategy? Heretofore, I'd try to talk about this, and I wouldn't know how to find someone in a company. Almost everybody is tied to some project or deliverable or bottom-line thing. So, that is a big change.

Editor's note:

See biography, page 236.



You always find something in the last place you look. Unfortunately, the average hard disk has about 20,000 places.

Of course, you might get lucky. And find the file you want in the 19,992nd place.

Or, you can find it almost immediately with new Lotus® Magellan® 2.0.

When you can't remember a file name, just type in a word, phrase, or concept related to it. Magellan will search your entire hard disk and come back with a list of relevant files in seconds.

Scroll down the list and you'll see each one as it actually appears in its application. Even if it's a graphics file. When you find the file you want, a single

keystroke launches the application and loads the file.



Magellan lets you find a file in seconds, even when you can't remember its name.

Magellan simplifies all of the other utility functions you use most, too. Copy, Delete, Move, Sort, Back-up or Rename files, groups of files, or entire directory

branches in the Tree mode, with one keystroke. And Undelete erased files just as easily. Even view a deleted file before you decide to restore it.

Magellan also lets you save disk space by compressing data files

up to 50%, with the built-in PKzip™ file compressor. And view compressed files without expanding them.

And since Magellan is customizable, you can turn any of its functions on and off, or even build custom menus.

All of which is why *PC Magazine* said, "Magellan could very well be the finest utility ever written for the PC." And why every major computing magazine has given it practically every award they have.

Call 1-800-TRADE-UP, extension 578, for a free auto demo disk.

You'll see. It's exactly what you've been looking for.



New Magellan 2.0 from Lotus

If you own the original Magellan, upgrade to new Magellan 2.0 for only \$39. Call 1-800-TRADE-UP, extension 578, and ask for the upgrade information kit. PKzip is a registered trademark of PKWARE, Inc. © 1990 Lotus Development Corporation. All rights reserved. Lotus and Magellan are registered trademarks of Lotus Development Corporation.

MONO



Traditional PC LAN

AViiON is a trademark of Data General Corporation. UNIX, Novell NetWare, MS/DOS, OS/2, and Macintosh are the respective registered trademarks of AT&T, Novell Inc., Microsoft Corp., International Business Machines, Inc., and Apple Computer, Inc. ©1990 Data General Corporation.

VS. MULTI



PC LAN with AViiON Server

Call 1-800-DATAGEN to learn how Data General and Novell NetWare let your PC LAN do more.

Data General has a host of Novell Portable NetWare® solutions that let your existing PC LAN run multiple applications simultaneously. Novell Portable NetWare on a Data General AViiON™ gives your PC LAN the power to share MS/DOS®, OS/2®, MAC/OS®, and UNIX® files. The power to cruise through MS/DOS, OS/2, and UNIX applications. And, the power to share peripherals.

Data General's NetWare for AViiON is the first RISC-based NetWare platform. It's fully scalable and can share the server with major standards like TCP/IP. It also uses the standard NetWare client software and Novell's IPX/SPX Networking Protocol, so it interoperates with existing Novell LANs. It lets users access

scores of applications. And, Data General offers a Software Developer's Kit to facilitate the development of client-server applications.

Data General's line of Novell NetWare solutions brings transparent networking and distributed applications to all your PC clients.

To learn more about how an AViiON server with Novell's Portable NetWare can bring more power and more applications to your LAN, call the distributors listed below or 1-800-DATAGEN. Also, ask about Data General's full line of PCs.



Data General
3400 Computer Drive, Westboro, MA 01580

DATA GENERAL'S NOVELL NETWORK DISTRIBUTORS

GATES/FA Distributing

121 Interstate Blvd.
Greenville, SC 29616
Sales: 800-332-2222
Customer Support: 800-332-2299
Technical Support: 800-332-2315
Credit: 800-332-3497

Western Microtechnology, Inc.

National Sales Office: 800-634-2248

1637 North Brian Street
Orange, CA 92667
(714) 637-0200

14636 N.E. 95th Street
Redmond, WA 98052
(206) 881-6737

6837 Nancy Ridge Drive
San Diego, CA 92121
(619) 453-8430

12900 Saratoga Avenue
Saratoga, CA 95070
(408) 725-1660

28720 Roadside Drive
Agoura Hills, CA 91301
(818) 707-0377

1800 N.W. 169th Place
Beaverton, OR 97006
(503) 629-2082

20 Blanchard Road
Burlington, MA 01803
(617) 273-2800

2545 Tarpley Road
Carrollton, TX 75006
(214) 416-0103

264 Passaic Avenue
Fairfield, NJ 07006
(201) 882-4999

Four Eves Drive
Marlton, NJ 08053
(609) 596-7775

Circle 470 on Reader Service Card

World Radio History

Expand Your Horizons With BayTech's Line of Statistical Multiplexers

BayTech invites you to expand your horizons to encompass a whole new world of data communications with our line of statistical multiplexers and modems. Our products will allow your communications capabilities to expand to their fullest extent. BayTech offers the highest quality and most cost-effective data communications products available. Let our new horizons lead you to product savings and satisfaction beyond your expectations!

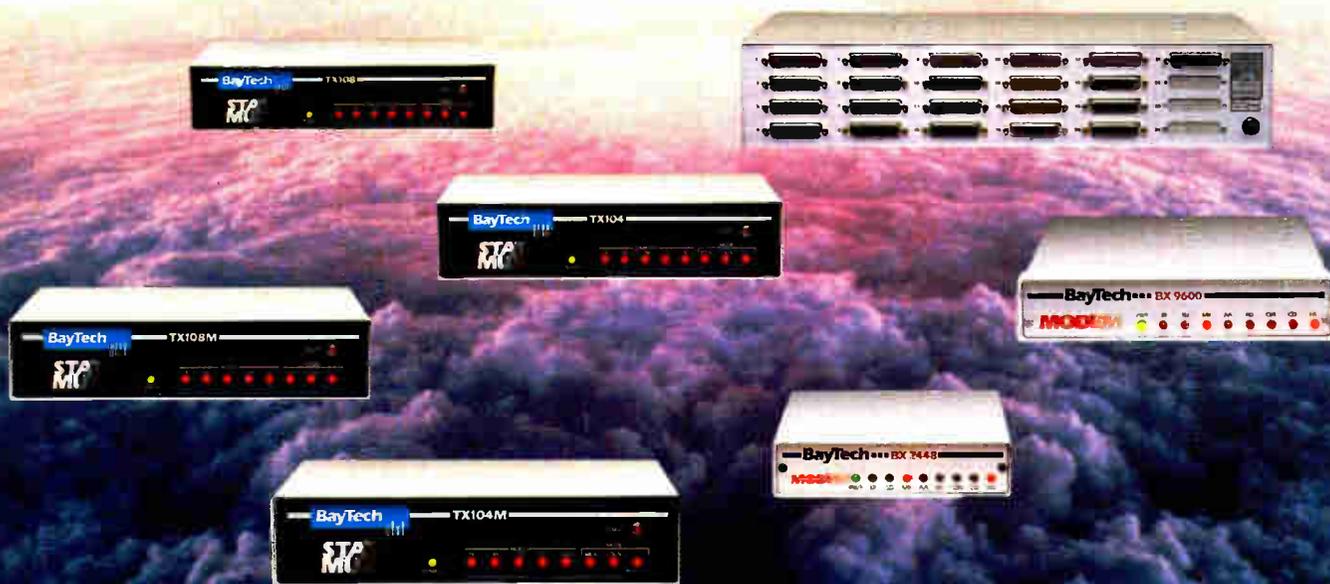
Convenience And Savings In Stat Muxes

BayTech's statistical multiplexers offer convenient, cost-effective solutions for your communications requirements. Our units multiplex from four to twenty individual communication channels to a single dial-up or

leased telephone line, cutting phone line costs to a minimum. BayTech's stat mux line includes units with internal modems. Units without internal modems are designed for use with external modems, or they can be directly connected for distances to 4,000 feet. Quality 2400 and 9600 bps external modems are available from BayTech.

Ultimate Product Support

All of BayTech's products are simple to set-up and to use. And all come with the most efficient technical support available, so BayTech's exceptional service continues long after the product is delivered. BayTech can help you tailor a system today to suit your specific application requirements. Call now to find out how BayTech's products can expand your horizons!



BayTech



Data Communications Products Division, 200 N. 2nd St., P.O. Box 387
Bay St. Louis, MS 39520 USA FAX: 601-467-4551 PHONE: 601-467-8231 or toll-free

800-523-2702

Circle 459 on Reader Service Card
(RESELLERS: 460)



T

here has got to

be a better way, and it's kind

of halfway between

programming and natural

language.

—*Esther Dyson*

THE BYTE SUMMIT FUTURE PROGRAMMING

What changes will we see in programming in the 1990s?

Bob Frankston: Programming is still bottlenecked in the expression of the ideas—or coding, to use a less grandiose term. We're going to be able to reduce the problem, basically make it easier to go from a design or conception to actually something that implements it.

Stephen Wolfram: I think one of the things that is part of the issue is what the building blocks for making software actually should be. Right now, most software is written in the C programming language or possibly some extension of that, and that's a pretty low level at which to create software. It's sort of interesting to think about, in general, how you can use high-level interactive symbolic programming languages to build general-purpose-type software.

Gary Kildall: I think that the actual brand-new language to replace something like C is really not necessary at this point, because C is sort of an intermediate—what I think of as an eye-level language and assembly language. And it seems to do the trick at that level.

Esther Dyson: But the real issue is what you do with the software and the model of the system, and stuff like that. And so things like object-oriented programming and all these other buzzy terms will probably get way oversold but, in the end, will probably really matter and be widely used. But they'll be so widely used that no one notices them.

John Kemeny: I still believe you have a great advantage with a universal language.

Bjarne Stroustrup: I think the idea of spanning the whole spectrum of programming with one language is absurd. It's like this strange notion some people have that there is one language that is the best for all people and all applications. It's crazy. Let's face it. It's like saying there should be exactly one kind of car and ignoring the fact that there's towns and there's country and there's trucks and there's fire engines, all kinds of things. Variety has its place.

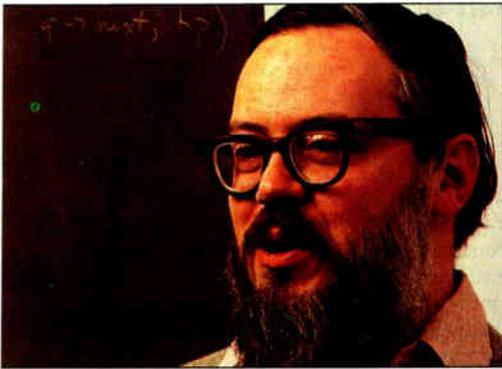
Carma McClure: I think right now what we see [in] the first half of the 1990s are what I would call evolutionary—not revolu-

tionary—changes to software development, meaning that basically the same languages dominate, the same methods still dominate, as have dominated our industry since—what—the 1970s to 1980s. You are still going to find languages like COBOL, for example, being the number one choice for developing business applications. And you're going to hear a lot of interest in object-oriented techniques, and a lot of people beginning to use them and beginning to learn about them, certainly—but I don't think they are going to have a real major impact until maybe three to five years from now. And I see them sort of infiltrating our methods, and you see the traditional structured methodology like Yourdon or something extended to include object-oriented. So, rather than giving the old ones up and replacing them, say with object-oriented techniques, we see them being extended to incorporate object-oriented techniques.

Alan Kay: I think the main thing is that there's no accounting for taste. The fact that COBOL is still around and going strong—even though it was obsolete by around 1965 or so, as far as a language with power [is concerned]—says something about the staying power of the familiar.

Esther Dyson: But there has got to be a better way, and it's kind of halfway between programming and natural language. Just as people don't think of themselves as telephone operators—they think of themselves as dialers—people won't think of themselves as programmers. They'll think of themselves as trainers, just the way I spent [six months] training my secretary. Every day new problems arise, and I show her how I want them handled, and sometimes I give her examples, sometimes I give her instructions. It's an iterative training process. So, in the same way, you're going to train your computer, both by giving it instructions [and] having it watch you, but it will just feel more natural. Ten years from now, people are going to say, "Oh, yeah, training your computer—that's so intuitive." And of course it won't be, but it will be taken for granted.

Carma McClure: I think [developing software] is going to get significantly easier,
continued



Dennis M. Ritchie is a member of the Computer Science Research Center at AT&T Bell Laboratories. He designed and implemented the C language and, with Ken Thompson, created the Unix operating system. He shared the 1983 A. M. Turing Award with Thompson.



Jonathan M. Sachs is an independent software developer in Cambridge, Mass. In 1981, he teamed up with Mitch Kapor to create Lotus 1-2-3. In 1985, he established the Sachs Foundation, which has been active in land preservation in New England and in Central and South America.

Ken Sakamura (not shown) is founder and director of the *TRON Project*, an effort sponsored by the University of Tokyo to develop and standardize computers of the future. The project has already developed a real-time operating system, standardized interfaces, and a 32-bit microprocessor chip set. Professor Sakamura is on the information science faculty at the University of Tokyo.

and I think one of the reasons will be that we won't be developing them from scratch, but we will [be] developing them from reusable software components—I like to call them software chips sometimes. And object-oriented methods are really the first methods that we have where the concept of reusability is really an integral technique within object-oriented. And so, that is another reason object-oriented is important and will play, I think, a more important role in the future—because it really fits with reusability as a development strategy.

BYTE: *Speaking of object-oriented methods, do you think that's a real movement or a passing fancy in the industry?*

Ed Yourdon: I think the industry is just beginning a transition into object-oriented methodologies—I would say that that is going to be the big one in the nineties, as a replacement of the pure process-oriented methodologies, like structured analysis and structured design, and pure data-oriented information-engineering kind of methodologies. And that's something that I'm very much involved in right now, is the whole object-oriented paradigm, which I think the industry does need.

Seymour Papert: Structured programming is good programming. In short, what's being projected there is a way of thinking that mathematicians like and many engineers who are mathematical in their way of thinking like. But it's out of touch with the sort of thinking of very many people, including many mathematicians who like to think in a way that's much more playful, less planned, less systematically organized, more exploratory.

Paul Carroll: I don't know of anything that would be beyond structured programming or object-oriented programming. It does seem to me that object-oriented programming is a very powerful thing that will take hold, and people are catching on to the idea that prototyping really is important. We'll see far more of that.

Niklaus Wirth: I think designing in an orderly structured fashion is inherent to all good engineering design. So whatever additional style differences will emerge in the future, I think a structured approach is mandatory anyway. I look at object-oriented programming not as something dramatically different and new. There are one or two things that characterize object-oriented design, but, by and large, you work with the same concepts as you did before. It

is not something radically new. [Except for] relatively isolated instances you can stick to your design methods that you have used before, provided that they are orderly and structured.

Bjarne Stroustrup: What's lagging behind is, of course, education. People get these great languages, and they come out of schools. They're taught how to write a procedure and to get real benefits of languages with inheritance, encapsulation—the good stuff. You need to start off thinking in a way that's appropriate to it. You have to actually do object-oriented programming, not just your old style of programming with the funny syntax. And that again means that you have to design your programs to take advantage of those facilities. So education matters a lot. Design matters a lot. And then you get tools that support that.

Bob Frankston: I tend to view things like object-oriented programming as overhype terms at this point. Yes, there's something there, but it's just a means, and it's just part of things.

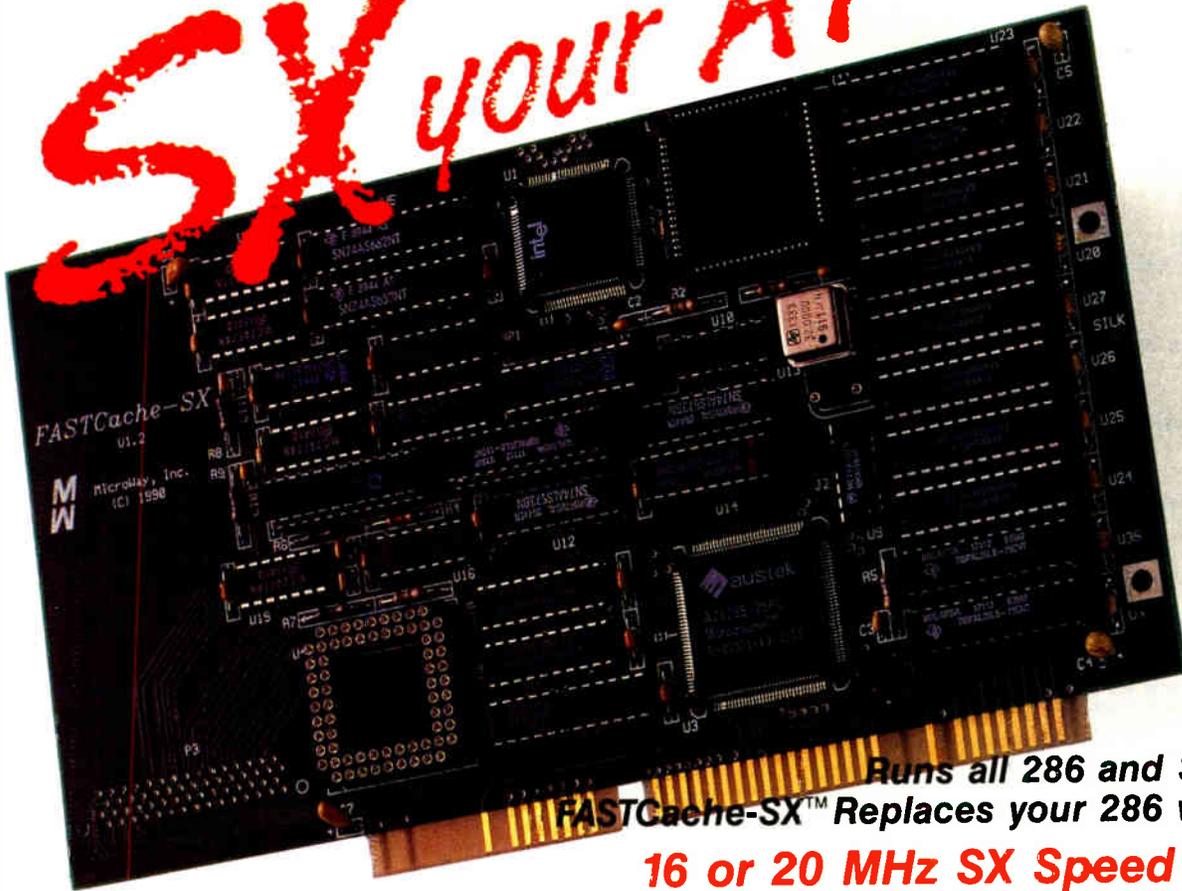
Jerry Pournelle: In a sense, Modula was object-oriented before anybody knew what it meant. And basically what's going to happen is the popular languages are going to get more and more like Modula.

Niklaus Wirth: The crucial example is that when object-oriented preachers talk about numbers, for them numbers are an object of the class number. You can't add 3 and 4 anymore; you have to send the message to add 4 to yourself to the object 3. Now, this is certainly counterproductive, when you not only think in terms of computers, but it confuses people from what they have learned before. That would be counterproductive. Anything that you overdo is counterproductive. When such a new method comes up, I think one should learn to master that method and not become mastered by the method.

Stewart Alsop: The biggest advance I've seen has been the Interface Builder in NeXT—where I've seen real programmers, in a commercial environment, trying to make software for resale, actually find that they had a real gain in productivity: Not in a false sense of programmer A can write 800 lines of code a week instead of 400 lines of code a week, but in the sense that they can take an idea and get from that point to having working code that can be tested and polished in significantly shorter

continued

SX your AT



Runs all 286 and 386 Software!
FASTCache-SX™ Replaces your 286 with a 386SX!

16 or 20 MHz SX Speed from \$495

If you currently use an 80286 and are hamstrung by the 640K memory limit or need more speed, you owe it to yourself to try a Microway accelerator. The FASTCache-SX plugs into your 80286 socket replacing it with a 16 or 20 MHz 80386SX. It is fed by a large four-way cache similar to the one built into the 80486. This results in zero wait state performance using ordinary AT memory.

Running on a 20 MHz FASTCache, the Landmark benchmark delivers 27 MHz for the CPU and 49 MHz for the FPU - four and eight times the throughput of the 286 and 287 that came with the original AT. It is 100% compatible with most 286 powered ATs running all your 286 and 386 software, including protected mode applications like Windows 3.0, DESQview-386 and, of course, Microway's NDP C-SX and Fortran-SX.

The Microway NDP Fortran-SX and NDP C-SX compilers generate the best code to take advantage of your 386SX. They feature excellent global optimizations not found in 16 bit compilers, plus the ability to take advantage of the 4 gigabyte address space of the SX. In addition, our complete line of ancillary products, including symbolic debuggers, profilers, virtual memory, plotting packages, windowing packages, graphics libraries and the NAG numerics libraries, can save you hundreds of hours moving your mainframe code to the SX. We also support the dialects you need, like VMS Fortran and ANSI C with the MS C DOS and graphics extensions. However, the best feature of these products is their price, just \$595 including the DOS Extender tools needed to run the SX in protected mode!

At a suggested list price of just \$495, the FASTCache-SX-16 is a real bargain!

Limited Offer - If you purchase a FASTCache-SX before October 15, we will bundle in a copy of the SX version of NDP-C, NDP-Fortran or NDP-Pascal for half price. For just \$795 plus the cost of an 80387SX you will be able to convert your 286 AT into a 32 bit development platform that will provide you with VAX performance for a fraction of the price! To order please call 508-746-7341.



Microway

World Leader in PC Numerics

Corporate Headquarters
P. O. Box 79, Kingston, MA 02364 USA
TEL 508-746-7341 • FAX 508-746-4678

U.K. 32 High St., Kingston-Upon-Thames, 081-541-5466
Germany 069-75-2023 Italy 02-74.90.749
Holland 40 836455 Japan 81 3 222 0544



he biggest

**limitation is the failure of
imagination that people tend
to project.**

—Bob Frankston

times. And the reason the Interface Builder seems to have an effect is not so much that there's an object-oriented development environment, where you have componency you can hook together—which is part of it—but that it incorporates the notion of prototyping, as part of the development process, in a way that no existing computer language has [ever] incorporated [it].

Dennis Ritchie: One thing that seems to be happening is that people are getting away, to a certain extent, from the procedural sorts of things, which is independent of object-oriented and so forth. Maybe I'm being unfair, but basically, that's a refinement or a variation of the same need of procedural programming, a little different style. But there are languages that are much more involved in data-flow things where the order of events is not so important but the grand flow of it is that data is passing by this program. That's something that I think is likely to increase so that, to some extent, [you're] increasing abstraction. Whether all this will make programming, as such, much easier for the average user, I don't know. I tend to doubt it. It's hard to see that it'll really make a gigantic change. It's not clear that the average user really wants to be a programmer, anyhow.

BYTE: *What do you think we mean when we talk about the average user doing programming?*

Bob Frankston: There's going to be a lot of empowering of the users in terms of programming so you'll be able to describe things better. I will give spreadsheets, of course, as an example of that, where the real thing is [that] you empower the user to take a description of the computer. There was a middle ground. The computer didn't speak the user's language literally, but

there was a middle ground in which there was—I hate to be anthropomorphic—some sort of understanding. The key thing is, they both dance with each other. That's going to be more widely available as computers get the power in terms of raw MIPS, and then we're going to handle some of the software capabilities. How do you give the user the ability to describe sort of interesting processes?

Carma McClure: I can see where lots of packages go into the hands of end users where they take the design of the system and they play with the interface, and they change it the way they want it, and then they just generate the system that they need.

Chuck Peddle: This thing about the concept of the program generator that lets people tailor programs—I have a strong belief that that is going to be important. I'm really surprised it hasn't done better than it has. So, I think that is a place to be looking for—the higher-level, tailored, specialized application.

John Markoff: I think that we'll see tools that will permit the average user to customize applications. Those are already there, and they are going to get much better. Apple's coming with stuff that will be built into the operating system. ToolBook is coming for Windows. Those are major thrusts in that direction for the nonskilled programmer. For real programmers, of necessity, the evolution of the computer industry is prying people away from the machine. Because programs have to be portable, people can't program in machine language anymore. Usually, there is still a penalty that is paid for that in terms of performance, but portability is more important than performance these days.

Niklaus Wirth: I don't know what the average computer user is. A competent computer user should in the future be able to buy systems that he can relatively easily extend and adapt to his particular needs, if he has the competence to some programming. So good computer users will become capable of doing such extension—custom-tailoring—themselves. But perhaps that is not the average.

Gary Kildall: Usually, when you get beyond just the basic language, general-purpose language, you get into special-purpose kinds of things. What you're really trying to do is get a control language, and a language built to really express that particular application fairly nicely.

Stephen Wolfram: The problem is that introducing a new programming language is a serious kind of sociological problem in the sense that if you tell people, "We have this great new programming language," people will immediately say, "Look, we're not going to recode all of our billions of lines of FORTRAN code or C code, or whatever it is, in your great new programming language." And so, really, the only way to introduce a new programming language is in a kind of Trojan-horse type of approach: People start using it as an application program, but then kind of fall into using it as a programming language.

Gary Kildall: C and most other languages are basically what we think of as top-down programming languages. You start with `main()`, and you start writing the rest of your program from there. But most of the things that are happening in embedded controllers and microprocessors now are exactly the opposite. It's all from the bottom up. It's all event-driven. And C and most other languages do not have that [bottom-up] perspective.

Stephen Wolfram: I think one really incredibly important direction in building software is going to be using higher-level languages. And I think the kinds of things one can expect to see happen in the next few years are things like being able to build graphical user interfaces and so on, using specification languages that are high-level symbolic languages, and being able to, for example, have some symbolic data structure that you can manipulate interactively that represents dialog boxes, windows, and things on your screen.

Gary Kildall: The improvements in the languages, I think, are going to be more oriented again toward some of the vertical markets, like scripting languages and things like that, where we'd have basic primitives that we build in something like C and just, you know, choose your favorite language. And then you build up languages that are really appropriate to the particular application that you are doing.

Bjarne Stroustrup: People talk about HyperCard and such things—that's programming of a sort. They still edit from a professional programmer point of view, but it's not meant for professional programmers. On the other hand, the casual programmer looks at something like C++ or even Pascal and says, "This is horrible. This is incomprehensible. It's useless. It's too hard

continued

We'll take your stats and make you the most valuable player in your league.



March 14, 1989

CHRIS JOHNSON Data Analyst

CAREER HIGHLIGHTS:

1983
Proposed remap of sales territories based on SPSS analysis of economic and consumer trends. Increased new-customer revenues 38% in 2 years.

1985
Used SPSS data entry/tabulation system to administer employee benefits more efficiently. Eliminated outside costs of more than \$75,000.

1986
Identified current customers likely to need added services, increasing average billings by more than 20%.

1988
Rewarded with special corporate recognition and bonus.

Another Story in the SPSS SUCCESS SERIES

Data analysis software from SPSS gives your PC a winning advantage.

It doesn't matter which field you play hardball in. With the right combination of equipment and ability, you can be a hero.

You get that ability with SPSS. Whether your equipment runs on MS-DOS™ or PC-DOS™ OS/2™ or a Macintosh.™ So you turn raw data into useful facts. And yourself into a smarter decision maker.

With SPSS and its options, you can interface directly with data from your database, spreadsheet or other

application software. Then manipulate it in countless ways. From data entry to advanced statistics, forecasting, presentation and more.

Voted #1 by the fans.

When the readers of *PC Week* chose the top statistical software for "user satisfaction" (12/5/88), their choice was SPSS. And no wonder.

SPSS is designed not only for your computer's operating system, but also for its operator. With menu and help systems, plus an on-line statistical glossary. So you're always in control. For market research, sales analysis, quality control and more.

And you can always count on the training, support, and ongoing upgrades of SPSS. The team that's come through for over 1 million users since 1968.

Find out how SPSS can make you first in your micro league, by calling
(312) 329-3315.

We'll give you the numbers to really stand out in your field.

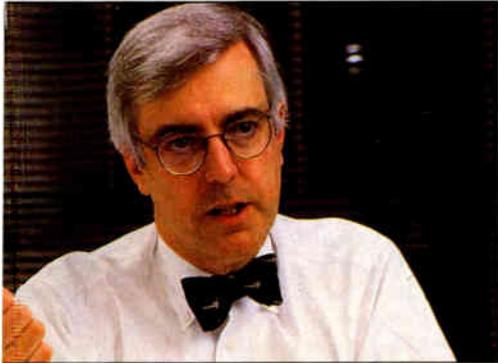
SPSS inc.

Best in the final analysis.

444 North Michigan Avenue, Chicago, Illinois 60611
SPSS International BV: Avelingen West 80,
P.O. Box 115, 4200 AC Gorinchem,
The Netherlands

SPSS is a registered trademark of SPSS Inc. PC-DOS and OS/2 are trademarks of International Business Machines Corporation. MS-DOS is a trademark of Microsoft Corporation. Macintosh is a registered trademark of Apple Computer, Inc. Not all options are available on all operating systems.

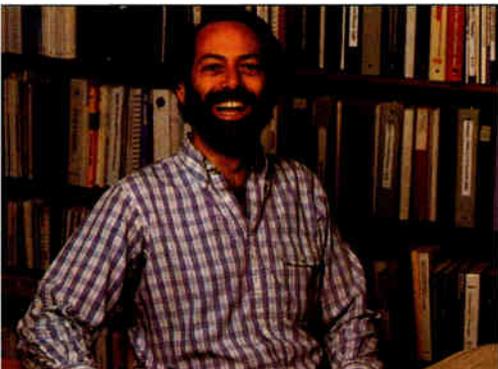
Circle 273 on Reader Service Card



Richard A. Shaffer is founder and principal in *Technologic Partners*, a consulting and publishing firm, and editor of *Computer Letter*, a weekly financial newsletter about emerging computer companies.



Charles Simonyi manages the development of application programs for *Microsoft Corp.* At Xerox PARC, he developed the first WYSIWYG word processor for the Alto.



Michael Slater is editor and publisher of *Microprocessor Report*. He also organizes the annual Microprocessor Forum conference, consults on microprocessor strategies, and conducts training seminars.

to learn." It wasn't meant to be learned in 2 hours by a casual user.

Brian Kernighan: I think what we'll see perhaps is that the set of tools that are available to people are more and more flexible so that people will be able to tailor them to particular jobs, so that you could imagine that they're kind of like programmable tools. But the transition from not programming to programming should be very smooth—where the program may do almost what you want right away, but, if not, you can fairly easily adjust it so that it does.

Paul Carroll: I don't think we will see in the next 10 to 15 years lay people do any appreciable amount of programming. I think they'll do a little customization of their software, because software developers will be able to cleverly hide that complexity from people. They'll just run people through a series of menus initially asking them how they want to handle something or other. You could in some sense think of that as programming, although I guess I don't. I certainly don't think people want to go beyond that.

BYTE: *What kinds of changes do you think we'll see in the jobs that programmers do?*

Stewart Alsop: I think programmers will become more efficient, but it will require a fundamental change in the approach to programming, and a lot of programmers are going to get waylaid by that change.

Seymour Papert: Many of the kind of programmers we used to call hackers (before the days when *hacker* was taken as a disreputable word) don't like to program in a structured way. They like to make something, maybe quick and dirty, that works. That's another way of doing computation.

Stephen Wolfram: I think also that the notion of who's a programmer and who isn't a programmer is going to get considerably blurred. It's already something that's happened a bit with macros for [Lotus] 1-2-3, and happened—perhaps less than was hoped, but happened somewhat—with HyperCard. And I think that, increasingly, what one will see is higher-level languages where writing in them is not so much thought of as being programming. I think part of people's feeling about programming is [that] programming involves doing all of this quite obscure, very machine-oriented stuff, and that will be decreasingly true.

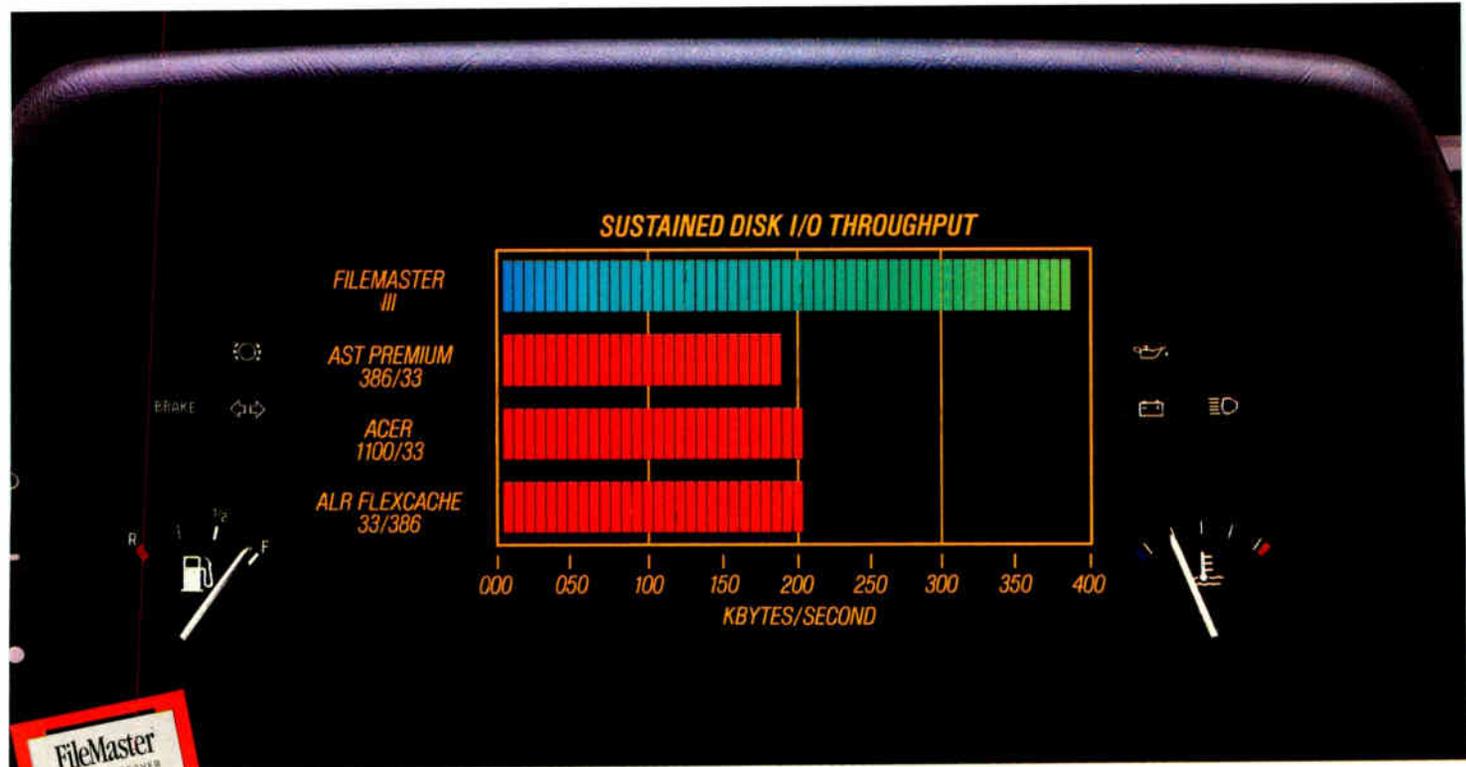
Bill Gates: Programmers are always the professional people who might get at things in a different way. But these visual tools—these object-oriented tools—they are fundamentally the tools we're going to use. The C of the eighties is C++, with a library of objects including visual objects and application objects. It means that huge portions of what you had to code before—the user interface pieces—are very easy to change how requirements work. You don't have to program all the algorithms about how you do resource allocation or what logic to use or how to categorize things.

Niklaus Wirth: No, I think programming will always remain important. I still remember 30 years ago when a colleague at Stanford asked me, "Can you imagine that you at 50 will still [be] doing programming? That's nonsense, you will move up somewhere. That is detailed, grubby work," and so on. And I have, together with a colleague, built a whole system, and I programmed it myself, and I really enjoyed [it]. I found it terribly interesting, but it needs, somehow, a technical mind to enjoy this kind of work.

Bjarne Stroustrup: I think that the world will be split up in what we call professional, or serious, programmers and casual programmers. If you look at history, then, people have always been talking about automatic programming. They have been talking about these grand new languages that are going to eliminate the programmer. It's always just the next technology around. But if you look, programmers have always been there. There has been a certain skill to it. To do a really good program, you have to know an application area, and you have to know something about the craft or engineering. If we're pretentious, or maybe if we've learned a little bit, we need both there.

John Kemeny: I still feel very strongly that learning how to program is an essential part of understanding computers. I don't mean someone who is just going to use it for word processing. But if you are going to do any serious work on computers, you really ought to program once in your life. I've even argued that if they are never going to write a program later in their life, the experience of writing a few programs, and particularly the experience of trying to debug programs, is a terribly important experience in understanding computers. Without it I don't think people have a feeling on how much they should believe of what comes out of a computer. ■

FileMaster™ Sets New



LAN Speed Record.

When we set out to develop the industry's first fileserver dedicated to Novell®

high performance networks, we designed it to be fast. Starting with a 386 CPU running at 33 MHz, we added a 16.5 MHz, high speed bus. Then came our proprietary AISA™ storage architecture that actually increases FileMaster speed as memory and drives are added.

How fast is it? In head-to-head competition against the biggest names in the business—AST, ACER and ALR—FileMaster won going away, with system throughput that measured almost twice that of the nearest NetWare® 286/386 competitor.



Now we are offering qualified systems integrators an opportunity to take FileMaster for a 30-day Test Drive on their own Novell tracks. See for yourself just how much faster—and farther—a server can take you when it's designed for only one job: *optimum Novell network throughput.*

It's not often a LAN speed record is broken. Or a chance like this is offered. So contact one of our participating FileMaster distributors listed below. Or call us directly at (408) 879-0300.

Storage Dimensions, 2145 Hamilton Avenue, San Jose, CA 95125.



STORAGE DIMENSIONS

U.S./Gates/FA: (800) 332-2222 Microware: (800) 777-2589 Micro Wholesalers: (800) 462-6002 MP Systems: (800) 854-8885 Tech Data: (800) 237-8931 Vitek: (800) 366-6655; CANADA/Star Peripherals: (800) 387-9772; UNITED KINGDOM/Ambar Systems, Ltd.: 0296-435511; BELGIUM/Computer 2000 NV/SA: 053-786125; FRANCE/Omnilogic: 01-40052800; WEST GERMANY/Computer 2000 AG: 089-76990161
FileMaster and AISA are trademarks of Storage Dimensions © 1990 Storage Dimensions

Call me, I'm interested: circle 536 on Reader Service Card

Please send literature: circle 537 on Reader Service Card

One Word About Your Hard Disk Controller

SLOW

One Word About the PSI hyperSTORE Controllers

FAST

Intelligent Mass Storage Controllers

Virtually all applications are disk bound. Today's PCs have over 60 times the power of their ancestors of just ten years ago, while hard disk performance has only just tripled. This makes mass storage the PC's worst bottleneck. PSI has eliminated this bottleneck with the hyperSTORE Caching Disk Controller, a sort of mass storage co-processor. The hyperSTORE

does for disk-intensive programs what a math co-processor does for number-crunching software. Databases, file servers, multiuser systems, and other disk-hungry applications start screaming . . . frustrated users stop screaming! Call (800)486-FAST now to find out more about PSI's line of intelligent controllers. All you have to gain is time.

hyperSTORE FEATURE HIGHLIGHTS

- Works in any 286, 386, or i486 system
- Simultaneous support for any interface: MFM, RLL, ESDI, SCSI, or AT/IDE
- Can control up to 28 physical disk drives
- OKB to 20MB of SIMM-based cache memory
- Supports all standard operating systems: DOS, Windows, UNIX/Xenix, Netware, etc.
- Data mirroring option for fault tolerance
- No device drivers are required

PSI

Perceptive Solutions, Inc.

2700 Flora Street · Dallas, Texas 75201

800-486-FAST · 214-954-1774 · Fax: 953-1774

European Inquiries: 415-284-9505

"This thing is literally faster at disk access than the original PC was at memory access."

-Jerry Pournelle, *Info World*, June 11, 1990

"PSI has created the power user's ultimate Lego set for disk controllers: the hyperSTORE/1600"

-Alfred Poor, *PC Magazine*, June 12, 1990

"The real-world result will be blazing record handling from within a data file as well as unstoppably fast program loads."

-Bill O'Brien, *PC Magazine*, February 13, 1990

©1990 by PSI. All rights reserved. hyperSTORE and the PSI logo are trademarks of Perceptive Solutions, Inc. Other brand and product names are trademarks or registered trademarks of their respective companies. Specifications subject to change. Ad Code: BY9009

Circle 523 on Reader Service Card (RESELLERS: 524)

World Radio History

Chuck Peddle:

On Microprocessor Trends

Because of the enormous installed base on the 8086 in the PC world—you've got a number estimated at 40,000 useful programs that are in general-purpose circulation, that use that architecture—for some relatively long period of time, probably through the end of the century, the continued supporting of [that] installed base will be terribly important to the marketplace. There's a bunch of ways you can get that done that are not necessarily buying the latest, hottest product from Intel; but, clearly, microcomputer systems, as opposed to necessarily microprocessors, are going to include some member of [the 8086] family for a long time.

Having said that, the next major thing that is driving the marketplace at this point is the fact that with the ASIC development tools that are available today, and the compiler generators, and the higher-level-language kinds of programs that are going on and everything else, you're starting to see a family of what I call "customer-design general-purpose microprocessors" occurring in the marketplace. And they are really super-ASICs. SPARC and MIPS meet that definition.

They're not strong enough and general-purpose enough, and cheap enough, and so forth, to have as broad a market following as, say, the 6502, or the 8088 or whatever. But they definitely have enough general-purpose application that multiple people will use them, and there is some level of support for them. So, that's a definite market trend. I think [that] you will continue to see that super-ASIC with some level of general purpose, and I think this will probably be where we get the richness of the development. I think we will see just a ton of those coming out (a ton being some number greater than 10).

And to the extent that, if Intel continues on the track that they are on—of forcing the marketplace to pay higher

and higher prices to Intel, who is then, at the same time, undercutting the very guys that are buying from them with their own end-product applications—there definitely is going to be some sort of marketplace rebellion against the level of control that Intel has. The rebellion won't be [an] overt "I won't ever buy another Intel chip" kind of thing. It will be that [vendors] slowly reverse this trend by building in some version of an Intel processor and putting in multiple general-purpose control processors for which they write all of their code. And they don't write any more code for the Intel processors themselves. And they use the Intel processors more as a compatibility tool, à la the 1401 simulator on the 360. Over a period of time, maybe a decade, you reduce the dependency on Intel as your only supplier.

Now, clearly there are some guys who are not going to take that strategy. The problem is that they are the guys who are always going to be bitching about [Intel's] price point and performance, and everything else.

The Importance of Memory

[On another front], the low-cost control-oriented product has not kept up with the growth in memories. They really haven't done it. What I am saying is that there isn't a family of products that are aimed at memory-intensive, higher-performance control. Some people talk about a SPARC doing that: It's the wrong solution. The SPARC, because it was a custom, was aimed at solving a problem of, "How am I going to get Unix running quickly; how do I run this C program?" and so it is tied to memory in a funny way. And it's really not the right answer, but it is the best one around right now.

And I really believe that that's a tremendous market opportunity. I hope we will see some number of general-pur-

pose guys continue to play in the marketplace, but solving a problem different than trying to take Intel on head-to-head. And I think if they don't, they lose.

Memory technology continues to drive the processing capability we've got. So I think you are going to see the real focus on getting memories that are good enough to keep up with some of this processor capability and system capability. I think that is where you are going to really see a lot of the inventiveness.

If you wanted to make a general comment on the most important difference in the [last] 15 years, it is that the amount of money that's on the table in the industry, it's so big that it changes the rules from 15 years ago.

The Payoff

I think we have to back off and ask ourselves what human beings need. What's the human's problem? Human beings need different things than we are driving for right now. And [that is] the other half of the thing I'm doing. I think that there is a human solution for how you use a lot of this technology that nobody else is working on. [I take that back]; there's too many people in the world to make that [broad a] statement.

A lot of people aren't writing about the solutions that I think people need. I think that's important. I think that that is where the applications are going to come from.

What do human beings need to do next? I think I know the answer, and that's what I'm working on. We are in the process of financing a company that has a chance of making a major market breakthrough, and we'll let you know if we get it financed.

Editor's note:

See biography, page 325.

THE BYTE SUMMIT

INSIGHTS

Ryoichi Mori:

On Superdistribution

I believe that the most fundamental breakthrough that will have huge effects is the realization of the smooth distribution of digital information. If we could establish a microelectronic method to achieve this breakthrough, then it would have the effects [on a scale] comparable to the breakthroughs that made the mass production of computer hardware economically possible.

I have been proposing a concept—superdistribution—to realize the breakthrough. Methods to realize satisfactorily fair transactions of digital information either place limitations on the actions of users (e.g., prohibit the copying of information) or keep and collect usage records that hold who has used

how much of what software.

Limiting the actions of users has proved very unpopular. It prevents the healthy growth of the software market. It is also widely recognized by most software manufacturers that it does not provide more profit for themselves. Therefore, the collection of usage records is the only way to realize satisfactorily fair transactions of digital information. Then the task for us is how to realize it by making the generation and collection of the usage records as comfortable as possible so as to be accepted by the users widely.

For the next 10 years, there is little doubt [that] the semiconductor integrated circuit technology [will] keep the

same rate of progress—that is, an increase of the integrating density of four times [for] each three years (1.6 times every year).

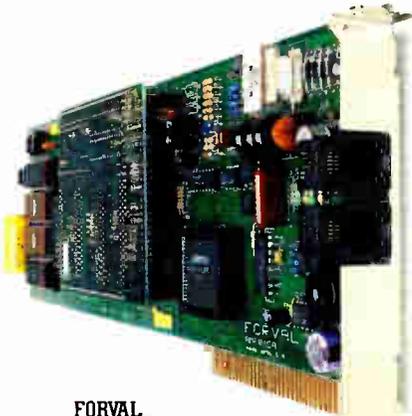
If this prediction is right, social needs for the microelectronic technology to provide the smooth distribution of digital information will become very strong. The reason [for this] is that the needs will become stronger as the scale of the software—or computer—market grows, and the cost of the microelectronic measure [needed] to realize that smooth distribution [will go] down rapidly.

Editor's note:

See biography, page 304.

The End Of The Me-Too Modem.

New
Stand-Alone
Version
Now Available.



FORVAL
IM14400 Internal PC Modem

When it comes to high speed, dial-up PC modems—we mean the very compatible kind—chances are, you had to settle for one of those me-too modems that look and act pretty much the same, over and over. And over.

Chances are, you also had to send your data at 9600 or 2400 bits per second. Or slower.

With FORVAL's new IM14400 internal PC modem, you can speed your data over the phone lines at 14,400 bps. And if you're really in a hurry, the IM14400's data compression mode will deliver your files and images up to a very impressive 57,600 bps. That's significantly faster than most me-too modems around.

Of Course, We Do Slow Things Down For The Competition.

Being 14.4/57.6 kbps fast doesn't mean we won't slow down for the me-too's. With the IM14400's automatic step-down mode, we'll talk to

them at the CCITT speeds of 9600, 2400, and 1200 bps. Whenever necessary. We also use the Hayes™ AT command set so you can run most popular communications software.

The IM14400 is unmatched when it comes to innovative features and technologies. To ensure accuracy and compatibility, we've incorporated the latest industry standards: the proposed V.32 extended transmission speed, V.42/MNP2-4 error correction, and V.42 bis/MNP-5 data compression. We've also added FORVAL Turbo Interface™, an extra safeguard to preserve data integrity at speeds over 19,200 bps. Me-too modems don't compare.

IM14400 Features:

- 14.4 kbps (proposed V.32 bis)
- Maximum 57.6 kbps with V.42 bis/MNP-5 compression
- Error Correction V.42 (LAP-M and MNP2-4)
- Hayes™ AT command set compatible
- Automatic/Manual fallback to 9600, 2400 bps and slower
- Full duplex synchronous/asynchronous operation
- FORVAL-Link™ and FORVAL Turbo Interface™
- 5-year limited warranty

AVAILABLE SOON IN STAND-ALONE
AND RACK-MOUNT VERSIONS.



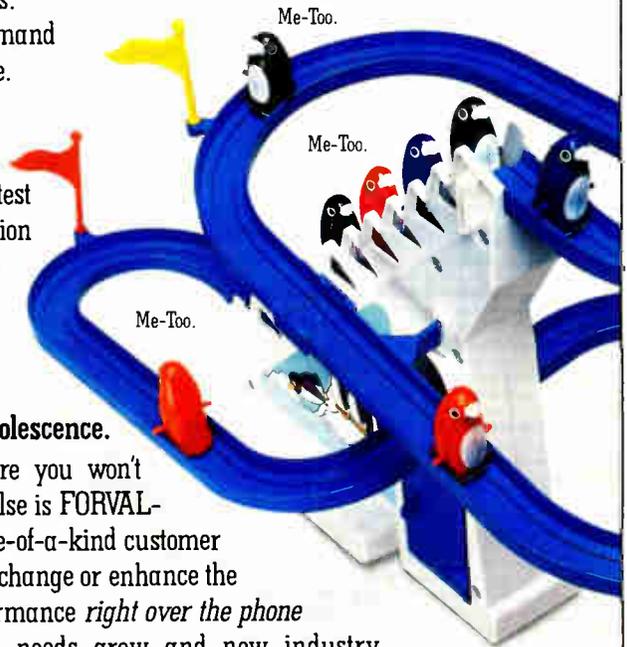
The End Of Obsolescence.

One more feature you won't find anywhere else is FORVAL-Link™. This one-of-a-kind customer service lets you change or enhance the IM14400's performance *right over the phone lines*. As your needs grow and new industry standards emerge (like 19.2 kbps), your investment is still protected.

Call FORVAL toll-free today for more details. Do it now, and get a price that even the me-too modems will find hard to match. **1-800-FORVAL-1**

FORVAL AMERICA, INC. • Modem Division
6985 Union Park Center, Suite 425 Midvale, Utah 84047
Tel: (801) 561-8080 • Fax: (801) 561-8777

Copyright © 1990 FORVAL AMERICA, INC. FORVAL-Link and FORVAL Turbo Interface are trademarks of FORVAL AMERICA, INC., Hayes: Hayes Microcomputer Products, Inc., MNP: Microcom, Inc.



Esther Dyson:

On Computers and Eastern Europe

I don't think you can go into the Soviet Union and Eastern Europe and make deals with the state-run corporations, with the industries that employ 60,000 people, 58,000 of whom are paper pushers. I think that's the wrong way to go about it. Compaq, for instance, is dealing successfully with individual dealers in Eastern Europe.

I think computers will be an important agent for change in Eastern Europe. In the Soviet Union, for instance, you find many people setting up their own businesses—selling T-shirts, or farm produce, stuff like that. Now, with computers, you're getting the intelligentsia involved in businesses. These are people who have felt useless—useless—all their lives! Do you know what it is like to feel useless all your life? Computers are turning many of these people into entrepreneurs. They are creating the entrepreneurs these countries need.

Computers are interesting and exciting. [That's why] they're important. If you're a trained engineer, you don't want to sell shoes, but you may find it

exciting to sell computers. There is an excitement to computers that you don't find in other areas.

I have done a lot of traveling in Eastern Europe recently—Hungary, East Germany, the Soviet Union. (I will never confuse Budapest with Bucharest again.) I'm organizing a conference, The East-West High Tech Forum (Budapest, [Hungary,] October 21-24, 1990). I want to be the Ben Rosen of Eastern Europe—not by supplying capital, but by bringing people together and supplying ideas and knowledge.

The revolutions [in Eastern Europe] weren't brought about by computers—I think television was far more important in bringing about the changes—but I think that computers, the computer industry, will play an important part in the economic revolution that will take place over the next 10 years by providing the entrepreneurs [that] these countries need to develop true market economies.

Editor's note:
See biography, page 236.

The **KEY** to your **OS/2 LAN SOLUTION**

INTEGRATE advanced word processing into your *Mission Critical Application* with
DeScribe™ —Word Publisher v2.0

CONTROL

Your application launches and controls DeScribe via our powerful macro language. Query and alert users. Chain macros and pass information between them. Compile and debug macros to boost speed. Write your application in any language with DeScribe. Review compiler messages.

Link

Forge hot links between your database and DeScribe using Dynamic Data Exchange. Your DeScribe document automatically updates when the database is changed. Create the DDE link in DeScribe. DeScribe opens the source file.

Customize

Map the keyboard. Add Hot Key definitions. Change the menus or invent new ones. Bind macros to keys or menus.

Easy

DeScribe's graphical interface is easy to learn, easy to use. Word processing operators can expect to produce their first business letter in less than 17 minutes . . . without instruction.

Features

DeScribe's "next generation" word processor features add professional polish to your pages with features like:

- Unlimited UNDO
- Import art¹
- Import formatted text²
- WYSIWYG display (means no surprises when printing)
- Multiple search and replace
- Multi-lingual spell check
- Thesaurus and definitions dictionary
- Protected text
- Network Resource Management

For Presentation Manager

" . . . DeScribe may be just the excuse you need to switch to Presentation Manager."

Eric Brown, PC World



DeScribe™ — Word Publisher US\$595. Language options US\$149.95. In the United States or Canada, your local computer store can order a copy from Ingram-Micro D. Now available from your local computer store in France, Germany and United Kingdom.

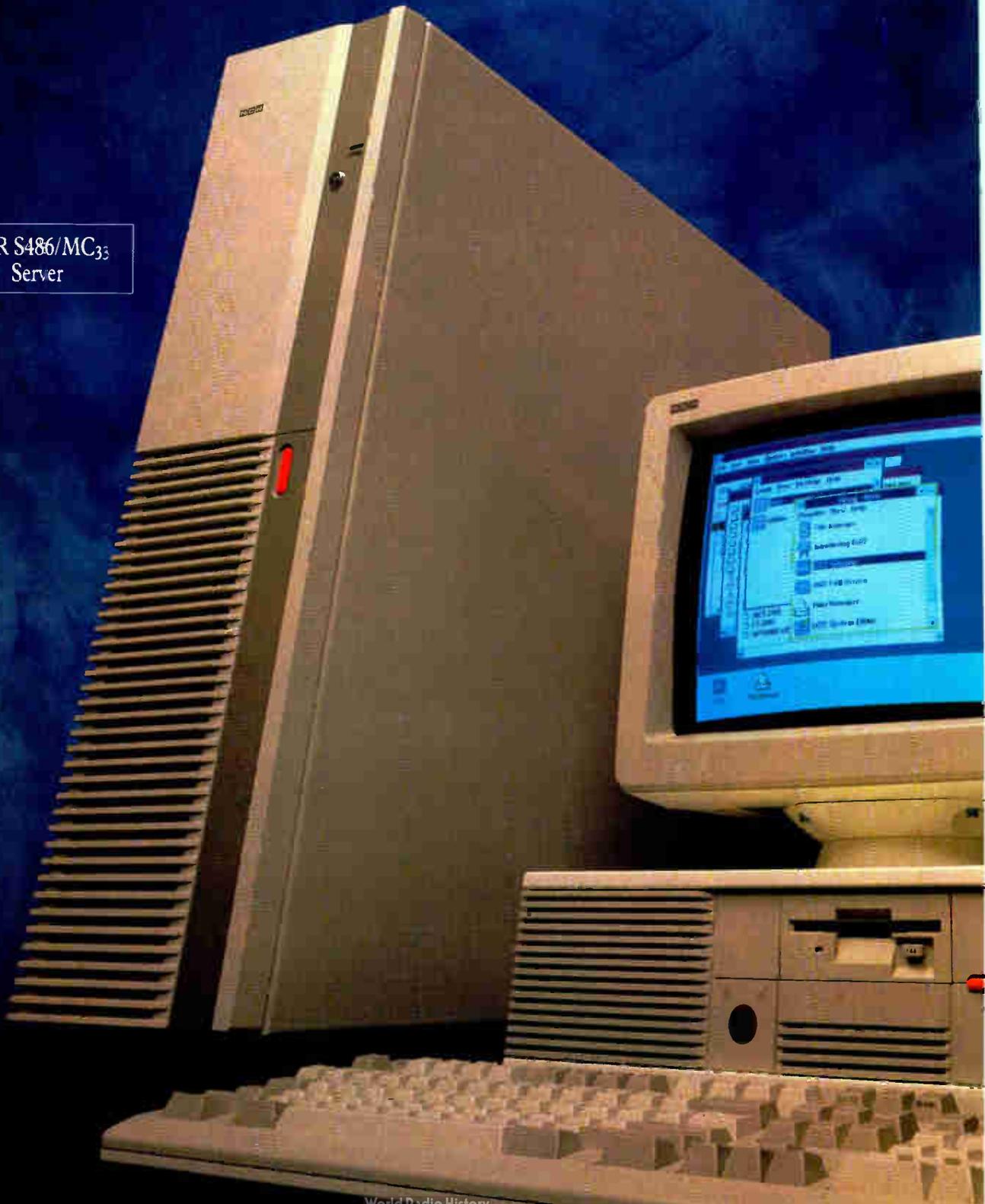
DeScribe, Inc.; 4047 North Freeway Boulevard, Sacramento, California 95834; 916/646-1111, FAX 916/923-3447.

Built-in graphics conversion courtesy of HiJaak technology from Inset Systems. ¹ Built-in text and format conversion courtesy of Word For Word from MASTERSOFT™, Inc. DeScribe is a trademark of DeScribe, Inc. IBM is a registered trademark of the International Business Machines Corporation.

OS/2 and Presentation Manager are trademarks of IBM. HiJaak is a trademark of Inset Systems, Inc. Word For Word is a trademark of MASTERSOFT™, Inc.

At 33MHz, They Out PC In The

NCR S486/MC33
Server



perform Every Other World Today.

The Micro Channel™ Architecture NCR PC486/MC33 and S486/MC33. They're hot, and they're available.

"With the PC486/MC33, NCR has introduced innovations in technology that will drive the market to still higher levels of performance...NCR is well on the way to accomplishing its goal of leading the pack in this technology." -PERSONAL WORKSTATION, June 1990.

"NCR PC486/MC33 Shows Most Consistent Overall Speed Advantage." -PC WEEK, June 4, 1990.

Our new NCR PC486/MC33 and its companion server are the hottest-performing 486-based systems in the world.

According to industry benchmarks, our systems deliver a staggering 27MIPS. That's 32% faster than most 25MHz i486™-based PCs. Our systems come in either a small footprint desktop or highly expandable, floor-standing server configuration.

And they're available *now*.

Our performance advantage is made possible by superior design. Both systems feature an NCR- designed Micro Channel chipset that lets you upgrade BIOS via software, without opening the system or changing chips. Both are optimized for multitasking environments. With intelligent bus masters for improved I/O and dual-ported memory for zero wait state performance. And SuperVGA graphics integrated onto the main processor board.

The PC486/MC33 and S486/MC33 are ideal for compute-intensive applications like economic and financial modeling, CAD, statistical analysis, simulations, and networking.

For more information, call 1 800 544-3333. We'll put you in touch with the NCR or Businessland representative, or other Authorized NCR Reseller nearest you.



Open, Cooperative Computing.
The Strategy For Managing Change.

Circle 509 on Reader Service Card

NCR is the name and mark of NCR Corporation. Micro Channel is a trademark of IBM Corporation. i486 is a trademark of Intel Corporation. © 1990 NCR Corporation.

NCR PC486/MC33
Desktop

Standard Features

- 33MHz i 486 Microprocessor
-
- Micro Channel Architecture
-
- Software-Upgradeable BIOS
-
- Interleaved, Dual-Ported Memory
-
- SuperVGA Integrated
On Main Processor Board
-
- High-Speed, Intelligent
SCSI Coprocessor
-
- Worldwide Service and Support
-
- Available Now

We're already the biggest.

We're already the best.

We've already got more
members.

We already offer more
services.

So we decided to make some improvements.

Isn't that just like us? Never satisfied. Even though CompuServe is already the best computer information service in the world, we're still full of surprises.

Like the CompuServe Information Manager software. It revolutionizes the CompuServe experience for MS-DOS users. Now, you can do things like utilize a windowed PC interface with pull-down menus and dialog boxes. Or compose letters and read PC support material offline.

All this for only \$39.95*, including software and a \$25.00 usage credit. Usage charges are as low as 10¢ a minute.

And it's not only exciting, and breakthrough, and revolutionary, it's easy to order, too. If you're already a CompuServe member, just type GO ORDER. If not, see your computer dealer, or call us today.

The new CompuServe. Now customized for MS-DOS computers.

CompuServe®
800 848-8199

Requirements for MS-DOS version of CompuServe: Hayes compatible modem and 640K RAM. Hard drive recommended.
*Suggested retail price.

Circle 469 on Reader Service Card

World Radio History



Why have we failed

to come up with "real" AI?

Robotics and expert systems were easy by comparison to really understanding intelligent behavior and learning at the very early stages.

—Nicholas Negroponte

Danny Hillis: Partly what I think is holding it up is [that] it's an extremely hard problem. We should not expect it to make progress in five years, or 10 years. It is fundamentally one of the hardest problems we've ever tackled. It's like the problem of understanding the mechanisms of life. And people aren't surprised that as soon as we got microscopes, we didn't understand life within five years. We're still understanding it. We still only understand some of the very simplest things.

Jerry Pournelle: It's just tough—a damn hard problem, that's all. We don't know the algorithms. We don't even know whether or not we're on the right track to get the algorithms.

Jonathan Sachs: I guess I'm not one of the people who say that computers will never achieve intelligence, but I don't expect it. I think it's a long way away, and they have to become a lot more powerful. There's a conceptual barrier that has to be broken where, somehow, you can write a program that is then capable of learning and becoming smarter than the person who wrote it. I think there's a qualitative difference between that and anything that exists now.

Seymour Papert: A small part of intelligence is called stupidity, and AI will go through this necessary phase. In the early days, though, we dreamed about big problems. A big problem is thinking about the nature of intelligence. Once you could make a little system that could pay off, it could be used in the real world. But it drained off energy thinking about small problems. The long-term goal/problem is to make a really intelligent machine. But it may be the next generation before we can.

Dick Shaffer: The role of machines is to do work for humans. Can you imagine if in 15 years or 500 years, people are parading in the streets, and instead of saying, "Do not kill animals, don't wear fur coats," they're saying, "Be kind to your machine"? I don't think I'm prepared for that, but it's not irrational.

Nicholas Negroponte: The reason we have, so to speak, not produced the results in AI that people talked about is, in my opinion

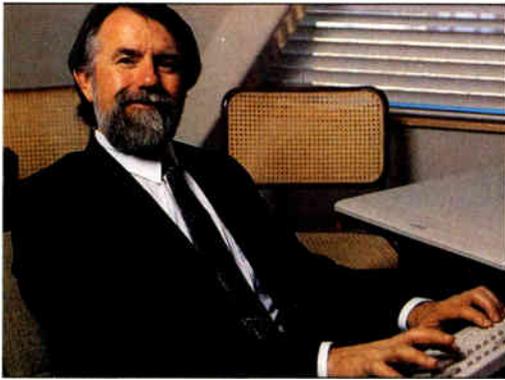
(and believe me, this is *not* shared by many people), that the AI community, about 10 years ago, started to work on the easy problems and sort of abandoned the hard ones. They started to work on robotics and expert systems, which were easy by comparison to really understanding intelligent behavior and learning at the very early stages.

Paul Carroll: Most of the initial efforts in expert systems were misguided. They were trying to duplicate everything that one incredibly astute expert in one field knew, rather than tackling systems with broader applications—customer service or something else. People have changed their focus, and the work done in AI from now on will be more profitable.

Rich Malloy: The problem is just that you're forcing one processor to do too much, and it's just overwhelming in the AI world. In the neural networks, you're balancing things over a much larger number of very simple processors and therefore able to do more complex things. But I think the problem is not so much in AI, but the promise that was hyped about AI. And that's just [that] people got carried away with it. But there are some benefits. There are some good expert systems that have resulted, and there's some good work being done. But a lot of the things that were promised about AI will probably end up being accomplished with neural networks.

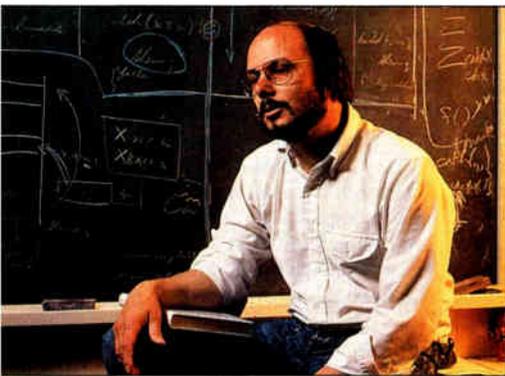
Federico Faggin: One problem with AI, in my opinion, was the approach of relying too much on logic. And the second thing, [which] is secondary, is that the computation power required to solve [the AI] class of problem is enormous. And it is enormous whether you use the old method of AI or the new method of neural networks. You need a form of computation that relies on learning, and learning as things change in the real world without supervision, without anybody telling the machine what to do. All that AI has pursued is to break down a problem into its logical parts and components, and on and on and on. That's what neural networks are bringing—which is new—the notion that you don't have to program in the kind of traditional way and try to use logic. Although that does not mean

continued



Alvy Ray Smith is cofounder and executive vice president of *Pixar*, maker of the RenderMan 3-D graphics system. He has also been director of computer graphics for the Computer Division of Lucasfilm Ltd.

William Stallings (not shown) is an independent consultant specializing in data and computer communications. His book, *Data and Computer Communications, Third Edition* (New York: Macmillan, 1990), is the standard text in the field.



Bjorn Stroustrup is a member of the Computer Science Research Center at AT&T Bell Laboratories. He designed and developed the original implementation of C++.



Jonathan A. Titus is editorial director at *EDN Magazine* and *EDN News*, which cover the electronics industry. He is credited by Robert Noyce and others with developing the first personal computer, the 8008-based Mark-8, now on display at the Smithsonian Institution.

that logic is not an appropriate thing. Logic is very appropriate for a certain class of problems, [but] not for all of them.

John Markoff: In the seventies and eighties, the model was just wrong. They were trying to mimic things that humans do. Expert systems that just basically use these decision trees that are stepped through—they have some utility, but it had nothing to do with the way humans think. I think the stuff that's going on in terms of neural research and neural-net computing is probably much more promising, and it will be very interesting to see what comes out of that. They're going to be successful at making machines that can understand the human voice. Vision is going to make a lot of progress. But it'll come because you've basically got a new model of how humans function.

Danny Hillis: I think that to me, artificial intelligence is making progress at a pretty respectable pace. In fact, we are learning quite a bit of stuff. I think we'll learn a lot more over the next 10 years. It will become more popular in 10 years, and it will become less popular, and so on—it'll wax and wane. But it's a problem that I expect to spend the rest of my life working on.

BYTE: *Do we understand enough about the human brain to mimic it with computers? And if we do, do we have enough CPU power available to do it?*

Paul Carroll: CPUs need to become more powerful to facilitate developments in AI. I'm intrigued by a book that Roger Penrose wrote, called *The Emperor's New Mind*, in which he argues that people, in fact, don't understand the way the brain works, and are quite far from understanding the way the brain works. Without running through the whole thing, he argues persuasively that computers can only handle things that are computable, whereas the brain has ways of handling things that are noncomputable in the classic mathematical sense. He says that until we figure out ways to incorporate those noncomputable attributes, we will never be able to get a computer to duplicate the brain's process.

Dick Shaffer: I think we have come up with machines that outperform people in many significant areas and will continue to do so. But we will not in the foreseeable future build machines that out-think the brain, for two reasons: (1) It's not worth doing, and (2) we don't know how. At a very fundamental level, we do not know

A t a fundamental

level, we do not know how

the brain works.

—Dick Shaffer

how the brain works. We can't come up with programs that at a behavioral level have the same results, the same output. What happens in between we hope is irrelevant. We haven't been able to produce specific results that are indistinguishable from those that people get to by thinking. At that level, we can do things that seem intelligent, but that's not what most people really mean by thinking.

Paul Carroll: People tried to tackle the entire problem all at once rather than breaking it off and doing it in bits and pieces. People went through the logic that Turing went through or the logic you find laid out in Hofstadter's *Gödel, Escher, Bach*, and decided [that], because we can do a mapping of a logical system onto a machine, therefore we can have a computer think the way a human does.

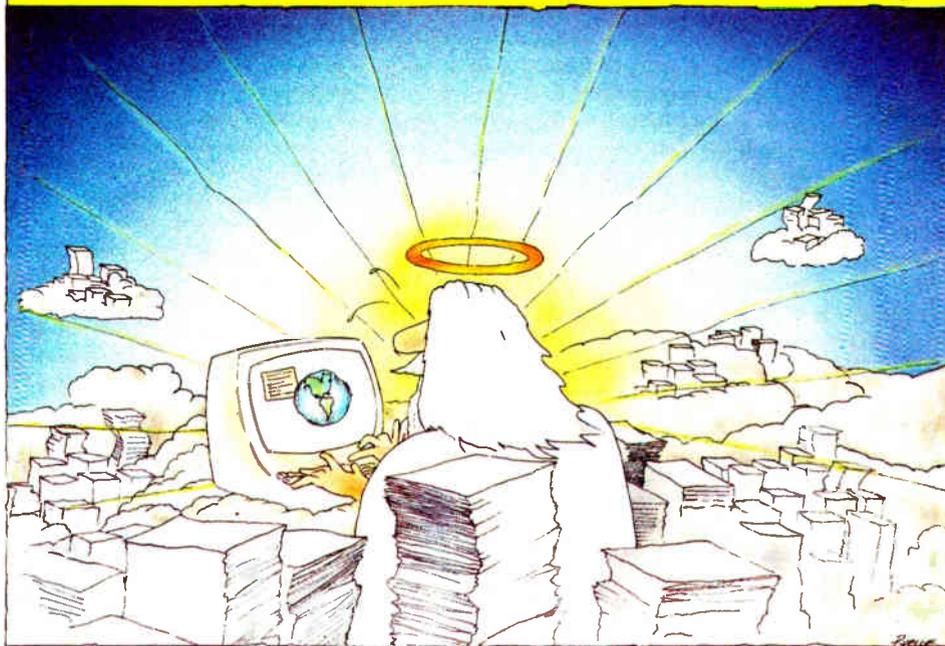
Seymour Papert: There are two obstacles in AI. Logic is the first one. It looks for a uniform approach: one thing that will be the secret—the clue (e.g., back propagation, etc.). But there is no single theory about how the mind works. The second obstacle for AI is that it became a victim of its own worldly success. In the sixties, people had a global goal of big intelligence for big problems. You can't make the *Society of Mind* in small systems. You have to have really big systems.

Danny Hillis: I think, certainly, even the most powerful computers today still fall far short of the information-processing bandwidth of the human brain. And I also believe that even if we had infinitely powerful computers, we still don't have a deep-enough understanding on how intelligence works to solve the problems. I believe both of those are holding it up.

Terry Winograd: This is right up my alley. One of the books that I've written, *continued*

A. R. SMITH PHOTO: MITCHELL RICE
J. TITUS PHOTO: GARY LEGG

Great Moments in C-Programmer History



On the third day, He identified the need for an advanced productivity tool.

If you're feeling overwhelmed by impossible deadlines, don't despair. Vermont Views™ 2.0 combines a menu-driven screen designer with a C library of over 550 functions to combat programming stress.

Have Fun Again

With Vermont Views, you'll visually create user interfaces in a fraction of the time required to code them. Include pull-down menus, window-based data-entry forms with tickertape and memo fields, scrollable regions, choice lists, context-sensitive help, and other state-of-the-art features. Quickly create and refine operational prototypes. Use DOS graphics without GUI hassles.



You'll enjoy interactive development without the limitations of 4GL's. When the extensive capabilities of Vermont Views don't meet special needs, attach your own processing functions to menus, forms, fields, and keys. We've designed it so you won't run into dead ends.

A Better CASE

Rapid prototyping is the latest CASE technology. But, with most systems, you must throw the prototype away when coding begins. With Vermont Views, the prototype becomes the application. Menus and data-entry forms are usable in the final application without change. Names of functions for retrieving, processing, and storing data can be specified as the prototype is created. Notes can be attached to forms and fields to help you complete and document the application. Vermont Views objects are checked for validity when created, so integration and testing go more quickly.

Easy Graphics

Vermont Views GraphEx™ makes it easy to enhance your DOS applications with graphics. All Vermont Views windows, menus and forms work in CGA, EGA, VGA, and Hercules graphics modes. Use your favorite graphics package to create charts, graphs, and other images to accompany text displays. Pop-up, overlap, and restore graphics and text windows.

Free Test Drive

Try a working copy of Vermont Views designer for free. Ask for our Test Drive Kit.

Call 800-848-1248

Fax 802-848-3502

Please Mention "072"

A Universal Solution

Create a single interface and port it among PC DOS, OS/2, UNIX, XENIX, and VMS. Use Vermont Views with any database that has a C-language interface (most do). Create interfaces for any roman-based language. Develop safely on networks with our form-locking version. Truly a universal solution for your interface development needs.



Sweet Music

"Vermont Views... will have the most timid designer riding high in the saddle in no time."

— Edgar Bartholomew, *Unix Review*, April 1990

"At a recent field staff meeting, we were able to get a consensus... using the Designer on a big screen TV. Changes can be posted real-time and a functioning prototype results... The form designer is GREAT."

— Randy Jones, Beta Tester

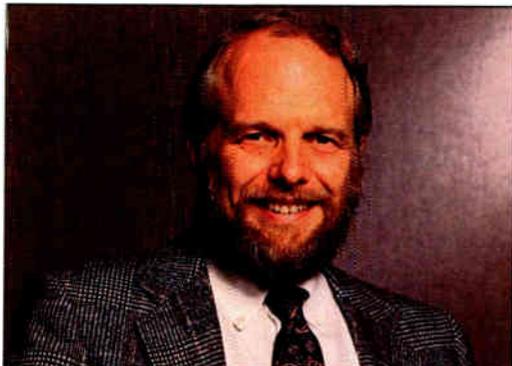
No-limit Trial

Reduce stress by calling 800-848-1248 and ordering Vermont Views now. There is no risk. You can return it for a full refund—anytime.



Vermont
Creative
Software

Pinnacle Meadows, Richford, VT 05476
Phone: 802-848-7731 Telex: 510-601-4160



John E. Warnock is chairman and CEO of *Adobe Systems, Inc.*, the company he co-founded in 1982. He has been a principal scientist at Xerox PARC.

Understanding Computers and Cognition, published by Addison-Wesley, talks about lack of basic understanding of how thought works. Some people think we don't have to understand how the brain works. That may be true in certain respects. Computers certainly do arithmetic better. The natural-language systems we have now can put language understanding in the broader sense.

Nicholas Negroponte: [Natural language and speech input] should become practical realities tomorrow, because speech input does not require natural-language understanding. There is a certain amount of speech control that does not require natural language. One of the things that have screwed us up a bit is that we have always coupled speech production and speech recognition with natural language.

Jerry Pournelle: The problem with natural spoken languages as they stand [is], "Time flies like an arrow," and "Time wounds all heels," and "There are flies on the fruit." You don't have any problem juggling all of that. We can understand [those sentences,

but they are] very difficult for a computer to understand. And I really wouldn't want to predict when it will be that a computer gets sufficiently complex to figure that out.

Nicholas Negroponte: There is a lot of room for speech I/O that we can do [that will] make computers much, much more interesting to use without getting into the other kind of what I'll call "transcription," where you're trying to go from the utterance to a full understanding of the text, at which point it doesn't make any difference whether it came from speech or typing.

Danny Hillis: There is a big difference between understanding a sentence well enough to access a database and understanding a sentence well enough to judge good poetry from bad poetry. At what point do you call the problems [of natural-language understanding and speech input] solved? I think that in some simple ways they'll be solved and put into practice in the near future. I think they already are in some very simple ways. And it will continue improving over [the] decades. ■

Data Junction® converts data files!

Any ASCII • dBASE • R:BASE • Lotus 1-2-3
Excel • Paradox • Informix • Q&A • Oracle • Xdb
askSam • SC4 • Clarion • DIF • SYLK • Symphony
ACT! • Platinum • DAC • ACCPAC+ and other apps
Btrieve • c-tree • EBCDIC • Packed & Zoned decimal
IBM/Mips/Sparc/Cray/Vax/Intel/68000 Binaries & Floats

Filter Your Files While Converting!

- No programming — completely menu driven
- Select & rearrange records, fields and characters
- Instant script file creation for total batch processing
- Written in C — Ideal for OEM applications

Clean Up & Massage Your Data!

- Search/replace and case translation by column
- Merge & split fields
- Edit/enter corrections — Build custom data types

"Definitely recommended." —*C Gazette*
"...more than worth its price." —*PC Magazine*
"...a surefire winner." —*Computer Language*

Standard \$99— Converts dBASE, ASCII, 1-2-3, Q&A, Enable, DIF, askSam, & merge files for WordPerfect, Word & Wordstar
Professional \$199— Standard formats plus Binary/EBCDIC, SC4, SYLK, Paradox, R:BASE, Clarion, Excel, c-tree & Btrieve
Advanced \$299— Standard & Prof. formats + Informix, Xdb, Oracle & C-ISAM

Call **800/444-1945** or 512/482-0824 • FAX 512/482-0976
Also available for LANs, Xenix & Unix, MC/VISA • AMEX • COD • Corp. PO.
Tools & Techniques Inc • 1620 W 12 • Austin TX 78703

Don't Move! without telling

BYTE

Clip out form below
and mail to:

BYTE Magazine
Subscriber Service
P.O. Box 850
Peterborough, NH 03458-0850

At least 8 week *before* your move, please give us your
new address and/or name change

(Please Print)

New address, name
Name _____
Address _____ Apt. _____
City _____
State _____ Zip _____

Print current name and address
(or affix the mailing label from your current issue of BYTE here)

Current address, name
Name _____
Address _____ Apt. _____
City _____
State _____ Zip _____

Mitsubishi Has A Monitor For Whatever You Have In Mind.

For a wide range of application versatility including desktop publishing, presentation graphics, CAD/CAM and more, Mitsubishi® has the right monitor with the right performance features.

With a variety of CRT sizes, resolutions, and spot-frequency or auto-scanning performance ranges, Mitsubishi enables you to choose the monitor to fit your exact needs. Expect only the very best from Mitsubishi with bright, vivid colors, and clear, crisp text. Best of all, Mitsubishi monitors are designed and manufactured to exacting standards to ensure the highest quality possible for long-term reliability.

You'll also have confidence in knowing you're fully supported by Mitsubishi's continuing commitment to customer service and satisfaction. So whatever you have in mind, keep Mitsubishi in mind for all your monitor requirements.

For a demonstration and more information on our full line of color monitors contact Mitsubishi Electronics today. Call 1-800-556-1234, ext. 54M in the U.S. and Canada (in California 1-800-441-2345, ext. 54M).



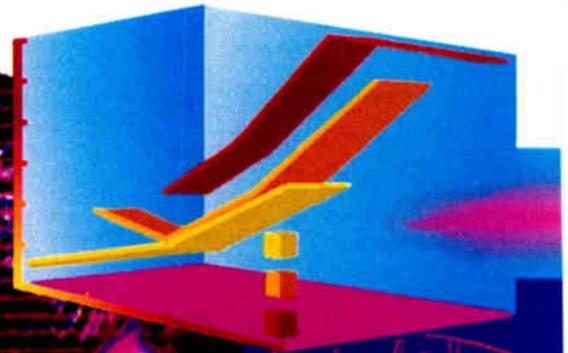
Mitsubishi Electronics America, Inc., Information Systems Division, 991 Knox Street, Torrance, CA 90502
Mitsubishi Electric Sales Canada, Inc., 8885 Woodbine Avenue, Markham, Ontario L3R 5G1

Circle 506 on Reader Service Card (RESELLERS: 507)

©1990 Mitsubishi Electronics America, Inc. Mitsubishi is a registered trademark of Mitsubishi Electric Corp., Tokyo. Monitors shown with optional bases. Actual unretouched screen images. Screen images produced with permission from the following companies (trademarked software package name follows company name): Visual Business Systems (VB #5); Dynaware Corp. (Dynaperspective); Adobe Systems, Inc. (Photoshop); Designs executed by Mac 'N' Stein.

“Man’s greatness lies in the power of thought.”

Pascal

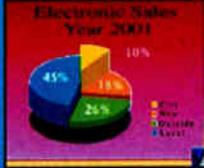




Jim N. Stein
5263 Case Blvd. #49
Mill Valley, CA. 95232
(415) 882-3947

Account

00
0



Electronic Sales Year 2001

T H E B Y T E S U M M I T

I N S I G H T S

Gordon Bell:

On The Computer Museum

I'm really excited about The Computer Museum [Boston, MA] at this point because its [latest] exhibit is a thing called a Walk-Through Computer. It's a many-times life-size computer. I mean, the monitor is, I think, 20 times real life. And it's got a keyboard and some keys and stuff like that, and you go in through it and look at it and see a blown-up version of it with traces and green boards and all the other stuff.

Then you go through a bunch of different stations. For example, you go to the CPU, and the CPU is sitting there with a projection TV, about a 36-inch television set, and there are three views [you] can have of [the CPU]. One view is what's happening at the electron level: watching voltages change on the various parts of the chip. The second view—there may be a 1's and 0's level,

I'm not sure—but then the next view is of instructions moving around to carry all of that. And then the highest level is this manic view of the application [that the CPU] happens to be running. The application is a program called [World] Traveler, and you pick two cities, and it then builds a map for you and gives you a slide show of [points in between]. It's all done in MacroMind [Director].

You can go to the little disk station and find out how 1's and 0's come off that, and what the commands are, and move to [higher levels]: "Get me a block, and get me a picture." And so you see all of these levels of how is it really doing it.

It's a huge exhibit. I think altogether it's a little over 5000 or 6000 square feet.

Mitch Kapor was a major donor to this exhibit and got it going. The Sloane

Foundation was a major giver. A lot of companies gave both parts-in-kind and cash, so it was about a \$1,000,000 exhibit. The neat thing about that exhibit is that [it] can be reproduced. That'll probably cost on the order of \$200,000 to \$300,000 to reproduce. It's a beautifully done exhibit.

Ken Olsen and I started [The Computer Museum] at a Digital building in 1979. And then we quickly formed a nonprofit public institution. And so I think the museum is really happening now. The Smithsonian just opened their information exhibit, and it's got a lot of computer things in it. It's got a lot of artifacts, but it doesn't focus on the computer the way [The Computer Museum] tends to.

Editor's note:

See biography, page 228.

Goodbye, Paper Chase Hello, Instant Recall™

Drowning in Information?

All those phone numbers, bright ideas, schedules, reports, stray facts, and to-do lists aren't going to stop coming at you fast and furiously.

You need a better way to manage it all. So everything's organized and at your fingertips. So separate pieces are pulled together into a coherent whole. And you can harness the information, using it to forge ahead in your work—better and faster.

Introducing Instant Recall: The First Personal Information Manager that really works

Instant Recall is the only full-featured PIM that's memory resident, popping up over any software you use—without interrupting your workflow. An incredible time-saver. And something no other personal information manager can offer.

Plus, it's memory-resident in just 32K (about half the memory needed by Sidekick®), leaving plenty of room for other programs.

Instant Recall replaces desktop organizer and text database software with an integrated solution. It makes connections between pieces of information. Gives you multiple perspectives. Creates time-lines from dates you've entered piecemeal. So it actually shoulders much of the work for you. And it's truly easy to start up and use.



Instant Information your way

Instant Recall takes any kind of information. Structured or freeform. Any single item can include up to 65,000 characters (over 30 pages) of text. And four familiar formats handle it all:

Notes: for freeform text—ideas, memos, lists, reports.

Tasks: for tracking and delegating, with priorities, target dates, advance notice.

Schedule: for managing time—with automatic conflict checking, recurring events, week-at-a-glance display.

People: for names, addresses, phone numbers, unlimited notes. With follow-up dates, auto dialer, address copy to any word processor—you'll never type an address again!

Integrated views make connections for you, speeding your work

Instant Recall lets you pull together notes, tasks, schedules, and people information on a single screen—by topic, date, person, priority, or embedded text.

Instant Recall also brings time-sensitive items to your attention on any date you choose. You can set advance notice for upcoming activities. View overdue items. Or automatically pop up alarm messages over other software.

Other unique features lighten your load

Instant Recall is the only general purpose PIM which offers a pop-up activity timer, a phone dialer, alarm messages, scheduling and tasks for multiple individuals and groups, automatic conflict checking, advance notice, and recurring activities.

Other convenient features include mailing lists and labels, direct copy of name and address to any word processor, overdue notice, follow-up dates, password protection, flexible printed reports, and a clipboard for exchanging text with other programs.

Circle 466 on Reader Service Card
(RESELLERS: 467)

Ready to use right out of the box

Instant Recall comes ready to work for you from day one. An intuitive user interface and context-sensitive help make it exceptionally easy to learn and use. You don't have to retype information that's already on your computer—Instant Recall has a built-in clipboard for pulling information directly from other programs and ASCII files. Plus transfer utilities for Sidekick®, Tornado™, MemoryMate®, and delimited ASCII files.

Here's what the experts say about Instant Recall:

Power: "A truly impressive, productive way to manage information...the best personal information manager I've seen to date"



Ease of Use: "So intuitively designed, you can make use of the program virtually as soon as you boot it up"



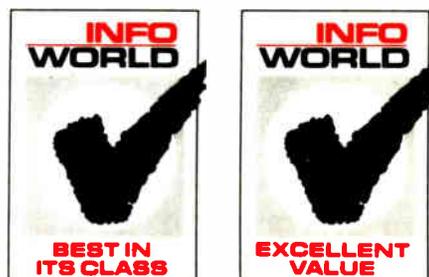
Value: "Instant Recall delivers high-end features at a bargain price"



Try Instant Recall free for 30 days

Experience the difference Instant Recall makes—the remarkable gain in control, speed, and effectiveness. You can't lose. Because this cutting-edge PIM is completely guaranteed. If you're not 100% satisfied, simply return it for a full refund—no questions asked.

So order Instant Recall today. And be on top of things tomorrow.



Call toll free: 1-800-848-4970

Yes! I want to eliminate the paper chase with Instant Recall. I understand that this innovative PIM is completely guaranteed. If not completely satisfied, I may return it within 30 days for a full refund. Enclosed is my check for \$99.95 plus \$5.00 shipping and handling (AZ residents add 7% sales tax).

Name _____

Address _____

City _____

State _____ Zip _____

Day Phone (_____) _____

Check disk size: 5.25" 3.5"

Charge my Visa Mastercard Amex

Card # _____ Exp. _____

Signature _____

CHRONOLOGIC
CORPORATION

5151 North Oracle • Suite 210 • Tucson, AZ 85704

Tel (602)293-3100 FAX (602)293-0709

Toll free: 1-800-848-4970

BM09

Instant Recall is always
just a keystroke away—yet
it needs only 32K of memory

Hardware Compatibility

IBM PC, XT, AT, PS/2, or compatible, 512K RAM (32K RAM in background mode), DOS 2.1 or higher (DOS 3.0 or higher for memory resident operation), at least 720K capacity on a single floppy or hard disk.

Carma McClure:

On Object-Oriented Technology

If you look at it, the smart programmers—the really productive guys out there, the guys that are four or five times as productive as somebody else—have been using reusability as their secret weapons. It is practiced all over the place, but it is not practiced on a corporate or department level for the most part. And what we are going to see is it [being] raised up to that level, not just the private domain of a few very fast people—very productive people—but really a standard way of doing things. And a repository is the thing that is going to allow us to manage [reusability] in the integrated tool environment, to [make us] able to take advantage, take it out, analyze it, modify it, understand the impact of change, and all that business. And it is really going to [enable] higher levels of reusability. I am not talking about reusing a subroutine or a macro but a design specification, the architectural structure.

I think that some of [the resistance to object-oriented technology] has to do with [the fact that] it's immature and it

is still developing, and people are having trouble saying, "Well, what is it: Is it a language, is it a technique, is it a methodology?" And most people would say, "Hey, it is not a methodology, it is a technique," or "It is a way of looking at things." And I think that as you get into the use of workstations and PCs and the wonderful graphics we have, we are going in a direction of using more and more graphic techniques to develop systems. And our tools [will] use graphic techniques. Object-oriented [technology] fits in perfectly with that kind of view of the world.

What's the biggest obstacle to [getting] there? I think it's people. You can't succeed with any of this unless the organization is ready for it. It means from the very top you have to have management support, give people time [to] change. People are always going to resist change, so you have to make this something that is exciting, that is attractive, and something that they feel they need and that they really must do. So a lot of it comes down to really a man-

agement issue, a training issue for the people.

In order to move toward what I call higher levels of software automation in the future, you are going to be using more standardized systematic-type procedures for developing software systems; there is no way around that. You can't automate unless you can define and pin down the process, and so you have to get people to accept that and have a different view on where the creativity lies.

Creativity is really in solving the problem for the user; it is not in transforming a detailed design spec into the best performance code. So you've got to change that perspective on it, and I think that is going to be the hardest thing. I think it's getting the people prepared and ready to change, training them in good skills, like analysis skills, communication skills, and problem-solving skills.

Editor's note:
See biography, page 292.

Let NewGen satisfy your hunger for high-resolution with an affordable 800 dpi printer!



The text for the menu was created in PageMaker, saved as EPS files and placed in FreeHand.

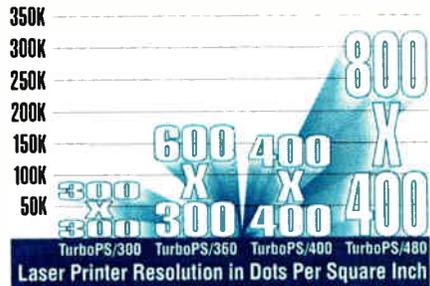
The Images with Impact® clip art illustrations were edited with FreeHand and color was specified in cyan, yellow, magenta and black.

The Apollo logo was created in FreeHand where the various elements were edited and combined.

Add powerful applications like PageMaker®, FreeHand® and Adobe® Type Fonts to produce typeset quality output at your own facility.

The NewGen TurboPS/480 can produce PostScript® language compatible output at 800 x 400 dpi, nearly four times the resolution of other laser printers. And when we say PostScript compatible, we mean it, including Type 1 fonts, special effects and EPS files from all your favorite applications and programs.

The NewGen TurboPS/480 is a complete printer with built-in AppleTalk®, parallel and serial ports. And unlike some printers, it works in mixed Mac-PC



Resolution close up, 18 point Garamond Italic enlarged 500%



300 x 300 dpi LaserWriter II 800 x 400 dpi NewGen PS/480 600 x 600 dpi Varityper VT-600

environments, and it doesn't require an internal PC processing board or dedicated server.

To show you how confident we are that you'll be impressed with 800 x 400 dpi output, we printed this page at actual size, including the menu which was output as color separations.

What does all this resolution and compatibility cost? Very little. The TurboPS/480 - with 800 x 400 dpi and RISC performance - lists for about 25% to 50% less than its competitors, while our TurboPS/400, TurboPS/360 and

TurboPS/300 laser printers cost less than slower 300 and 400 dpi PostScript language printers.

If you have an appetite for high-speed, high-resolution PostScript language printing, call 714/641-8900 today to get your TurboPS evaluation kit.

Dealer inquiries welcome.



This ad was created and separated on a TurboPS printer. For information about its production, contact NewGen Corporation.

Circle 511 on Reader Service Card (RESELLERS: 512)



NewGen Systems Corporation™

17580 Newhope Street, Fountain Valley, CA 92708
Telephone (714) 641-8900 FAX (714) 641-2800

NewGen, NewGen Systems Corporation, NewGen logo, TurboPS/300, TurboPS/360, TurboPS/400, TurboPS/480 are trademarks of NewGen Systems Corporation. Aldus PageMaker and Aldus FreeHand are registered trademarks of Aldus Corporation. PostScript is a registered trademark of Adobe Systems, Inc. NewGen's PostScript language interpreter is fully compatible with Adobe PostScript. All other brand product names are trademarks or registered trademarks of their respective companies.

T H E B Y T E S U M M I T

I N S I G H T S

Andy Bechtolsheim:

On the Acceleration of Change

What's exciting to me is that the rate of change—the curve—is accelerating. It's sort of a [feedback] cycle where we have these workstations—every engineer at Sun has their own SPARC-station now—[with] very good design tools—CAD tools—on [them]. People can just design better machines because they have better tools. Once we use those machines, we can design even better ones. So the machines and the tools available today help us design much bet-

ter computers than [we could] as little as five years ago. And that is a fundamental change.

Also, the engineers are just able to get these things *out*. Obviously, things are not going to get simpler as we go faster. [The engineers] might have to do some very elaborate multilevel caches and some other things that need to be simulated very, very well, but the tools are just so much better now than ever before.

[One such tool] actually simulates the electromagnetic wave of each trace on the PC board before you have a built PC board, and it tells you, like, if you have a reflection problem before you ever lay out the board. That was unheard of just a few years ago. That [sort of thing] just helps us to design faster machines more efficiently.

Editor's note:
See *biography*, page 228.

DEMAND QUALITY



You've heard all about those "Super-Big-Number-One" cartridges.

We've heard all about you wanting Solutions, not numbers.

Introducing the Solution II™ series of font cartridges, featuring the quality, hand-tuned fonts, most requested by demanding laser printer users.

For those special needs, the Custom Solution II™ cartridge is custom engineered for your unique requirements. Your Custom Solution II™ cartridge will include fonts, logos, signatures or other graphic images.



Mitchell Pacific
Suite 1050, 10303 Jasper Avenue
Edmonton, Alberta Canada T5J 3N6
Phone (403) 425-0100 Fax (403) 420-0900

Customer Inquiries Handled Instantly!



**Copia
International Ltd.**

1964 Richton Drive, Wheaton, IL 60187
(708) 682-8898 Fax: (708) 665-9841

The time that it takes to send an interested customer more information, may just be enough time to have cost you the sale.

Let FaxFacts provide information to your customers while the impulse is strong! FaxFacts delivers customer information while he/she is on a Fax phone.

Call for the complete story or for a demonstration.

DEMO NUMBER: (617) 740-0025 PRESS: 1625000#

Also marketed under the names BENEFAX and FastFacts.

Have your cake and eat it too!



With POWERLan and POWERserve. . . A peer-to-peer network with a dedicated server

You *can* have it all. The flexibility and simplicity of peer-to-peer networking with POWERLan®. The performance and capacity of multitasking, dedicated file service with POWERserve™. All to NetBIOS and SMB standards, meaning true compatibility with IBM® PC LAN and OS/2®. And all on the same network.



In PC Magazine tests, POWERserve outperformed NetWare® 286 hands-down. And they named POWERserve "the unexpectedly attractive alternative for performance, ease of installation, and flexibility. . . the only product to challenge NetWare 386!"* At roughly a third the cost.

Corporations like Citibank, PG&E Resources, Royal Bank of Canada, Trammel Crow, Nabisco Distribution Centers, H.J. Heinz of Canada, and many, many others already know how sweet it is. You can too.

Call today and order POWERLan and POWERserve at a very scrumptious price.

PERFORMANCE TECHNOLOGY

800-825-LANS or 512-349-2000
See us at NetWorld booth #1654

*PC Magazine, "The Power Behind the Server," May 29, 1990

POWERLan and POWERserve are trademarks of Performance Technology, Inc. All other products mentioned are trademarks of their respective manufacturers.

Circle 525 on Reader Service Card

World Radio History

Northgate™ Elegance 386™ Computers

Northgate does it again!

PC Magazine Editors' Choice Elegance 386
tops competition in *InfoWorld* tests!



Prices From \$3299.00!

- Fastest 386 system ever!
- Flawless Software and Hardware Compatibility
- Outstanding Expandability
- Unlimited, 24-Hour Toll Free Technical Support
- 1-Year System Warranty
- 30 Day No Risk Trial

NOVELL LABS
AUTHORIZED
TESTED AND
APPROVED
NetWare Compatible

Performance and value that set computing standards for the 90's!

Award winner in three speed classes—33, 25, and 20 MHz! Sizzling Northgate Elegance 386 systems have won three *PC Magazine* Editors' Choice awards PLUS two *Computer Shopper* "Best Buy" recognitions! In 1989 *InfoWorld* tested and reported Northgate's Elegance 386/33 MHz system as the top performer in its class.

Northgate widens the lead! In the May 7, 1990 issue of *InfoWorld*, Elegance 386/33 surged to the top again—soaring past Compaq, ALR, AT&T and a host of others—winning the "Best In Its Class" Award.

Put this league leading performance to work for you! For as little as \$3999.00 you can find out what industry experts and thousands of satisfied customers already know: Elegance 386/33 gives you more performance for the price than any other computer on the market!

You'll see why industry publications rave! Top of the line—Elegance 386/33 MHz—four times a winner! Look at these standard features ... Northgate gives you both 1.2Mb 5.25" and 1.44Mb 3.5" floppies, 1Mb of RAM, one parallel and two serial ports, a 68Mb hard drive, a 14" high resolution monochrome monitor, MS-DOS 4.01 and GW-BASIC installed and Northgate *OmniKey*™/ULTRA keyboard standard.

If that's not enough ... Northgate engineered the motherboard with 16Mb RAM capacity that's hyper-enhanced with up to 256K of 25ns read/write-back Cache—boosts the scorching processor power even more!

Speed you must see to believe! Recalculations of even the biggest spread sheets are amazingly quick ... large databases sorts are short work ... even CAD drawings seem to appear as fast as you can release ENTER!

This hummer is housed in a tower case with space for seven half-height storage devices. Or choose a desktop case with five half-height storage devices. Either way, a 220-watt power supply provides all the juice you'll need to operate your drives and add-in boards.

Want even more performance? Here it is! Need more hard drive power? Northgate has options all the way up to dual-600Mb drives with 15ms access for a colossal 1.2 gigabytes of storage capacity! Want color? We'll set you up with a 16-bit VGA display for a brilliant rainbow of vivid colors. More floppies, optical drives, tape backups? We've got 'em! Just tell us what you need ... Northgate will custom configure a system to meet your needs!

We make 'em better ... we back 'em better! Use your Elegance 386 system for 30 days. If it fails to meet your expectations, return it—NO QUESTIONS ASKED!

Support and more support! You get unlimited, 24 hour a day toll-free technical support. PLUS a full one year parts and labor warranty. AND, we ship replacement parts to you overnight—AT OUR EXPENSE—before we receive your troubled part!

ORDER TODAY! Call toll-free 24 hours every day. Don't forget to ask about custom configurations, leasing and financing programs.

Elegance 386/33 MHz System

\$3,999.00

Complete System
Delivered to your
home or office!

For 25 MHz systems, prices start at \$3299.00

EASY FINANCING: Easy payment options. Use your Northgate Big 'N', VISA, MasterCard ... or lease it. Up to five-year terms available.

Elegance 386 System Features

- 25 or 33 MHz Intel® 80386 microprocessor
- 68Mb hard drive
- 1Mb RAM on motherboard; expandable to 16Mb
- 64K SRAM read/write-back cache; expandable to 256K
- Eight expansion card slots; one 32-bit, six 16-bit and one 8-bit
- Co-processor support
- High density 1.2Mb 5.25" and 1.44Mb 3.5" floppy drives; also read/write low density disks
- One parallel and two serial ports
- 14" high resolution monochrome monitor
- MS-DOS 4.01 and GW-BASIC software installed
- Desktop, Tower and Jumbo case models available
- Clock/calendar rated at 5 years
- On-line User's Guide to the system and MS-DOS 4.01
- 220 watt power supply
- 1 year warranty on system parts and labor; 5 years on keyboard
- FCC Class B Certified

CALL TOLL-FREE 24 HOURS EVERY DAY

800-548-1993

Notice to the Hearing Impaired: Northgate now has TDD capability. Dial 800-535-0602.



**NORTHGATE
COMPUTER
SYSTEMS**

"We hear you!"

1 Northgate Parkway, Eden Prairie, MN 55344

©Northgate Computer Systems, Inc., 1990. All rights reserved. Northgate, OmniKey, Elegance, and the Northgate 'N' logo are registered trademarks of Northgate Computer Systems. 80386 is a trademark of Intel. All other products and brand names are trademarks and registered trademarks of their respective companies. Prices and specifications subject to change without notice. Northgate reserves the right to substitute components of equal or greater quality or performance. All items subject to availability.

Circle 516 on Reader Service Card

Un-retouched VGA screen image. Special hardware required for motion video.*

Introducing the door into Windows!

Easy access to Windows

KnowledgePro (Windows) contains high-level commands for manipulating screen objects, lists, text, fonts, rules, external files and bitmap images. DLL and DDE support lets you integrate your own C routines with KnowledgePro and link your application directly to Excel and other Windows programs.

At a price you can afford

KnowledgePro (Windows) costs \$695 with no runtime fees for applications. KnowledgePro for DOS costs \$495. The systems run on IBM PC, XT, AT and PS/2 compatible machines with 640k of memory and a hard disk. KnowledgePro (Windows) requires Microsoft Windows 286 or 386 version 2.x or greater.

Call **518-766-3000** (FAX 518-766-3003) for more information or write to: Knowledge Garden Inc., 473A Malden Bridge Rd., Nassau, NY 12123 USA. Amex, Visa or M/C accepted.

Another
intelligent
tool from



KnowledgePro is a registered trademark of Knowledge Garden. Excel is a trademark of Microsoft Corp. IBM, XT, AT and PS/2 are trademarks of International Business Machines Corp.
*VideoWindows digital video overlay board by New Media Graphics.

Circle 498 on Reader Service Card
World Radio History



**omputers are
utterly subversive of
dictatorships, because
they're such a powerful
instrument of
communication.**

—Brit Hume

THE BYTE SUMMIT

THE GLOBAL MARKET

What is going to be necessary to develop the new worldwide markets?

Jerry Pournelle: Freedom in the world. That's an easy one.

Stewart Alsop: I don't think there should be a world market for computers, because computers are only valuable in the context of the society and culture that they're being used in. I think what we'll end up with is three basic computer markets in the world. We'll have a North American market, and a European market, and the Asian market.

John Markoff: My view of the next decade is [that] America will increasingly become a design center, and manufacturing will increasingly move to being close to the markets that it serves. So, in that sense, it will be a very global economy. I don't think the high-technology industry is any closer to that than anything else.

Gordon Campbell: I think as a nation we need to get much better at international selling and working as an international economic force. And that's something we haven't done as well as we should.

Rich Malloy: Free trade is probably a more global way of looking at it. And when you open things up and you have a free market, I think you have a lot of activity and a lot of things going on, and it's very exciting. When you start to regulate it or overregulate it, things start to slow down and move to freer markets.

Jerry Pournelle: Well, you must understand, I think the American way of doing business isn't very American anymore. I think we have glued regulations on top of things to the point where it is silly. I think the FCC is the worst enemy of American productivity I know of in the computer business. Let me elaborate on that for a minute. In order to market a new computer, you have got to essentially pay tribute to the FCC of \$20,000 to \$30,000. That means you have to get into the hands of the "vulture" capitalists in order to get your company going nowadays.

Paul Carroll: The spread of computerization outside the U.S. will have a significant effect. It's obviously already happened to a large extent in Europe and at least Japan. But I think that what goes on in Eastern Eu-

rope over the next few years will be important, and I think it will also be important to see what happens in parts of Southeast Asia. I think it's naive to think that this will all happen quickly. All you have to do is take a look at how long it's taken the Europeans to get as far as they have in terms of unity to see how slow the process will be.

Ken Sakamura: If Japanese PCs continue the way they are now, I'd say they probably won't be any more or less successful than now. But let me stress that this is if Japanese PCs continue like they are now, i.e., [based on] MS-DOS or whatever the future operating system is. I don't think we'll ever see the day that Japanese PCs sell as well as Japanese VCRs or TVs, at least not in America. The problem with Japanese PCs is really software. It's the lack of innovative software that's holding us back.

Charles Simonyi: I think the tremendous opportunity is that Europe is a tremendous growth area, in terms of market but also in terms of production. Certainly, we are recognizing how quite a bit of our revenue comes from international business, and a large percentage of that is Europe. But the opportunity for producing software in Europe has not been exploited yet.

Gordon Campbell: Another strength that the U.S. has that we have to capitalize on is that the fundamental business language in the world is now English. That appears to be the common bridge throughout almost all of Asia. Even as we start exploring business opportunities in the U.S.S.R. and the Eastern bloc, English is again becoming the common way to communicate. So I think some of these fundamental things we really have to take advantage of if we're going to be successful.

Stewart Alsop: But there are two things that are important. One is that in an area like Eastern Europe, the problem has absolutely nothing to do with technology. The only problem they have is, they have no money. And if there's no money, there's no way to finance the development of computer technology. When it comes to where political changes are happening very rapidly, the fundamental problems are econom-

continued

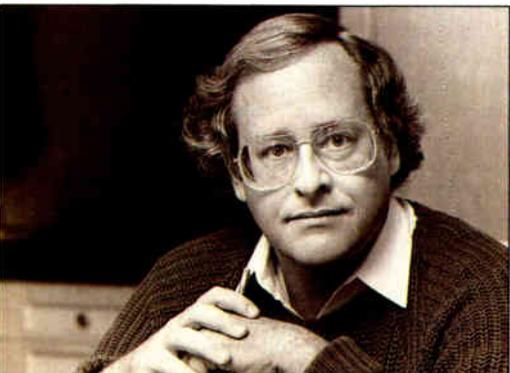
Terry Winograd (not shown) is professor of computer science at *Stanford University* and is noted for his work in natural-language understanding in computers.



Niklaus Wirth is a professor at the *Swiss Federal Institute of Technology* (ETH). He is the designer of the Pascal and Modula-2 programming languages, the Lilith workstation, and the Oberon language and operating system. He is a recipient of the A. M. Turing Award.



Stephen Wolfram is founder and president of *Wolfram Research, Inc.*, which produces *Mathematica*. He has performed research into the behavior of complex systems at the Institute for Advanced Study at Princeton.



Edward Yourdon is an independent management consultant and author, and publisher of *American Programmer*, a journal that analyzes software technology trends. He is known as the developer of the "Yourdon method" of structured analysis and design.

ic and political, but not technical. And then the second thing is that while computing is fundamental and universal in that respect, it's also very cultural. I don't think it's possible [to] design one [computer] and sell it in multiple markets without changing it. And I think it would be a pipe dream for the industry to believe that the computer industry will be homogeneous around the world. Computers are this sort of multipurpose extension of the individual in that they have to reflect the cultural differences of individuals, of people living in different cultures and regions.

Rich Malloy: It's hard to gauge how much the events of the past year have been the result of electronic communication, but there must be some factor there. When you have information transferring so easily, it's hard to control populations. And so you'll probably see a tremendous move toward free societies who can pretty much try to rule themselves, as opposed to being ruled by a smaller society or an individual. And that's hard to stop; as Jerry Pournelle [says], you can't put the genie back in the bottle.

Brit Hume: My sense is that just about anything can go now. They're going to need the hardware. But once they get the hardware in their hands, I don't think there is much you can do but stand back and hope for the best. Anything you can do to encourage the ownership of microcomputers on the part of people in Czechoslovakia and Hungary and Poland and anywhere else is fine. Computers are utterly subversive of dictatorships, because they're such a powerful instrument of communication. My sense is that this will either take off on its own or it won't, and there's not a lot you can do to affect the outcome of that. The people there are either going to have the talent and the wherewithal to do it, or they're not.

Philippe Kahn: I think that those are very intelligent populations, very highly educated populations, who appreciate quality, etc., and are willing to do business on that level. I think that I see most U.S. companies doing business in the Eastern bloc in better and better ways.

Esther Dyson: I'm organizing a conference, the East-West High-Tech Forum (Budapest, [Hungary,] October 21-24, 1990), which will bring together people in computers from the East and the West. I'm meeting personally with every participant in the conference. I want to bring businesspeople and small entrepreneurs from East-

The fundamental

problems are economic

and political, but

not technical.

—Stewart Alsop

ern Europe together with people in the computer business in the West.

BYTE: *Do you think we will ever see a "global village" network?*

Brit Hume: Of course. To some extent we already do [have a global village network]. Some of what came out of China during the Tiananmen Square protest was coming out by modem, some of it by fax machine. So there is some of that happening already. I don't know what else it would take, but my sense is that it's almost here.

Jerry Pournelle: You already have [a global village network]. Getting closer. Ain't going to be that long. You know the Chinese don't quite know how to shut down the fax system even now. Arthur Koestler in 1946 said that the necessary and sufficient condition for the end of totalitarianism is the free exchange of ideas. Well, you can't operate without it.

Dick Shaffer: If we see a global village, I hope I own vacation spots in [places] in which people can get cut off from that! Then what will be valued will be isolation.

Paul Carroll: Even if we did all get to the point where we were hooked up electronically, there would still be so many language differences and cultural differences that I don't expect to see anything approaching a global village in my lifetime.

Dick Shaffer: The only thing we know about the future is that predictions about it are almost always wrong. Not only in degree but often terribly wrong in direction, so, what I say, take it accordingly. I don't think a global village will occur, except to the extent that we can see via satellite real-

time photographs of what's going on in Vietnam. We know about assassinations in Israel the next morning—and to that extent, we're already a global village.

John Markoff: I think we will never see a global village in the McLuhan sense. McLuhan's view of the global village was very homogeneous, and I think one thing the computer networks are doing that McLuhan didn't foresee falls out of the nature of computer technology. Computers permit people to communicate in a many-to-many fashion, while television as a technology was essentially a one-to-many broadcast. And as a result, what the computers are going to do is create tiny separate villages focused on particular, very narrow passions that individual groups might have.

BYTE: *Is there anything else you would like to say regarding computing in the future?*

Federico Faggin: The next 15 years are probably going to be even more exciting [than the last], in terms of technology and application of technology, and even more. We will not be able to anticipate many of the things that we will be able to do. And if we look back at the last 15 years where we have had enormous surprises, and enormous impact of technology, well, we have not seen anything yet. And neural networks will play a role. Neural will definitely play a role in this scenario.

Tom McWilliams: I guess the only thing I'd like to say is that, in the next 10 years, we're likely to see changes that are every bit as large as what we've seen in the last 10. And I think that advancement of computing on the chip will allow us to drive much better user interfaces, which will enable you to make much wider use of computers than what we've been able to do in the past with the relatively primitive user interfaces.

Rod Canion: You've really hit the high points with your questions. The key about it is, we're not at some plateau or some pinnacle. We're just really on the increasing slope of what the importance and the impact of microcomputers is going to be in the coming decade. It's an exciting place to be. All of us in the industry recognize how lucky we are to be here, and [we] feel good about what we're going to contribute to society and to the world. Then, after about a minute of that, [it's time to] roll up our sleeves and get to work. There's a lot to be done. ■

LAPTOP & LASER MEMORY AT MEMORABLE PRICES

We manufacture memory upgrade kits for COMPAQ, SHARP, TEXAS INSTRUMENTS and TOSHIBA LAPTOPS, and for laser printers from Dataproducts, Sharp and Texas Instruments. All of our kits go thru 100% QA inspection and functional tests/burn-in before they reach you. As far as we can tell, we are the only laptop/laser memory manufacturer in the world that actually burns-in each kit that leaves the assembly line. And that is why we can confidently provide each memory upgrade kit with a limited lifetime warranty and a 24-hour exchange guarantee. And the beauty of it is that, in the extremely slim case of failure due to mishandling, you never have to worry, because you can ask for an immediate replacement direct from us — *The Actual Manufacturer.*

WE ARE PRESENTLY SHIPPING THE FOLLOWING MEMORY KITS:

2MB FOR TOSHIBA T1200XE.....	\$229
2MB FOR TOSHIBA T1600.....	\$229
2MB FOR TOSHIBA T3100 (T3100/10).....	CALL
2MB FOR TOSHIBA T3100/20.....	CALL
512K FOR TOSHIBA T3100e.....	CALL
2MB FOR TOSHIBA T3100e.....	\$229
2MB FOR TOSHIBA T3100SX.....	\$229
4MB FOR TOSHIBA T3100SX (SEE NOTE).....	\$689
2MB FOR TOSHIBA T3200SX.....	\$229
4MB FOR TOSHIBA T3200SX (SEE NOTE).....	\$689
2MB FOR TOSHIBA T5100.....	\$229
2MB FOR TOSHIBA T5200 & T8500.....	\$229
8MB FOR TOSHIBA T5200 & T8500.....	CALL
1MB FOR COMPAQ SLT/286.....	\$169
1MB FOR COMPAQ LTE/286.....	\$139
2MB FOR COMPAQ LTE/286.....	\$229
1MB FOR SHARP PC-6220 NOTEBOOK.....	CALL
2MB FOR SHARP PC-6220 NOTEBOOK.....	CALL
1MB FOR SHARP PC-5741 20MHz 80386SX.....	CALL
4MB FOR SHARP PC-5741 20MHz 80386SX.....	CALL
8MB FOR SHARP PC-5741 20MHz 80386SX.....	CALL
1MB FOR SHARP PC-5541.....	\$449
3MB FOR SHARP PC-5541.....	\$749
1MB FOR TI TRAVELMATE 2000.....	CALL
2MB FOR TI TRAVELMATE 2000.....	CALL
1MB FOR TI LT286 MODEL 12.....	\$229
1MB FOR TI LT286 MODELS 25 & 45.....	\$449
3MB FOR TI LT286 MODELS 25 & 45.....	\$749
1MB FOR TI MICROLASER PRINTER.....	CALL
2MB FOR TI MICROLASER PRINTER.....	CALL
4MB FOR TI MICROLASER PRINTER.....	CALL
1MB FOR SHARP JX-9500 LASER PRINTER.....	CALL
2MB FOR SHARP JX-9500 LASER PRINTER.....	CALL
1MB FOR DATAPRODUCTS LZR-650 LASER PRINTER...CALL	
4MB FOR DATAPRODUCTS LZR-650 LASER PRINTER...CALL	

Note 1: Our 4MB Memory Kits are not the same as having 2 sets of the 2 megabyte kits. So when you buy additional memory for your laptop or laser printer, INSIST on the one WE manufacture. That's your only guarantee of ABSOLUTE PEACE OF MIND.

tote-a-lap

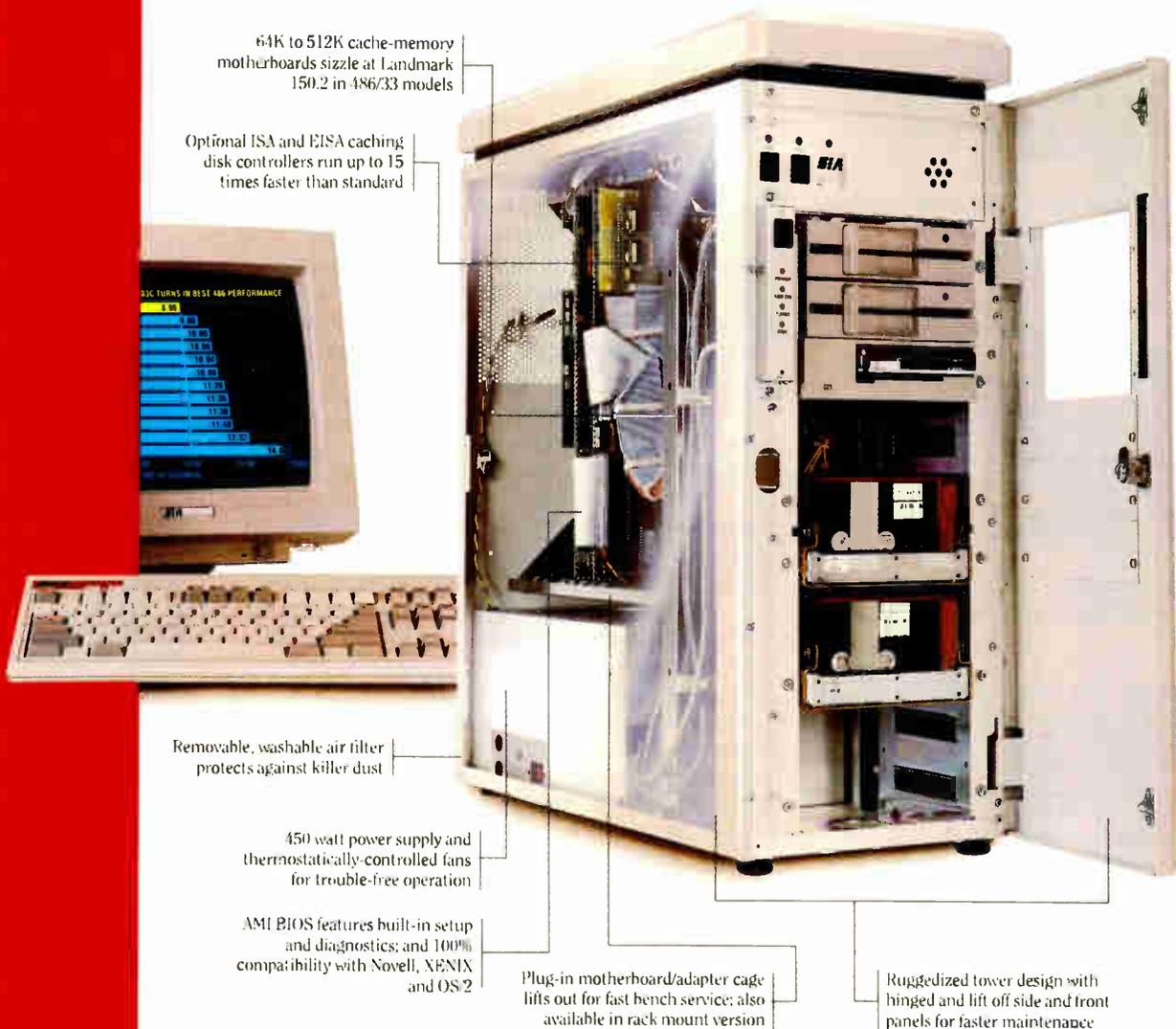
"Experts in portable intelligence"

550 Pilgrim Drive, Suite F

Foster City, CA 94404

(415) 578-1901 • ext. 924 • FAX (415) 578-1914

SIA Tops The List... Again



64K to 512K cache-memory motherboards sizzle at Landmark 150.2 in 486/33 models

Optional ISA and EISA caching disk controllers run up to 15 times faster than standard

Removable, washable air filter protects against killer dust

450 watt power supply and thermostatically-controlled fans for trouble-free operation

AMI BIOS features built-in setup and diagnostics; and 100% compatibility with Novell, XENIX and OS/2

Plug-in motherboard/adaptor cage lifts out for fast bench service; also available in rack mount version

Ruggedized tower design with hinged and lift off side and front panels for faster maintenance

When you're the industry leader, you've got to stay ahead. So after *BYTE* magazine named our computer the "world's fastest 386,"¹ we took on the 486 world... and won again.

SIA's 486/33C just topped the charts in the March 1990 issue of *PC Computing*.² And no wonder. Our 486 computers feature motherboards with an exclusive high-speed cache design, using 64K to 512K static cache memory for zero wait state and a Landmark rating up to an amazing 150 MHz. And they're available with either the ISA (AT) or EISA bus, each in 25-MHz and 33-MHz versions.

But resellers know it takes more than speed to keep ahead. That's why we offer them American-made

components. 50+ hour burn-in. ruggedized construction. AT hardware interchangeability, and AMI BIOS to ensure compatibility and reliability. For the details, just take a look through the tower of our 486/33C.

And we support our resellers. With exclusive channels, area leads, excellent margins, five-color brochures, double boxing, and 12-month warranties.

Our complete line of high-performance 386/486 PCs fits your serious VAR applications: in CAD, imaging, publishing and networking. And they're available in the configurations your client requires: desk, tower or rack-mount.

So if you or your clients want the top in performance, reliability and speed, call SIA today at (312) 440-1275.

U.S. only circle 532 on Reader Service Card (DEALERS: 533)

¹ *BYTE* Editors, "Megahertz Madness," *BYTE IBM Special Edition* (Fall 1989), p. 13.
² *PC Computing* Editors, "11 Hot 486s—Are You Ready For The World's Fastest PC?" *PC Computing* (March 1990), p. 97.

Systems Integration Associates.
 The high-performance choice
 for the serious reseller.



Systems Integration Associates
 222 East Pearson
 Chicago, Illinois 60611

See us at
 COMDEX/Fall '90 at
 our Sands Booth

1975-1990

15 YEARS OF BITS, BYTES, AND OTHER GREAT MOMENTS

*Witness to the birth of the microcomputer, its infancy, childhood,
and adolescence, BYTE continues to press forward on behalf of its readers*

Gene Smarte and Andrew Reinhardt

The founders of BYTE were clever enough—or lucky enough—to start their new magazine the same year the microcomputer revolution ignited. Since 1975, BYTE's history has paralleled that of the industry, reflecting its booms and busts, its hype and hubris, and, above all, its intoxicating energy.

Before 1975, the drumbeats of change in the computer world were heard but not understood. Intel had introduced the first microprocessor, the 4004, in 1971, followed in 1972 by the 8-bit 8008 and in 1973 by the 8080. Nolan Bushnell of Atari revolutionized arcade games and later home entertainment with the Pong game in 1972, and that same year a group of Californians dedicated to demystifying computers formed the People's Computer Company. In 1973, Scelbi Computer Consulting created what was arguably the first microcomputer, the 8008-based Scelbi 8-H.

But it was in 1975 that things really took off. MITS introduced the Altair 8800, computer clubs started springing up all over the U.S., and three chips that would dominate the early years of the industry—the Zilog Z80, the MOS Technology 6502, and the Motorola 6800—were all introduced. By 1976, dozens of companies had joined the fray, the first microcomputer conferences were held, and the Apple II was just around the corner.

In the following pages, we replay the story of the microcomputer industry, with a history of BYTE woven in. Compressing 15 years into 30 pages sharpens our hindsight; some products that made hardly a ripple at their introduction have gone on to become giants, while other stars have sunk out of sight. Most of all, it's sobering to realize that despite the fantastic rate of growth and change in the computer industry, we are still dealing with many of the very same problems today that we faced five and even 10 years ago.

To provide a little perspective, we've also tossed in real-world events. As a reminder of how young this industry is, recall that the IBM PC hadn't even been announced when Ronald Reagan was inaugurated and that the Macintosh was introduced the same year that Michael Jackson topped the charts with *Thriller*. Perhaps we have all, at times, gotten caught up in compiler speeds or register definitions and lost sight of the big picture.

In its early days, the microcomputer industry careened recklessly forward, often heedless of issues in the wider world. But now, computers increasingly shape the direction of our world, and as their role grows in importance, we must address important questions about their social, political, economic, health, and environmental impact. Follow our journey through history and you will see once again just how quickly the microcomputer has developed from a curiosity into a necessity.

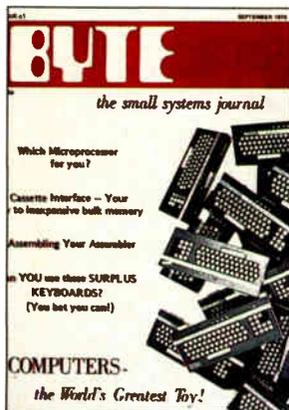
Gene Smarte is BYTE's senior editor for special projects. He can be reached on BIX as "gsmarte." Andrew Reinhardt is an associate news editor for BYTE. He can be reached on BIX as "areinhardt."

RESEARCH: AMANDA WATERFIELD
AND JEFF BERTOLUCCI

TIME LINE INDUSTRY PHOTOS,
1984-1990: PAUL AVIS

1975

COMPUTER INDUSTRY



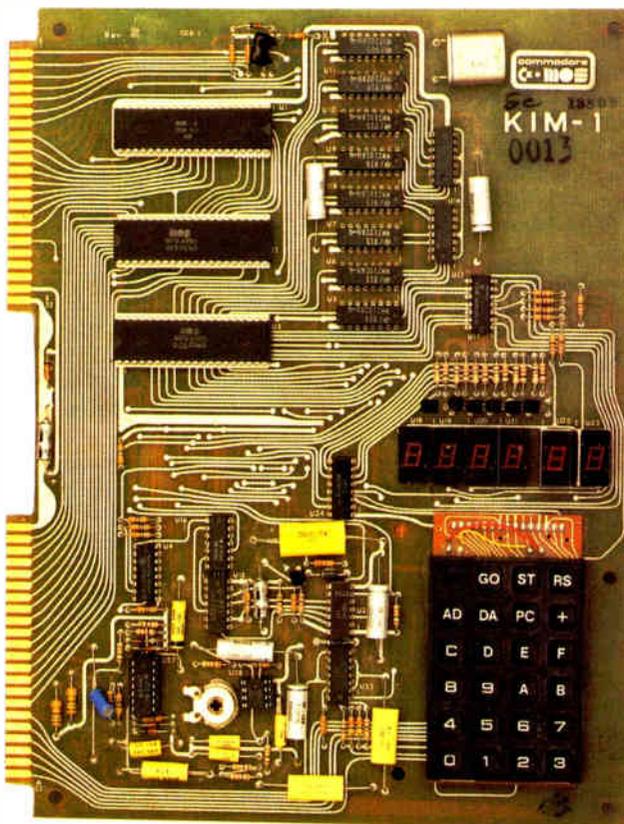
SEPTEMBER

BYTE's first issue! The state of the microcomputer industry, if you can call it that, was reflected in the articles BYTE printed. "Recycling Used ICs" and "Deciphering Mystery Keyboards" clearly showed that this endeavor was meant for low-budget hobbyists. BYTE begins the practice of reviewing computers by looking objectively at the RGS 008A microcomputer kit, and Don Lancaster had an article on the "Serial Interface." As far as software was concerned, "Write Your Own Assembler" sort of says it all. Interestingly, this technically based type of article, appearing in the very first issue, was to become BYTE's hallmark.

OCTOBER-DECEMBER

The first Robert Tinney cover illustration. Over the years and continuing today, Robert makes insightful contributions to BYTE. Hardware projects dominated because there were few commercial products available and enthusiasts could hardly afford them, anyway. "Assembling an Altair 8800" and "Build A 6800 System With This Kit" demonstrated that a few manufacturers were trying to fill needs. "The Software Vacuum" demonstrated that today's cry regarding hardware outpacing software is nothing new.

The Altair 8800 was featured on the cover of *Popular Electronics* as the "World's First Minicomputer Kit to Rival Commercial Models." Considered the first real microcomputer, it had an Intel 8080 processor, 256 bytes of memory, and a toggle-switch-and-LED front panel. The Altair sold for \$395 (or \$498 fully assembled), but up to \$2000 worth of peripherals were needed to make it go. MITS shipped about 2000 of the machines in 1975. Pictured below right is the interior.



MOS Technology announces the KIM-1, a \$245 assembled single-board computer based on the 6502, with 1K bytes of RAM, LED readout, cassette and serial interfaces, and a 2K-byte ROM monitor. BYTE's write-up says that the KIM-1 "will prove attractive to readers who are not inclined to fondle hardware extensively."



Zilog announces the **Z80** microprocessor, which will become the heart of the first major generation of non-Apple personal computers, the CP/M machines. It is available in February 1976.

The Homebrew Computer Club is founded by Fred Moore in Gordon French's Menlo Park garage.

Scelbi Computer Consulting announces the **Scelbi 8-B**, a successor to the 8-H. Both were based on the Intel 8008; the 8-B boosted memory capacity from 4K to 16K bytes and offered tape cassette and teletype interfaces, an oscilloscope-type CRT, and a ROM-based editor, monitor, and assembler.

The Amateur Computer Group of New Jersey is founded.

IMS International announces the **IMSAI 8080**, an improved clone of the Altair 8800.

MOS Technology announces the **6501** and **6502** microprocessors, which cost only \$20 and \$25, respectively, versus \$150 for an Intel 8080. The 6502 will later become the heart of the Apple II line.

First issue of **BYTE** is published by Wayne Green and Carl Helmers.

Objective Design announces **Encounter**, the first microcomputer game, which is shipped in assembly language on paper tape.

Wavemate founded; introduces **Jupiter II** kit.

Southwest Technical Products introduces the \$450 **M6800** computer kit, which has a serial terminal interface and ROM monitor.

Paul Terrell and Boyd Wilson open the first **Byte Shop** in Mountain View.

Microcomputer Associates offers the **JOLT** kit (6502, 512 bytes of RAM, serial interface to terminal, and monitor in ROM) for \$249.

IBM announces the **IBM 5100**, a 50-pound briefcase-size computer with 16K bytes of RAM, BASIC, a 16-line by 64-character built-in display, and a magnetic tape storage system, for about \$9000.

Ted Nelson's *Computer Lib* is published.



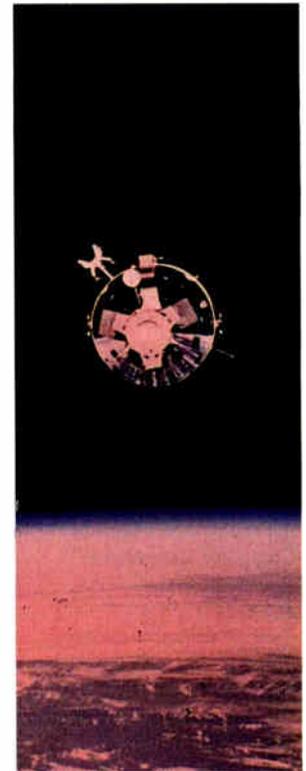
△ Bill Gates and Paul Allen write the first microcomputer **BASIC** and found Microsoft.

MITS announces its 4K- and 8K-byte **BASIC**, developed by Gates and Allen.

◊ The Sphere I used a **Motorola 6800** and offered 4K bytes of RAM, a keyboard, video interface, and ROM-based monitoring, all for \$650.



Saigon falls.



The last Apollo mission is a joint flight with Soviet cosmonauts; spacecrafts link and crews share meals and a press conference.



The Concorde supersonic transport begins commercial flights.



1976

COMPUTER INDUSTRY

BYTE

JANUARY

All sorts of computer-related gizmos and interfaces for the home and other hobbies were appearing, along with games.

FEBRUARY

Memory was a worry then as now, as evidenced by "How to Save the Bytes." And as microcomputers began to find their way into more and more hands, one of the early scare-scenarios of the computer's proliferation moved from giant climate-controlled data-processing centers to desktops: "Could a Computer Take Over?"

APRIL

More home control and other "We've got a computer, now what are we going to do with it?" articles. Don Lancaster writes "How to Build a Memory with One Layer Printed Circuits." And now things are starting to get interesting with "The Magic of Computer Languages."

JULY

Despite advances, homebrewing was still in fashion with recycling "Coincident Current Ferrite Core Memories," "Build a FAST Cassette Interface," and "Make Your Own Printed Circuits."

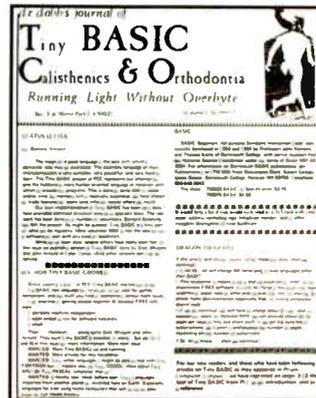
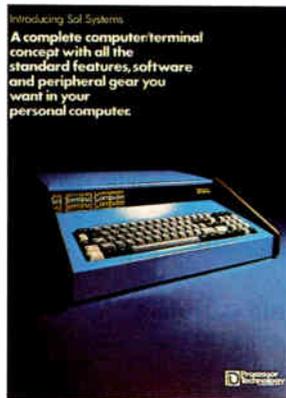
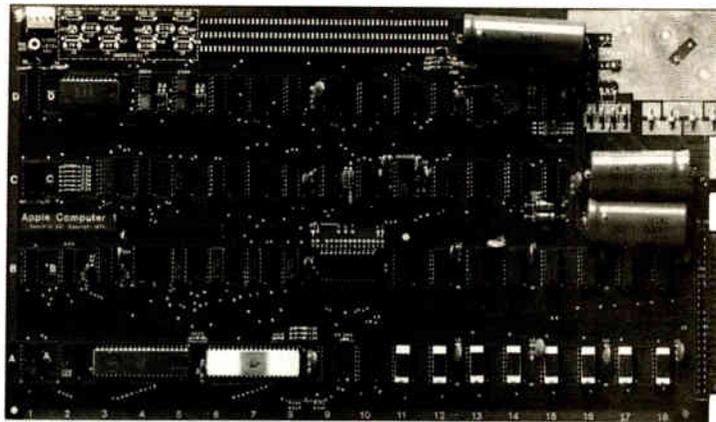
AUGUST-DECEMBER

"What Do You Do With a Video Disk?" is a question that's finally getting answered today. Computers with voices were croaking in "The Time Has Come to Talk," and we looked at chips in "Microprocessor Update: Zilog Z80." Interest in computer games continued to grow. Steve Ciarcia first appears with "Make your Next Peripheral a Real Eye Opener" as part of a graphics focus in the November issue.

The 6502-based Apple I was a real bare bones computer: no case, power supply, or peripherals. But Steve Jobs (right) and Steve Wozniak (left) took one to The Byte Shop, which ordered a few dozen on the condition that the kit be preassembled. Thus was born Apple Computer.



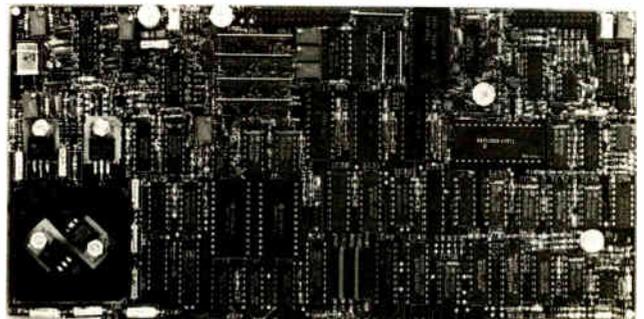
APPLE COMPUTER, INC.



Dr. Dobb's Journal of Computer Calisthenics and Orthodontia: Running Light Without Overbyte publishes its first issue.

Processor Technology introduces the Sol, designed by Lee Felsenstein, a \$995 kit with walnut sides and a metal case.

The Cromemco TV Dazzler offered 128-by-128-pixel resolution, required 512 bytes of memory, and cost \$215.



First microcomputer conference: David Bunnell of MITS organizes the World Altair Computer Convention at the Airport Marina Hotel in Albuquerque, New Mexico; 700 enthusiasts attend. Among the products introduced: the **Cromemco TV Dazzler**, the first microcomputer color graphics board.

Texas Instruments announces the **TMS9000**, the first 16-bit microprocessor.

Apple Computer is formed.

Steve Jobs and Steve Wozniak show the **Apple I** computer to the Homebrew Computer Club.

The first computer trade show of national scope: the Personal Computing Festival held in the Shelbourne Hotel in Atlantic City; Jobs demos the Apple, and the S-100 bus used in the Altair and IMSAI acquires its name.

Steve Wozniak proposes to Hewlett-Packard that it create a personal computer. Steve Jobs proposes the same to Atari. Both are rejected.

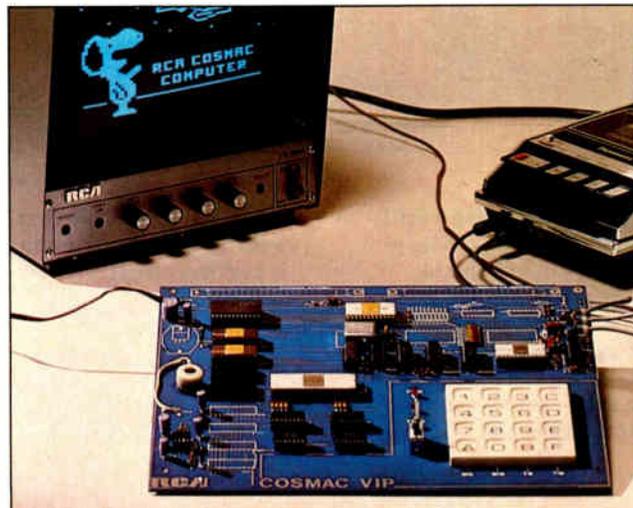
PolyMorphic Systems advertises the **Poly 88**, an 8080 machine based on the S-100 bus with 512 bytes of RAM, interfaces for video, keyboard, and cassette, and 1K bytes of ROM for \$685 in kit form.

Michael Shrayner writes **Electric Pencil**, the first word processor for microcomputers.

Crowther and Wood develop the first **Adventure** game for microcomputers.

Cromemco introduces **Z-1**, the first Z80-based system, with 8K bytes of RAM and serial I/O for \$2495.

At the urging of *Creative Computing* editor David Ahl, the NCC show for the first time devotes a day of conference sessions to microcomputers.



△ **RCA introduces the 1802 microprocessor.** It is later used in the RCA COSMAC VIP system, which was developed by Joseph Weisbecker from a design he pioneered five years before called FRED. The COSMAC included 2K bytes of RAM, 512 bytes of ROM, a hexadecimal keypad, and interfaces for video, cassette, and audio. RCA later exited the computer business.

▽ **Shugart announces its 5¼-inch "minifloppy" disk drive for \$390.**



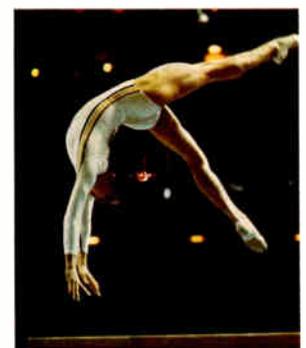
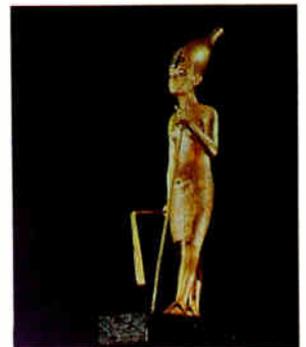
Viking I (July 20) and Viking II (Sept. 3) land on Mars and send back striking photographs of a barren, rocky landscape.

Chao-En Lai dies in China at 78.

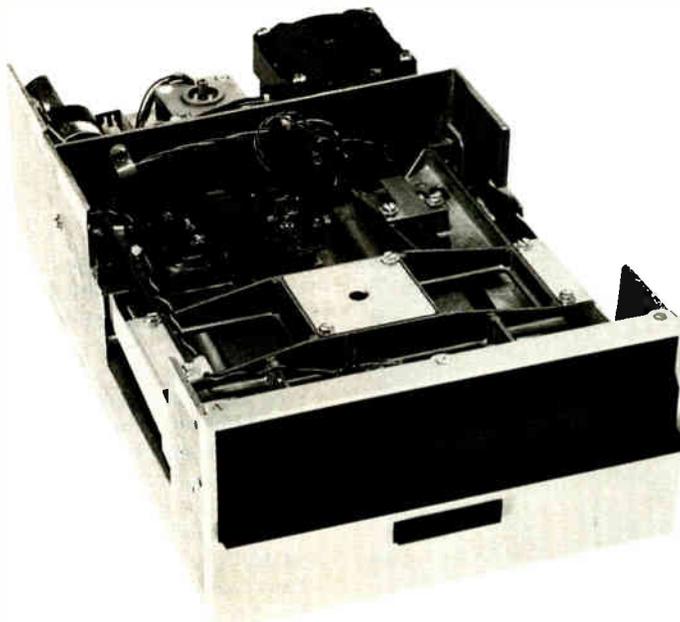
Mao Tse-tung, the father of the Chinese revolution, dies at 82.

Israeli commandos rescue 104 hostages held captive at the Entebbe airport by Ugandan dictator Idi Amin.

The King Tut exhibit, first of the blockbuster art shows, opens in Washington, D.C.



Summer Olympics in Montreal: 14-year old Romanian pixie Nadia Comaneci wins five perfect 10s in gymnastics.



BYTE

JANUARY-FEBRUARY

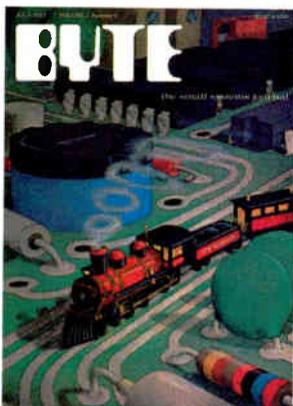
"Build the 'Coffee Can Special' EROM Eraser" and "Build This Economy Floppy Disk Interface" say it all. "Tiny" was operative with "A Review of Tom Pitman's Tiny BASIC."

MAY

Steve Wozniak provides a description of "The Apple II," introduced, along with the Commodore PET, at the first West Coast Computer Faire in April.

JULY-DECEMBER

Microcomputers were still looking for jobs in "How to Computerize Your Model Railroad." "Speech Recognition for a Personal Computer System" showed that this area was under exploration. Also, "SCORTOS: Implementation of a Music Language" and "Techniques for Computer Performances of Music" reflected this growing field. Although BASIC and assembly language dominated, "C: A language for Microprocessors?" hinted at things to come. Games such as Othello, Mastermind, NIM, and others appeared. Homebrewing continued to be a focal point in BYTE with the introduction of Ciarcia's Circuit Cellar.



△ The Apple II used a 6502 and offered 16K bytes of RAM (expandable to 48K), 16K bytes of ROM, a keyboard, cassette interface, eight-slot motherboard, game paddles, and a color-capable graphics/text display, for \$1298.

▷ Camp Retupmoc, the first week-long computer camp, is held in Terre Haute, Indiana.



▷ The TRS-80 (TRS stood for Tandy Radio Shack) used a Z80 and had 4K bytes of RAM and 4K bytes of ROM (including BASIC), a keyboard, display, and cassette interface. Tandy spent only \$150,000 to develop the system, including design, tooling, and software. Reportedly, only a few thousand were made so that if it flopped, the systems could be used to track inventory in Radio Shack stores.

Ohio Scientific Instruments offers the first microcomputer with Microsoft (floating-point) BASIC in ROM.

Computer Shack (later to become ComputerLand) opens its first franchise store in Morristown, New Jersey.

Jim Warren organizes the first West Coast Computer Faire in San Francisco.

Apple introduces the **Apple II** at the WCCF.

Radio Shack introduces the **\$600 TRS-80**.

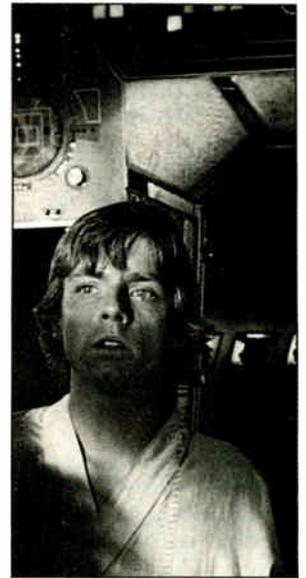
North Star Computers announces the **Horizon** (Z80, 16K bytes of RAM, one 5¼-inch floppy disk drive, 12-slot S-100 bus, serial I/O) for \$1999.

Micropolis introduces the **Metafloppy**, a 5¼-inch floppy disk drive with the capacity of 8-inch disks.

The venerable *Computerworld* adds a section on microcomputers.

Gary Kildall of Digital Research develops the **CP/M** (control program for microcomputers) operating system, which drives the first generation of PCs but will be passed up by IBM in favor of MS-DOS.

MITS is sold to Pertec Computer Corp.

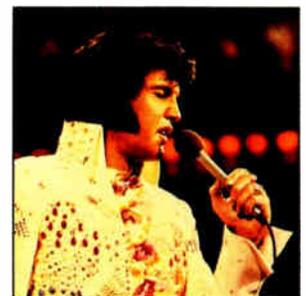


Star Wars blows away moviegoers and is the top-grossing film of the decade.

The TV show *Roots* becomes the most-watched miniseries in TV history and spurs crazes for genealogy and miniseries.

Carter pardons Vietnam War draft evaders.

Worst aircraft disaster in world history: KLM and Pan AM 747s crash on a runway in Tenerife, the Canary Islands, killing 581 people.



Elvis Presley dies at Graceland.

Voyager 2 launched; it will encounter Jupiter, Saturn, Uranus, and Neptune on its way out of the solar system.

Heathkit introduces the **H-8 microcomputer kit** based on an 8080 processor with an octal front-panel keypad. ▷



Commodore Business Machines unveils the **Commodore PET (Personal Electronic Transactor)** at the West Coast Computer Faire in April. The 6502-based machine cost \$595 assembled and included 4K bytes of RAM, 14K bytes of ROM, keyboard, display, built-in cassette tape drive, and 8K Microsoft BASIC. ▷



1978

COMPUTER INDUSTRY

BYTE

JANUARY-APRIL

The first "year of the LAN" may have appeared with "Personal Computers in a Communications Network." Robotics-related articles continued to appear. Microcomputer training begins to get serious with "A College Microcomputer Facility." The long-lived TRS-80 gets a review.

JUNE-JULY

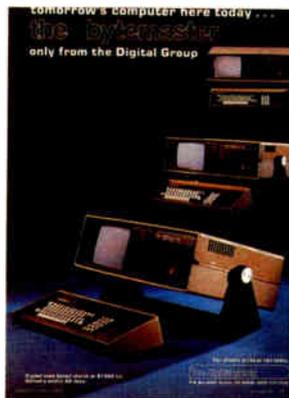
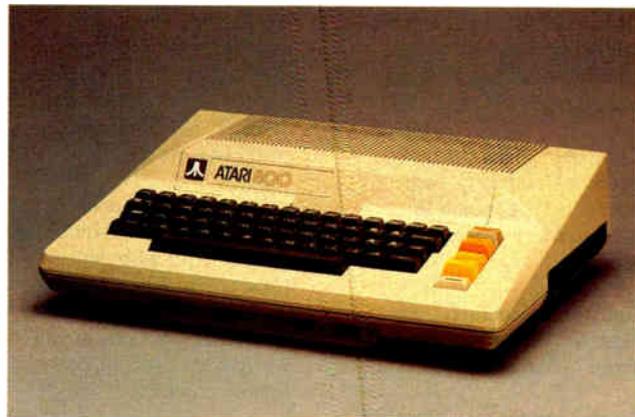
Real-world applications continue to emerge: "A Theatrical Lighting Graphics Package" and "Audio Processing with a Microprocessor." Also, the fixed disk drive, an expensive glint in users' eyes, is described in "A Look at Shugart's New Fixed Disk Drive." And computer industry retrospection is nothing new: "A Short History of Computing" and "The First Ten Years of Amateur Computing" appeared in July.

AUGUST-DECEMBER

In August we focused on Pascal, the start of a long-lived tradition of BYTE's annual August language issue. Computerized chess programs proliferated. The "Hobbyist Computerized Bulletin Board" could only hint at what we have today. "FORTRAN and Its Generalizations" combined with Pascal, C, and BASIC, to develop a rich set of languages for the "hobbyist."

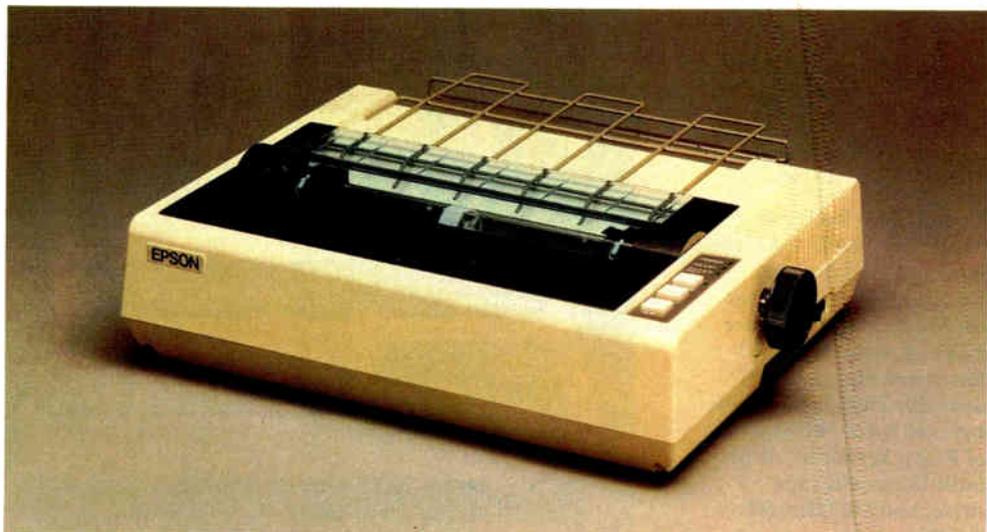


▷ The Atari 400 (bottom) and 800 (top) were both based on the 6502. The 800, which cost \$1000, had a full keyboard, 8K bytes of RAM (expandable to 48K), two ROM cartridge slots, and custom sound and graphics chips designed by Jay Miner (who later designed the Amiga's custom chips). The 400 had an unfortunate membrane keyboard. Neither machine shipped until late 1979.



◁ The Digital Group announces the Bytemaster, a sewing-machine-size computer housing a display, keyboard, and disk drive. Never very popular, it pre-dates the Osborne 1.

▷ Epson America introduces the MX-80 dot-matrix printer and revolutionizes the low-cost printer market.



WORLD

MicroPro International, founded by Seymour Rubenstein of IMSAI, announces **WordMaster**, precursor to WordStar.

Dan Bricklin and Bob Frankston team up to develop **VisiCalc**.

Apple and Radio Shack announce 5 1/4-inch floppy disk drives.

Houston Instruments announces **HiPlot** plotter.

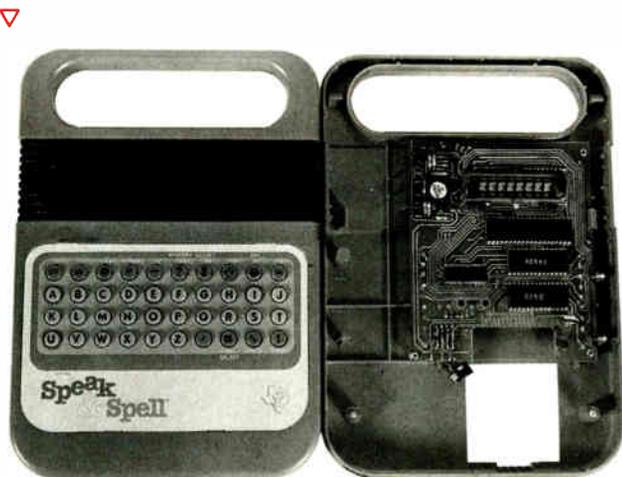
Summagraphics announces **Bit Pad**, the first digitizer.

Computer Headware announces **WHATSIT** database manager.



△ The Exidy Sorcerer sold for \$895 and included a Z80; 8K bytes of RAM; 12K bytes of ROM; a keyboard; and serial, parallel, and cassette interfaces. Its major innovations were the use of plug-in ROM cartridges for software and user-definable characters.

Texas Instruments introduces **Speak and Spell**, the first talking toy to use digital speech synthesis.



THE COMPUTER MUSEUM



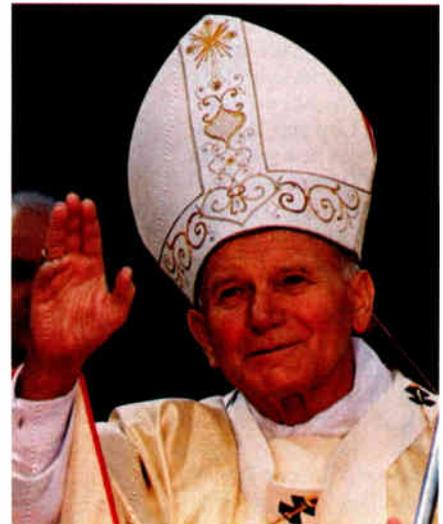
Camp David agreements bring together Israel and Egypt.

The Supreme Court's **Bakke** decision outlaws strict racial quotas for affirmative action.

Louise Brown, the first "test tube" baby, is born in England.

Catholics get a new pope, **John Paul I**, but he dies only 33 days later.

Polish cardinal John Paul II is elevated to the papacy.



California voters pass **Proposition 13**, an anti-property tax initiative that kicks-off a national tax revolt.

Sony introduces the Beta-format VCR and kicks off the home-video revolution; VHS arrives in 1979.



1979

COMPUTER INDUSTRY

BYTE

JANUARY-MARCH

Today's deluge of junk mail might be traced back to "A Computerized Mailing List." More beneficial topics covered were MUMPS, IPS, and "Elements of Statistical Computation." Mac-ace-to-be Jef Raskin looked at "Unlimited Precision Division." Computer security was already an issue, as "The Standard Data Encryption Algorithm" shows.

JUNE-SEPTEMBER

Man keeps trying to figure out the human brain: "A Model of the Brain for Robot Control." Bubble memories burst on the scene. Math, graphics, and music continue to be discussed. The August issue looks at Lisp and Motorola's curious new processor, the 68000. And lest you think that things were getting sophisticated, "Soldering Techniques" was published.

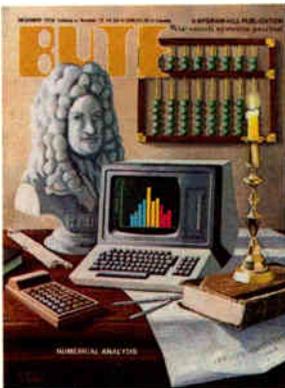
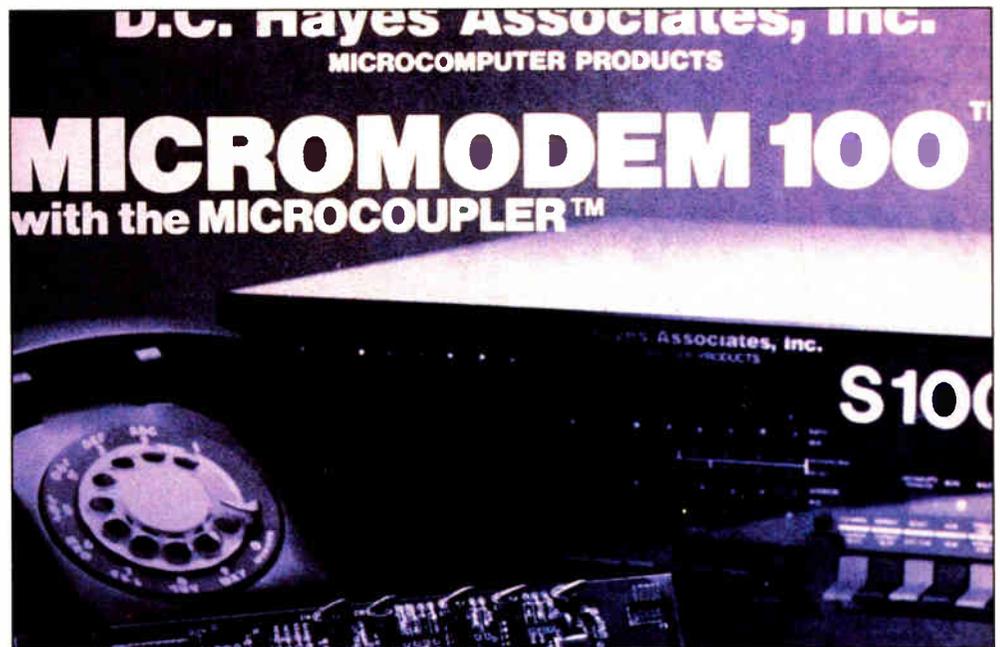
NOVEMBER-DECEMBER

Steve Ciarcia looked at "The Intel 8086" system design kit. Applications began to look less odd, though esoteric: "Noniterative Digital Solution of Linear Transfer Functions." The problem of memory crunching appeared in an article on text compression using Huffman codes. Programming diversity was demonstrated in "Twenty-Four Ways to Write a Loop."



Dan Bricklin and Bob Frankston of Software Arts show VisiCalc at the WCCF. It is marketed by Personal Software, later to become VisiCorp.

Hayes Microcomputer Products announces the Micromodem 100 (bottom). This auto-dial, auto-answer modem transmitted at 110 to 300 bps and retailed for \$399.



WORLD

CompuServe founded.

The Source founded.

Magic Wand becomes WordStar's first serious competitor.

Wayne Ratliff develops the **Vulcan** database program that will later become dBASE II.

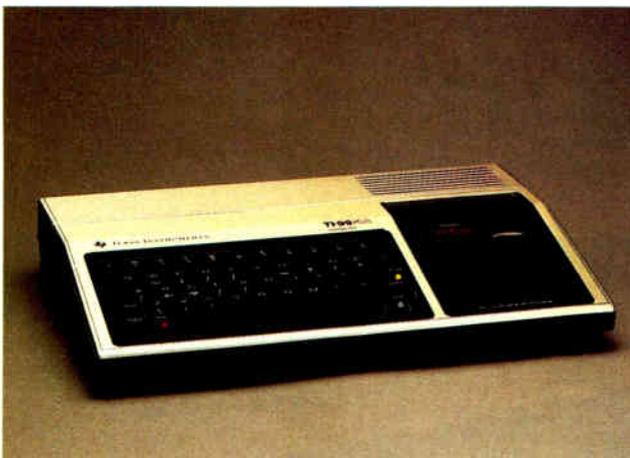
Video games, such as *Space Invaders* and *Pac Man*, become a huge craze.

Intel introduces the 8088, which will become the heart of the IBM PC.

The first Apple clone appears at the West Coast Computer Faire; it is called, appropriately enough, the **Orange**.

Xerox, DEC, and Intel announce **Ethernet**.

The TI-99/4, which included a color monitor in its \$1150 price, suffered from slow performance (despite being based on the 16-bit TMS9900 processor), an awkward keyboard, and a lack of third-party software support. The TI-99/4A was an improvement, but the firm took a huge loss on the machine and in the end units sold for as little as \$99.



Three Mile Island disaster nearly melts down the U.S. nuclear industry.

Margaret Thatcher is elected the first female prime minister of Great Britain.

An American Airlines DC-10 crashes outside Chicago in the worst disaster in U.S. aviation history, killing all 275 aboard. The FAA grounds all DC-10s.

Sony introduces the Walkman.

Sandanistas come to power in Nicaragua.

Skylab, launched in 1973, falls out of orbit over Australia, leaving a fiery trail of debris.

The U.S. government bails out Chrysler in a \$1.5 billion deal.

Star Trek: The Motion Picture is the first of a successful film series.



The Soviet Union invades Afghanistan, starting the war that will become its "Vietnam."

Annual U.S. energy consumption peaks at 78.9 quadrillion BTUs.

Ninety hostages, including 63 Americans, are seized in Iran by militant student followers of the Ayatollah Khomeini.



1980

COMPUTER INDUSTRY

BYTE

JANUARY-MARCH

Two articles foretold some things to come: "Telephone Dialing by Computer" and "A Computer-Generated Reminder Message," called Tickler. Scientific applications were emerging with programs that solved the Schrödinger wave equation and modeled hydrocarbon molecular bonding on an Apple II.

JULY

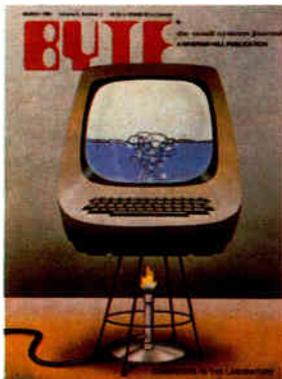
The beginnings of VDI might be traced to "Interactive Control of a Videocassette Recorder with a Personal Computer," which linked a Sony Betamax with an Apple II or TRS-80. Several articles made up an "Education Forum." And, significantly, "science fiction writer" Jerry Pournelle began one of the longest-running and most widely read computer magazine columns.

SEPTEMBER

Personal computing gets down to business with "A Basic Floppy-Disk Accounting System," a "six-program package to keep your budget records in order." BYTE turns five years old.

NOVEMBER

Digital imaging and visualization are big topics today. Back in 1980, they were just emerging with "Digital Storage of Images."



◁ The Sinclair Research ZX80 was the first micro-computer to cost less than \$200. Based on a Z80 with 1K bytes of RAM and 4K bytes of integer BASIC in ROM, it had a membrane keyboard and was the brainchild of English genius Clive Sinclair. The successor ZX81 (inset) was later sold by Timex and dropped to less than \$100 before Timex exited the market.



◁ The Commodore VIC-20 was targeted at the same buyer as the TI-99/4, but it was a better machine. It used a 6502A and offered 5K bytes of RAM, BASIC in ROM, serial, cassette, and modem interfaces, a color display, and ROM software cartridges, for \$299. It became the first million-seller in the history of the industry.



◁ Personal Software introduces Zork, the Underground Empire, a "second-generation" computer adventure game.



The first issue of *Infoworld* is published.

Apple announces the problem-plagued **Apple III** for \$3495.

Shugart begins selling 5 1/4-inch **Winchester** drives that hold 80 times as much data as a standard floppy and transfer data 20 times faster.

Radio Shack announces the **TRS-80 Color Computer**.

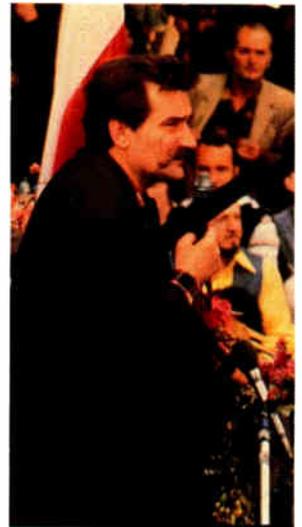
Altos introduces the first microprocessor-based multi-user system; the **8000-5** used a Z80A, supported up to four people, and sold for roughly \$8500.

Apple goes public with 4.6 million shares sold at \$22 apiece; Jobs and Wozniak are instant multimillionaires.

Digital Research announces **CP/M-86**.

Satellite Software International, later WordPerfect Corp., announces the first version of **WordPerfect** for Data General computers.

Apple's successor to the hugely successful Apple II was a business computer called the Apple III that was a disaster. Shipped a year late, the machine initially suffered a nearly 100 percent failure rate and almost dragged down the company.



Polish Solidarity trade union forms; it will pave the way for reform in Eastern Europe nine years later.

Ted Turner's **CNN** begins broadcasting and changes the face of TV news.

Ronald Reagan wins the presidency.

Fire sweeps through **MGM Grand Hotel** in Las Vegas during the second **Comdex** show, killing 84 people.



Mount St. Helens blows up, killing at least 25 people and casting ash across the northwestern U.S.

The U.S. hockey team wins the gold at Lake Placid.



1981

COMPUTER INDUSTRY

BYTE

MAY
BYTE looked at "The Commodore VIC 20 Microcomputer: A Low-Cost, High-Performance Consumer Computer." Software piracy and protection issues were discussed."

JUNE
Gary Kildall explained Digital Research's operating systems, while Unix and Xenix were moving down from large-computer environments in other articles. Author Stephen Wozniak describes how "An 8-bit microcomputer is harnessed to the Herculean task of computing the mathematical constant e to 115,925 places."

AUGUST
Smalltalk isn't just small talk anymore. Adele Goldberg prefaces this very popular topic and BYTE issue.

SEPTEMBER
How to benchmark systems has been a popular topic for years. In "A High-Level Language Benchmark," the now-classic Sieve of Eratosthenes is introduced.

OCTOBER-DECEMBER
Later-to-be editor in chief Phil Lemmons provided a first impression of the IBM PC, noting that "The computer giant embraces software compatibility and support for independent peripheral manufacturers."



△ Adam Osborne, publisher of microprocessor books, unveils the \$1795 Osborne 1 Portable. It includes a Z80, a 5-inch display, 64K bytes of RAM, a keyboard and keypad, two serial interfaces, two 5¼-inch floppy disk drives and bundled software.

▽ IBM introduces the PC, which costs \$3005 for an 8088, 64K bytes of RAM, and a single 5¼-inch floppy disk drive. Its importance cannot be understated.

The Alto, developed by researchers at Xerox PARC, paved the way for the Macintosh. Although never sold as a commercial product, the Alto came with the Smalltalk programming language, a mouse, and Ethernet connectivity.



WORLD

Warner Amex, Atari, and CompuServe announce cable TV information service.

Steve Wozniak crashes his private plane but survives to return as an incognito grad student at Berkeley. He sponsors the money-losing US Festivals.

Tracy Kidder's *The Soul of a New Machine*, a chronicle of the development of a Data General minicomputer, becomes a national bestseller.



Timex contracts with Clive Sinclair to market the **Timex/Sinclair 1000**, the first under-\$100 computer in the U.S.

Atari and Mattel **Intellivision** video games are huge hits in an otherwise disappointing Christmas season for computer makers.

Corvus introduces **Omni-Net**, an inexpensive twisted-pair LAN.



First launch of the space shuttle, the Columbia.

Assassination attempt on Pope John Paul II in St. Peter's Square, Rome, by escaped Turkish criminal Mehmet Ali Agca.

The as-yet-unidentified AIDS epidemic is first reported in the Center for Disease Control's Morbidity and Mortality Weekly Report.

Francois Mitterand becomes the first socialist president of France.

Anwar Sadat is murdered by Moslem extremists.

Martial law imposed in Poland by ruling Communist leaders.



Sandra Day O'Connor is confirmed as the first female Supreme Court Justice in U.S. history.

Hayes introduces the **Smartmodem 300**, which becomes the industry standard.



△ **Epson America shows the HX-20**, perhaps the first laptop computer; the machine weighs less than 3 pounds and uses a CMOS version of the 6801, 16K bytes of RAM, and a 20-character by 4-line display.



Iranian hostages released minutes after Reagan inaugurated.

Assassination attempt on Ronald Reagan; the would-be killer is a loner fixated on actress Jodie Foster.



Charles and Di tie the knot.

1982

COMPUTER INDUSTRY

BYTE

JANUARY

Real-world applications continued to grow, and BYTE published "A Closer Look at the IBM Personal Computer." And for "under \$200" you could add a whopping 16K bytes to your Sinclair ZX-80.

APRIL

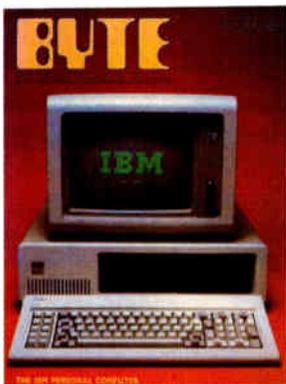
BYTE looked at human factors in human/machine interfaces for both hardware and software, a topic of considerable interest today (and probably well into the future).

JUNE-AUGUST

Multimedia is a hot topic today, and BYTE provided state-of-the-art information on an emerging, accessible technology, the videodisk. More mainstream applications emerge. LOGO, a language designed to introduce kids to computers, gets some in-depth adult treatment in a comprehensive series of articles.

SEPTEMBER-DECEMBER

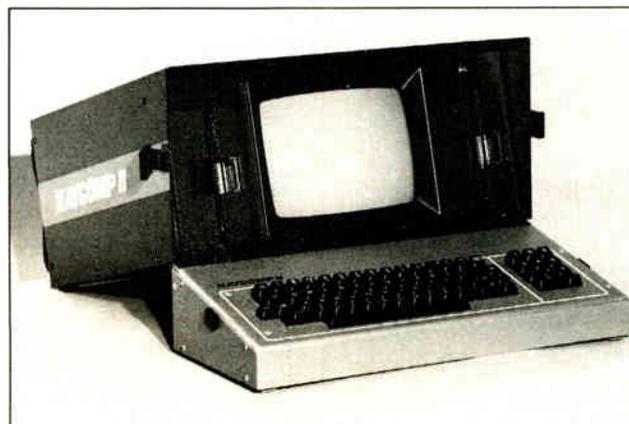
Steve Ciarcia begins his MPX-16 Computer System project, an IBM workalike. BYTE evaluates Epson's unique QX-10/Valdocs system, we have reports from the National Computer Conference and the Hanover Fair, and "A Comparison of Five Compilers for Apple BASIC" reinforces the BYTE tradition of providing in-depth technical material.



△ Compaq Computer Corp. announces the Compaq Portable, an IBM PC-compatible system.



◁ Commodore announces the Commodore 64. Based on the 6510, it included 64K bytes of RAM, 20K bytes of ROM (including Microsoft BASIC), a custom sound chip, color graphics, and a serial interface. It retailed for \$595, but eventually the price dropped to around \$200.



◁ Kaypro (then called Non-Linear Systems) announces the \$1795 Kaycomp II portable; with a 9-inch screen and bundled software, it was targeted to compete with the Osborne.

WORLD

GRiD Systems announces its first pricey executive portable, the futuristic-looking \$8000 **Compass 101**.

Franklin Computer Corp. announces the **Ace 100**, an Apple II clone.

David Bunnell starts *PC Magazine*.

Lotus Development introduces **1-2-3** at Comdex.

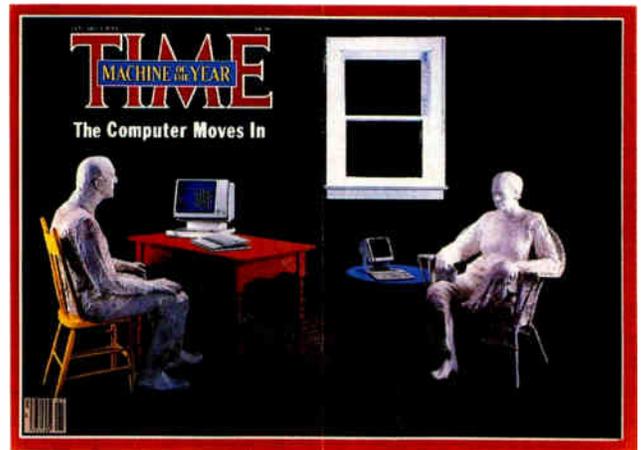
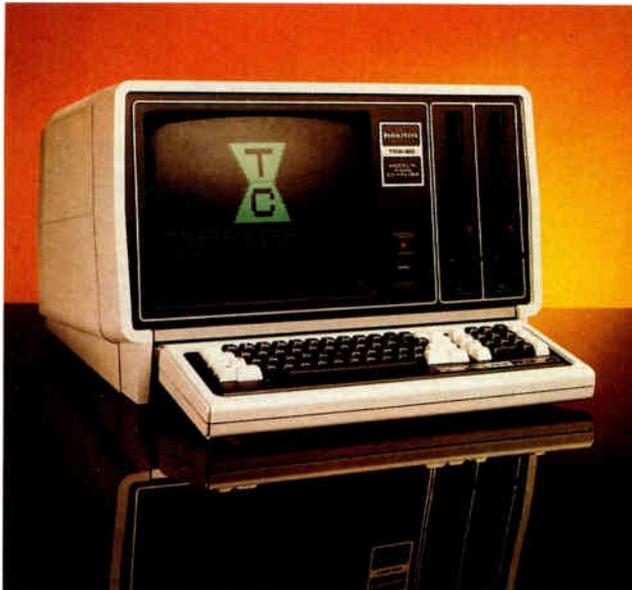
Intel announces the **286**.

Autodesk announces **AutoCAD**, the first CAD system for the PC.

Peter Norton Computing introduces the **Norton Utilities**.

Softsel publishes its first **Hot List**, originally called the "Top 100."

Radio Shack announces the **TRS-80 Model 16**, based on a 68000 and Z80, with 128K bytes of RAM and an 8-inch floppy disk drive, for \$4999.

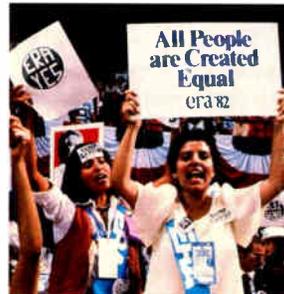


Time magazine names the computer its annual **Man of the Year**.

Antitrust suit against AT&T settled with signing of consent decree to break up the Bell System.

Israel invades southern Lebanon.

The movie *Tron* glorifies video games and includes an unprecedented computer animation sequence but is otherwise disappointing.



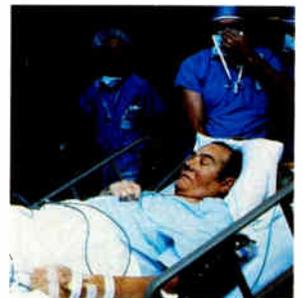
The **Equal Rights Amendment** is defeated after a 10-year struggle for passage.



Falklands War: the QE2 is commandeered as a troop carrier; the British use the Harrier and the Argentines use the Exocet.



E.T. lands in theaters to become the most successful movie of all time.



Dr. **Barney Clark** receives implant of first artificial heart.

Columbia Data Products announces the first IBM PC clone, the **MPC**; it is soon joined by Compaq and Corona, but only Compaq thrives.



BYTE

FEBRUARY-MARCH

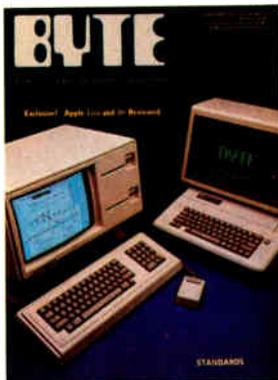
Lisa arrives not quite dressed for the ball. BYTE discussed "A Proposed Floppy-Disk Format Standard," ANSI standard BASIC, NAPLPS, the IEEE S-100 bus standard, and graphics standards. Several articles, such as "The Promise of Perpendicular Magnetic Recording," played out new mass storage scenarios.

APRIL-MAY

A series begins on the 68000 chip, which will later proliferate in the Macintoshes. We looked at coprocessing with the 8087 chip, provided for in the original IBM PC by an empty socket. Niklaus Wirth's Modula-2 is introduced. The promise of the paperless office is as yet unfulfilled, although BYTE devoted its Theme to the topic in May.

AUGUST-NOVEMBER

In August, BYTE looked at the C language and a little of Unix, topics that often dominate conversations today. "Computing on the Run" looked at the developing portables and the technology behind them—rather primitive by current standards, yet intriguing and exciting then. Then, in October, Unix received closer scrutiny in its own Theme. And for November, the "Inside the IBM PC" Theme spearheaded BYTE's largest issue so far, 720 pages.



△ Apple unveils the Lisa, a \$10,000 machine based on the 32-bit 68000 and featuring a graphical user interface and mouse.

Apple also announces the Apple IIe, priced at \$1395. ▷



▷ Tandy announces the 80186-based Tandy 2000.

▷ Coleco unveils the Adam at CES, but it becomes the "Adam bomb."



△ Radio Shack announces the 4-pound TRS-80 Model 100 for \$800.



▷ The Gavilan computer, a laptop with built-in software and a touchpad "mouse," is introduced at Comdex but never takes off.



Novell introduces **NetWare**, the first file server LAN operating system.

Micro Edsels: Atari announces the **1200XL**, and Mattel announces the **Aquarius**.

IBM introduces the **XT**, which adds a 10-MB hard disk drive and three more slots to the original PC design, for \$4995.

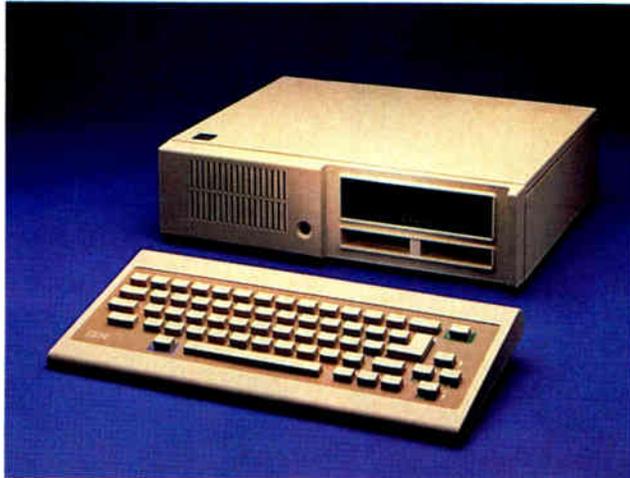
PC Magazine sold to new owners; most of staff quits to form *PC World*.

Microsoft announces **Word** (originally called Multi-Tool Word).

Microsoft and a group of Japanese companies announce the **MSX** standard for Z80-based computers.

Osborne files for Chapter 11 bankruptcy.

IBM announces the PCjr, which is arguably the company's biggest failure of the 1980s despite reengineering and huge marketing.



AST introduces the hugely successful **SixPakPlus**, a PC add-in combining memory expansion; serial, parallel, and game ports; clock/calendar; and utility software.

Shugart shows a 1-gigabyte **WORM** drive for \$7600.

Borland International announces **Turbo Pascal** for CP/M and 8088 machines.

Ovation Technologies announces **Ovation**, perhaps the most hyped-up product to that point, and it never ships; the term *vaporware* is coined to describe it.

Compaq goes public, and 6 million shares are sold in one day.

Canon displays a 300-dpi laser printer engine for OEMs that costs less than \$2000; it shows up the next year in the HP LaserJet.

Microrim, founded by Wayne Erickson in November 1981, introduces **R:Base 4000**, the first relational database for PCs.

Microsoft announces **Windows**, but it doesn't ship for two years.

The Semiconductor Industry Association reports a book-to-bill ratio of 1.6, the highest ever recorded.

AT&T announces **Unix System V**.

Iomega introduces the first **Bernoulli Box**, an innovative removable disk drive.

◀ **The Hewlett-Packard HP 150 was an 8088-based machine that offered a unique touchscreen.**



Sally Ride becomes the first U.S. woman in space aboard the shuttle Challenger.

Faked Hitler diaries capture the news.

Dr. Luc Montagnier of the Pasteur Institute in Paris discovers the virus that causes AIDS.

Philippine opposition leader Benigno Aquino fatally shot while disembarking at Manila Airport.

Soviets shoot down Korean Air 007, killing 269 people.

Lech Walesa wins Nobel Peace Prize.

U.S. Marine barracks in Beirut are blown up by suicide-bomb terrorist; 241 lives are lost.



1984

COMPUTER INDUSTRY

BYTE

THE SMALL SYSTEMS JOURNAL

FEBRUARY-MARCH

BYTE covers the new Macintosh and the design team behind it. And we devoted an entire Theme to the thorny issues of benchmarking and performance evaluation. In March our "Feigning Reality" Theme looked at using the computer to simulate real-world activities.

MAY

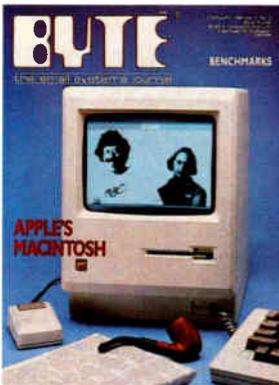
"Professional Computing," how microcomputers were faring in the workaday world, was our May Theme. In a feature, we noted that Macintosh pricing "turns out to be more expensive than expected."

JULY-SEPTEMBER

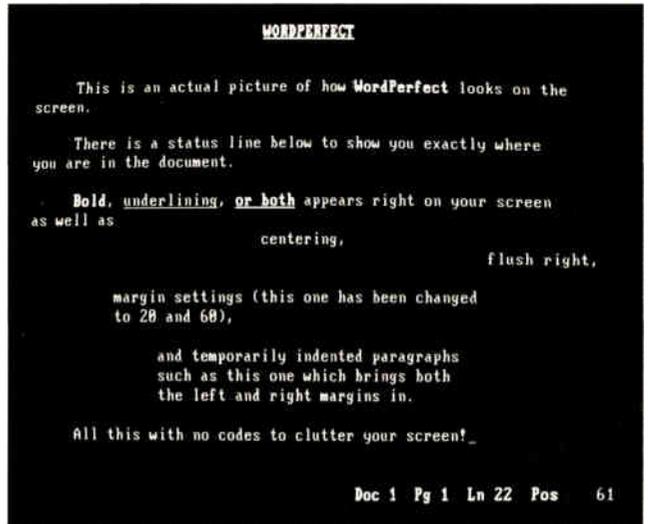
Computer users' fascination with video continued with our July Theme, while in August we looked at Modula-2 in depth. Despite the IBM PC's success, nothing could save the IBM PCjr we reviewed in August. BYTE produces its first yearly IBM-only special issue. Graphics gets its own Theme in September.

OCTOBER-NOVEMBER

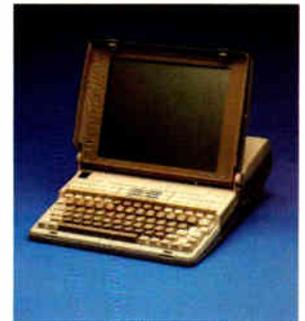
For October, the BYTE staff looks at the IBM PC AT and the Theme is databases. In November, "New Chips" was the Theme, and we first looked into Soviet computing with "AGAT: A Soviet Apple II Computer."



▷ Satellite Software International brings out WordPerfect for the IBM PC, Victor 9000, DEC Rainbow, Zenith Z-100, and Tandy 2000.



▷ Hewlett-Packard introduces the LaserJet and the HP 110, an early 80C86 laptop.



▷ Data General introduces the DG/One laptop.



▷ More of the fruit motif: Britain produces the Apricot PC.

With Lotus's **Symphony**, the era of integrated packages gets under way; the next month, Ashton-Tate introduces **Framework**.

Visionary Alan Kay leaves Atari to join Apple.

AT&T tries to muscle into the game with its first DOS machines, but the PC 6300 is greeted mostly with yawns.

Motorola introduces the **68020**.

Former Commodore president Jack Tramiel buys Atari from Warner Communications.

IBM also announces **Top-View**, a multitasking windowing environment for DOS programs that never catches on.

Innovative Software (later Informix) introduces **Smart Software**.

Commodore Business Machines buys Amiga Corp.

Computer Associates buys Sorcim, the maker of **SuperCalc**.

Visicorp sells much-touted but never-delivered **VisiOn** package to Control Data Corp.

Visicorp merges via stock swap with Paladin Software.

George Tate, cofounder of Ashton-Tate, dies. There was no Ashton; Tate's partner was named Lashlee.

Lotus announces **Jazz**, which went on to become the company's first flop.

Exactly one year after reaching its historic peak, the SIA's book-to-bill ratio reaches its lowest point ever: 0.64.



△ Apple unveils the Macintosh for \$2495.

◁ Apple introduces the Apple IIc.

IBM introduces the AT, with a 286, 256K bytes of RAM, a 16-bit bus, and a new high-density floppy disk drive for \$5469.



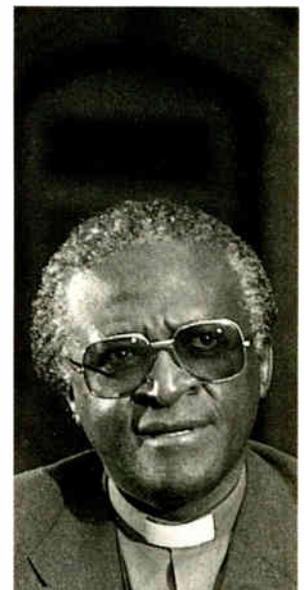
Geraldine Ferraro becomes the first woman on a major party ticket, but she can't save Mondale; Reagan is reelected in a landslide.

Indian Prime Minister Indira Gandhi is assassinated by Sikh extremists.

U.S. Census Bureau reports that 15 million Americans own home computers but only 53 percent use them.

Soviets pass up the summer Olympics in L.A.

Deadly gas leak at Union Carbide plant in Bhopal, India, kills 2500—the worst industrial accident in history.



Bishop Desmond Tutu of South Africa is awarded the Nobel Peace Prize.

1985

COMPUTER INDUSTRY

BYTE

THE SMALL SYSTEMS JOURNAL

JANUARY-APRIL

The Mac begins to make inroads into our readership, as evidenced by the number of Mac-related articles. February's Theme was Computing and the Sciences. In March, Jerry Pournelle reported on Hackercon, a first-of-its-kind convention. AI gets plenty of ink in April, with top names in the field speaking their minds.

MAY-AUGUST

Smalltalk gets a mini-treatment in May, emphasizing the growing interest in object-oriented programming. "Inside AppleTalk" hinted at the future of Apple-related networking. BIX is announced. Computers and Space is the July Theme. "The Amiga Personal Computer" is covered in August, as are the declarative languages.

SEPTEMBER-OCTOBER

BYTE's 10th anniversary issue is published in September! October's "Simulating Society" Theme presented the idea of modeling and predicting using personal computers. BYTE's second IBM Special Issue hits the streets, reflecting the growing influence on the industry.

NOVEMBER

"Five C Compilers for the Macintosh" indicated that the Mac was gaining ground. Years earlier, only MS-DOS machines would have had multiple compilers to choose from. And "CD-ROMs and Their Kin" reinforced the coming optical revolution.

DECEMBER

A "Computer Conferencing" Theme indicated that BYTE readers and the technology were ready to link up via BIX, BBSes, and other on-line electronic services.

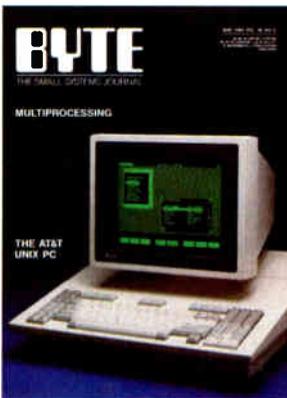


Atari announces the Atari 520ST at CES. ▶

Tandy announces the Model 200 laptop. ▼



General Computer HyperDrive, a hard disk retrofitted into the Mac, becomes available; it's a short-lived market niche. ▶



▶ AT&T announces the Unix PC, a 68010-based, \$5600 machine that failed to establish Unix as a PC standard.

Commodore's Amiga 1000 features a multitasking, windowing operating system and sells for \$1295. ▼



WORLD

Coleco gives up on the Adam and writes down the loss.

One year after the Mac, Apple unveils the **Macintosh Office**, which includes AppleTalk and the LaserWriter, and renames the doomed Lisa the Mac XL.

DEC admits it has stopped making the **Rainbow**, and then announces a new and equally unsuccessful version.

IBM, Toshiba, NEC, Fujitsu, Hitachi, and Mitsubishi all report 1-MB DRAM chips at the annual ISSCC.

IBM says it will drop the **PCjr** in April.

Apple discontinues the Lisa.

Digital Research ships **GEM** to end users; the interface was eventually used by the Atari ST and Ventura Publisher.

Microsoft releases **C 3.0**, its first homegrown C.

Dayna Communications announces **MacCharlie**, which lets a Mac run IBM PC software; many readers think it is an April Fools' joke. ▽



Intel sues NEC over **V20** and **V30**.

Microsoft announces **Excel** for the Mac.

Lotus finally ships **Jazz**.

Lotus and Intel announce an expanded memory specification that will eventually become **LIM/EMS 3.2**, and Intel announces **AboveBoard**.

Lotus acquires Software Arts; stops shipment of **VisiCalc**.

Aldus introduces the original **PageMaker** for the 512K-byte Mac.



Quarterdeck Office Systems releases the **Desqview** windowing program multi-tasker.

Steven Jobs resigns from Apple.

Ansa introduces **Paradox**, later to be bought by Borland.

IBM introduces its **Token Ring** network.

Intel announces the **386**.

Microsoft finally ships **Windows 1.0**.

△
Toshiba introduces the fantastically successful **T1100** laptop.



Gorbachev comes to power in the U.S.S.R.

Reagan and Gorbachev hold first superpower summit in six years, in Geneva.

Nevado del Ruiz volcano erupts in Columbia, killing 22,940.

South Africa imposes state of emergency, including press censorship.

Mexico City earthquake, 8.1 on the Richter scale, kills at least 4200.



Ethiopian famine kills millions, spurs worldwide relief effort, including "Live Aid" concert in Philadelphia and London.

1986

COMPUTER INDUSTRY

BYTE

THE SMALL SYSTEMS JOURNAL

JANUARY-MARCH

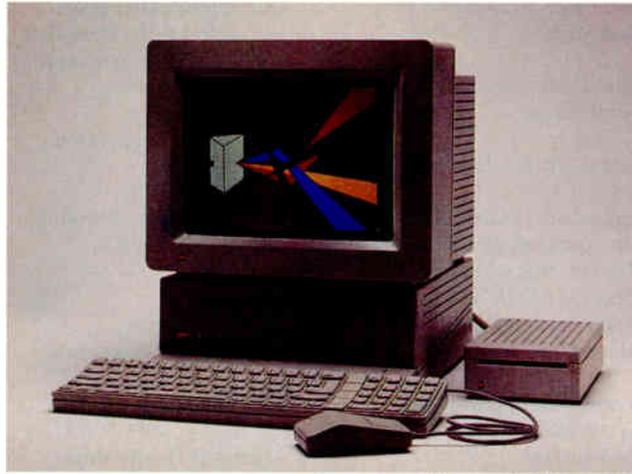
The Atari 520ST was the focus of a Product Description in January, and the 1040ST was previewed in March. It's interesting to note that despite the Atari's and Amiga's potential, the general-use personal computer industry remained mostly divided between the MS-DOS and (growing) Macintosh camps. February's "Text Processing" Theme hinted at the future popularity of desktop publishing. In March, "Homebound Computing" reflected a growing interest in telecomputing.

JUNE-JULY

We look at the Macintosh Plus in a Product Description and conclude that this is the machine that Apple should have made much earlier. And the Theme is (brass fanfare) "Computers and Music." The growing acceptance of—and even demand for—MIDI-linked music equipment begins to change foundations of musical creativity. In July, the "Engineer's Toolbox" Theme reflects the increasing use of personal computer assistance in the engineering disciplines.

AUGUST-DECEMBER

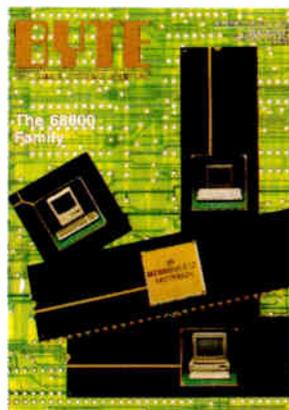
The traditional August "language" Theme is "Object-Oriented Languages," and their potential continues to be explored today. September's "68000 Machines" Theme showed that the Intel microprocessors were not everyone's choice. We previewed the Apple IIGS in October and the Compaq Deskpro 386 in November. The proliferation of PC products and peripherals led to the BYTE "23 Modems" group review process, the forerunner of today's Product Focus.



◀ The Apple IIGS is introduced on September 15.



◀ IBM introduces the RT PC, its first and not very successful venture into RISC-based desktop workstations.



IBM introduces the PC Convertible, a 12- to 16-pound battery-powered laptop for \$2000, which becomes its second unsuccessful portable.

WORLD

Sperry and Burroughs agree to merge into Unisys.

Little-known Advanced Logic Research announces the first 386 PC, the Access 386.

U.S. and Japan sign semiconductor trade agreement to halt chip dumping.

Peter Norton Computing announces the Norton Commander.

Corporation for Open Systems formed.

U.S. International Trade Commission rules 5-0 that Japanese manufacturers are dumping 256K-byte RAM chips in the U.S., setting the stage for the semiconductor trade agreement and later RAM crisis.

Motorola announces the 68030 microprocessor.

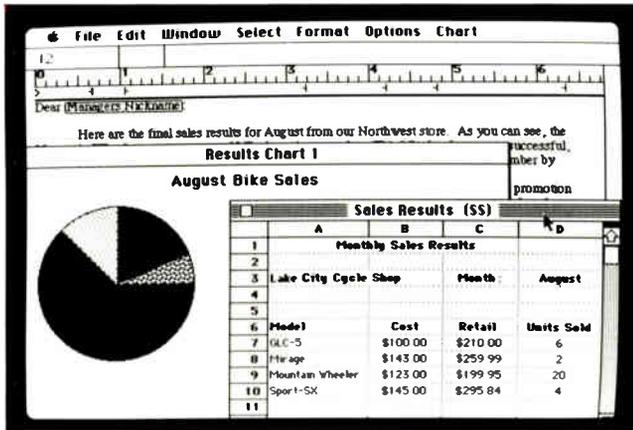
Lotus announces HAL.



Challenger explodes, causing national outpouring of grief.

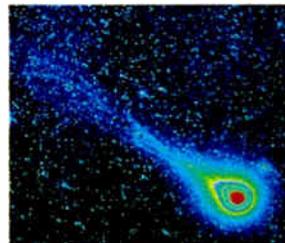
Ferdinand Marcos flees the Philippines after 20-year rule; wife Imelda leaves behind massive shoe collection.

Swedish Premier Olof Palme shot dead while walking home from a movie in Stockholm.



Compaq introduces the Flex architecture Deskpro 386, its first 386 and the first Compaq machine to include a separate memory bus.

Microsoft introduces Works for the Mac.



Halley's Comet returns but is hard to see.

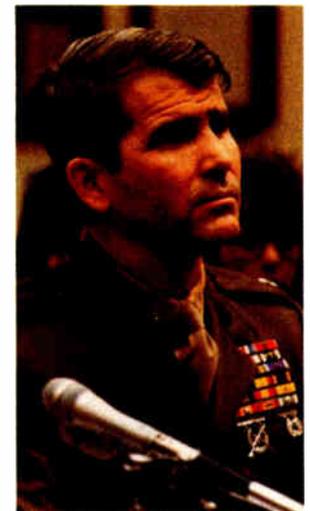


Statue of Liberty 100th birthday celebration is an exercise in heart-swelling pride and lovable vulgarity.



Chernobyl meltdown drives nail in the coffin of the nuclear industry, heightens awareness of environmental problems in the Eastern bloc.

Iran-Contra scandal revealed.



BYTE

THE SMALL SYSTEMS JOURNAL

FEBRUARY-MARCH

We look at IBM competitors Advanced Logic Research and Compaq. Commodore tries again with a preview of "The Commodore A2000"; Borland makes points with "Turbo BASIC" and Turbo C.

APRIL-JUNE

The Mac II arrives at BYTE in April. Its open-ended design might have made all the difference had it arrived closer to the IBM PC's announcement. Desktop publishing is May's Theme, echoing a ground swell of interest. The PS/2s, targets of the June First Impression, redefine IBM's microcomputer standards. OS/2 is born. Zoomracks receives a lukewarm review but will become a legal challenge to Apple for attributes embodied in HyperCard software.

JULY-SEPTEMBER

Benchmarks are a hot topic, and BYTE rolls out an attempt to fairly compare 386 and 68020 microprocessors. The "year of the LAN" resurfaces, but this time the Mac is included. We review six popular CAD programs, complementing July's review of five Mac CAD programs. "A Programmer's Introduction to OS/2" is only the beginning of the "operating-systems wars" that still rage.

NOVEMBER-DECEMBER
Long-dominated by Lotus 1-2-3, the spreadsheet race gets more interesting with Excel, Quattro, and PlanPerfect. The division between personal computers and workstations begins to blur as we look at "Workstation Technology" in the November Theme. In December, HyperCard gets a First Impression.

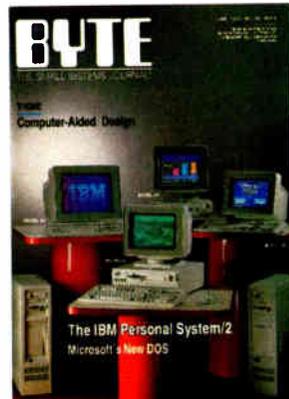


◀ Compaq introduces the Portable III.

▶ Apple introduces the Mac II and the Mac SE.



▶ IBM introduces PS/2 line and OS/2, the first IBM 386 (Model 80), and unveils its M*A*S*H ads.



WORLD

Paul Allen, the cofounder of Microsoft, talks about his new company, Asymetrix, and its product plans. **Tool-Book** will show up nearly 3½ years later.

Traveling Software introduces **LapLink** file transfer software for \$130.

IBM announces 4-MB DRAM chips.

Lotus files a look-and-feel lawsuit against Paperback Software and Mosaic Software, charging they have unfairly copied 1-2-3.

The Sematech consortium of chip makers is announced in Washington, D.C.

IBM announces Systems Application Architecture.

Atari and Commodore settle outstanding litigation.

Lotus signs 10-year agreement to develop software for IBM mainframes, starting with 1-2-3/M.

Lotus announces 1-2-3 release 3.0.

Microsoft and 3Com announce intention to develop OS/2 Lan Manager.

Borland acquires Ansa Software and gets Paradox.

IBM introduces the PC Convertible Model 3.

IBM introduces the PS/2 Model 25.

Apple introduces HyperCard, which proves to be enormously popular.

To merge the expanded memory specifications of LIM/EMS 3.2 and AST, the companies join to announce EMS 4.0.

Compaq announces it won't sell a clone of the PS/2s, although it has designed such a system.

Microsoft announces **Excel** for the PC, the first real Windows application.

Lotus announces **Agenda**, the product that brings vim to PIMs.

AT&T and Sun agree to share Unix technology.

IBM hooks up with Steve Chen, formerly of Cray, and announces plan to produce a 64-CPU parallel system in the early 1990s.

Borland introduces **Quattro**.

DAY OF WEEK	DATE	LOCATION	TRANSPORT	HOTEL	ENTERTAIN	MEALS
SUNDAY	06/22/87	SAN DIEGO	\$89.00	\$0.00	\$10.00	\$36.95
MONDAY	06/22/87	SAN DIEGO	\$9.00	\$67.00	\$32.50	\$19.58
TUESDAY	06/23/87	SAN DIEGO	\$27.55	\$67.00	\$0.00	\$35.00
WEDNESDAY	06/24/87	SAN DIEGO	\$12.50	\$67.00	\$98.10	\$45.15
THURSDAY	06/25/87	SAN DIEGO	\$0.00	\$67.00	\$0.00	\$24.25
FRIDAY	06/26/87	SAN DIEGO	\$0.00	\$67.00	\$0.00	\$28.55
SATURDAY	06/27/87	SAN JOSE	\$133.00	\$67.00	\$0.00	\$0.00
TOTAL			\$271.05	\$402.00	\$140.60	\$189.46

Commodore announces the Amiga 2000 and 500.



Reagan and Gorbachev sign the INF nuclear-reduction treaty.

Canada's Meech Lake Accord is passed, but it fails to win approval within three years.

Palestine Intifada breaks out in Israel.



Wall Street crash wipes 508 points off the Dow.

1988

COMPUTER INDUSTRY

BYTE

FEBRUARY

The Compaq Deskpro 386/20 reigns as performance champion; third-party Micro Channel memory boards reflect interest in the PS/2 line.

APRIL-JUNE

April has First Impressions of Microsoft language products that bridge to OS/2. The In Depth is "Memory Management." May's Product Focus on "Workstations for Desktop Publishing" concludes that word processing capabilities are not yet up to desktop publishing products. In June, BYTE unwraps its suite of benchmarks. We focus on 9600-bps-and-beyond modems. We review OS/2 Standard Edition.

JULY-AUGUST

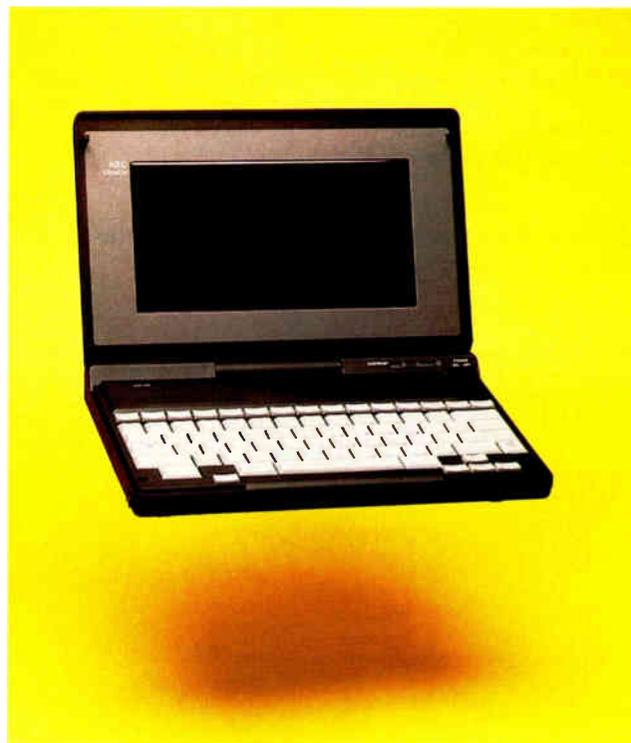
Sun's 386i shows that the distinction among PCs, workstations, and mini-computers is fogging up. July also has a First Impression of OS/2 Extended Edition. In August, in addition to our regular coverage of the Mac, we begin a series of Mac supplements.

SEPTEMBER-OCTOBER

September's cover story is a First Impression of the IBM Model 70 and the Tandy 5000 MC. The portable Toshiba T5100 and GRiD-Case 1530 show you can pack power into small packages. We review 20 affordable 386s, look at Presentation Manager, and cover five Mac scanners.

NOVEMBER-DECEMBER

The NeXT Computer tries to usher in a new era by hitting the education market with a technologically advanced system. ALR's FlexCache 25386 sets a new speed record. The Mac Ix is covered in December. Six months' worth of system benchmarks are provided.



Microsoft and Ashton-Tate team up to announce SQL Server.

Apple and DEC announce agreement to cooperate.

Informix announces WingZ, a new spreadsheet for the Mac.

MIT and 11 companies announce consortium to develop industry standards for workstations.

Tandy introduces the Tandy 5000MC, the second Micro Channel clone (Dell was first), and announces Thor, a system for rewritable, erasable compact disks, which still has not shipped but is supposed to be available in 1990 for \$500.



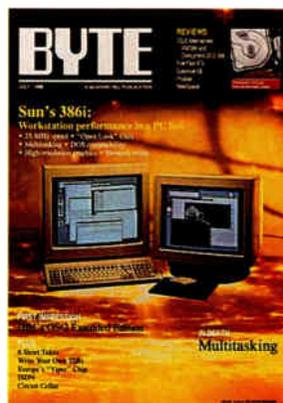
NEC announces the 4.4-pound UltraLite.



Apple announces the Mac IIx, 10 to 15 percent faster than the Mac II.



Compaq introduces the SLT/286.



NEC asks the court to invalidate Intel's copyrights on the 8086/8088.

The memory shortage is in full swing.

Apple files suit against Microsoft and Hewlett-Packard in federal district court, charging that Windows infringes on Mac copyrights.

Lotus announces delay in 1-2-3 release 3.0.

MIPS announces its RISC processor.

AT&T plans new software to make Unix easier to use.

Quarterdeck and Phar Lap develop the Virtual Control Program Interface (VCPI), the first standard for addressing 386 virtual mode with existing DOS applications.

IBM announces plan to license NextStep from Steve Jobs.

Maxtor introduces the first magneto-optical rewritable optical disk drive.

The Open Software Foundation is announced; it plans to base its version of Unix on IBM's AIX.

AMD introduces the 29000 32-bit microprocessor.

Intel announces the 386SX.

Caere announces OmniPage.

Sun, Texas Instruments, and Cypress announce agreement to promote SPARC.

Intel buys the DVI technology from GE.

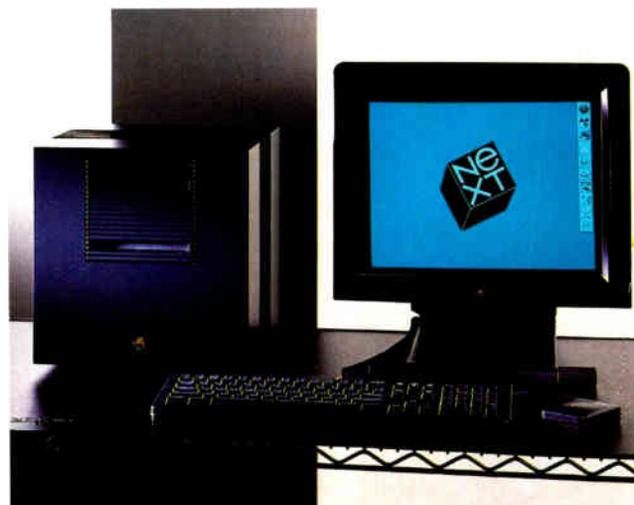
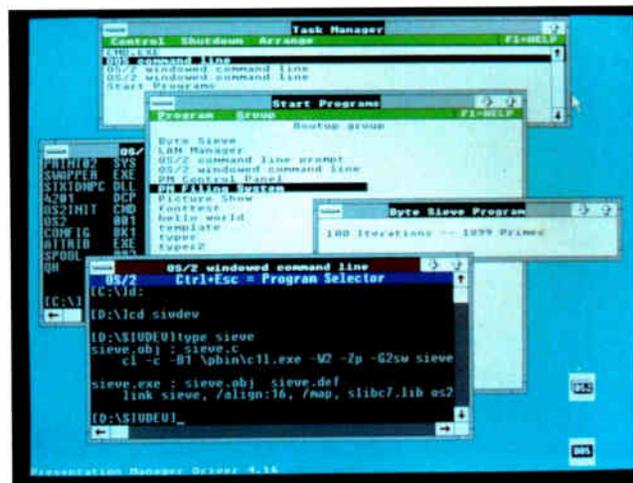
The NeXT cube is announced at gala event in San Francisco. ▶

The EISA consortium, also known as the "Gang of Nine," is announced; it will develop a 32-bit bus alternative to IBM's Micro Channel.

Ashton-Tate ships dBASE IV after a series of delays.

The ARPANET worm created by "bored" Cornell graduate student Robert T. Morris Jr. wreaks havoc at an estimated 6000 sites around the U.S.

IBM and Microsoft ship OS/2 1.1 with Presentation Manager. ▼



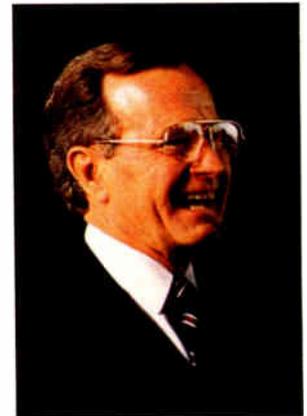
Ashton-Tate files a look-and-feel lawsuit against Fox Software and SCO on the first day of Comdex.

The Systems Performance Evaluation Cooperative (SPEC) is formed between Hewlett-Packard, Apollo, MIPS, and Sun.

Brier announces 21-MB floppy disk drive.

IBM ESD head William Lowe leaves for Xerox, and James Cannavino steps in.

OSF announces its selections for the software components that will make up Motif: DECWindows and a modified PM from Microsoft and Hewlett-Packard.



George Bush defeats Michael Dukakis for the presidency.

Irving King Jordon becomes first deaf president of Gallaudet University.

U.S.S. Vincennes shoots down Iranian civilian airliner, killing 290.

A pair of runners named Joyner capture our fancy, as Jackie Joyner-Kersey and Florence Griffith-Joyner take home Seoul gold.

Shroud of Turin is declared to date only from thirteenth century.

Earthquake rocks Soviet Armenia, killing 25,000.

Pan Am flight 103 is bombed over Scotland.



BYTE

JANUARY-MARCH

We inaugurate the **BYTE Awards**, a yearly tip of the hat to overachieving products. "The X Window System" emerges from MIT to an enthusiastic audience, and the growing interest in PC communications is addressed in an expanded **In Depth**. The powerful Mac SE/30 is the February cover story. In March, we examine the 386-versus-286 question.

APRIL-JUNE

The **TRON** project looks ahead to standardizing computer data and communications. Two workstations from Sun fuel the PCs-versus-workstations debates. Unix gets expanded coverage in May, and Intel's high-speed i860 processor receives a **First Impression**. In June, speed is again the hot topic, with **First Impressions** of two new 386 machines.

JULY-SEPTEMBER

Graphical user interfaces are explored in "A Guide to GUIs." In August, laptop technology takes a leap forward with the Agilis and Zenith entries. The first 486 machine is made in the U.K.! Four multiuser operating systems are the subjects of a **Product Focus**, and we look at LANs in a special supplement.

OCTOBER-DECEMBER

Arriving from Apple are the long-awaited Mac Portable and IICI. We spotlight optical technology in both the **Product Focus** and the **In Depth**. If bus-related things weren't complicated enough, "EISA Arrives," in the form of the Hewlett-Packard Vectra 486 PC. With 32-bit processors comes the **In Depth** software topic "32 Bits and Above." In December, the software development furnace is stoked by a **Product Focus** on nine "CASE Tools."



▷ **DEC** introduces its first RISC-based workstation, the DECstation 3100.



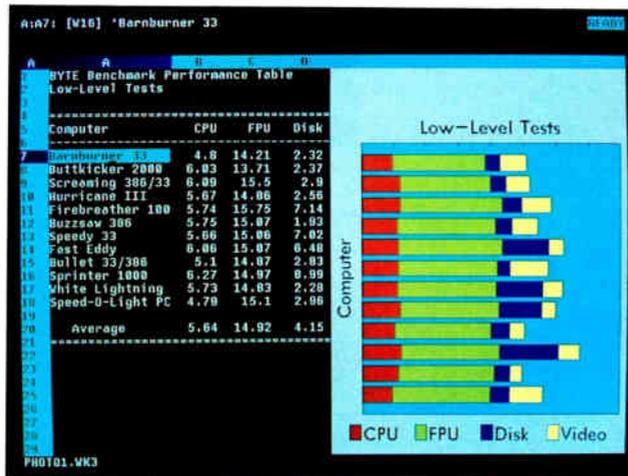
▷ **Apple** introduces the SE/30, a \$4369 compact Mac with a 68030.



▷ **Sun** announces the 12.5-MIPS SPARCstation 1 for a base price of \$8995.

After a year's delay, **Lotus** finally ships its 3-D spreadsheet, 1-2-3 release 3.0, along with a junior cousin, release 2.2.

Apple announces the top-of-the-line Mac IICI and the long-awaited Mac Portable, whose active-matrix screen and built-in trackball are overshadowed by its 16-pound weight and nearly \$6000 price tag.



▷ **Poqet Computer Corp.** announces a 1-pound DOS PC for \$1995.



Borland unveils **Paradox 3.0**.

Informix finally ships **WingZ** for the Mac.

Intel takes the wraps off its **i860** superscalar RISC chip. It also announces the **i486**.

Apple introduces the powerful, compact **Mac IIcx** and has an instant hit.

Hewlett-Packard announces that it will acquire **Apollo**.

Texas Instruments unveils the **TIGA-340** graphics standard.

Adobe announces **Adobe Type Manager**.

Apple discloses details about the **System 7.0** Mac OS.

Novell announces **NetWare 386**.

IBM unveils **OfficeVision**, a multiplatform office software system that takes advantage of PM and is a key part of the SAA strategy.

Microsoft and IBM announce **OS/2 1.2**.

Borland announces **Turbo Pascal 5.5** with object-oriented extensions.

NEC takes a shot at Nintendo with the 16-bit **Turbografx-16** home video game.

Seven computer and semiconductor firms plan to form a DRAM consortium called U.S. Memories, but the plan fails for lack of money.

Computer Associates acquires **Cullinet** and **Cricket Software**.

Hewlett-Packard ships **NewWave**.

ALR announces the first PC with an EISA bus, a \$13,000 486 box.



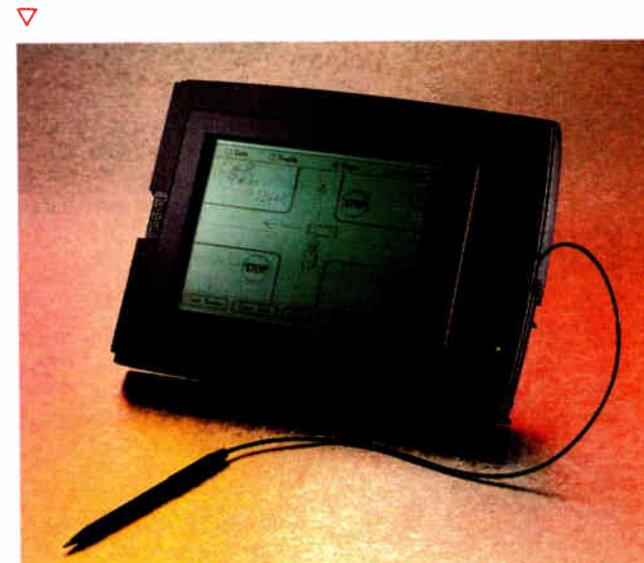
Compaq announces the 8086- and 286-based **LTE** notebook PCs.

Microsoft ships **Excel** for OS/2 PM, the first OS/2 spreadsheet.

Headstart Technologies introduces a PC with built-in CD-ROM at Comdex.

Lotus starts shipping **Notes**, a high-ticket groupware application that raised the bar.

GRID Systems announces the **handwriting-recognizing GRiDPad**.



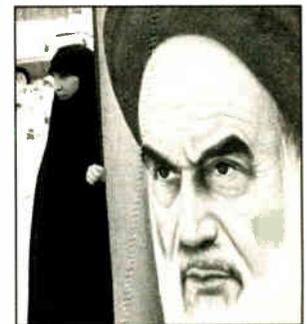
Compaq takes the plunge into multiprocessing PCs with the EISA-based **Systempro**.



IBM tries again in portables with the 386-based **Model P70**.

Exxon Valdez oil spill awakens environmentalism.

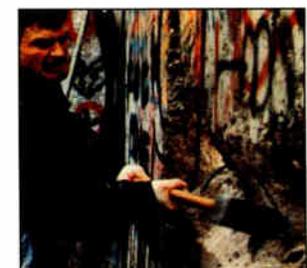
China crushes protesters in **Tiananmen Square**.



Ayatollah Khomeini dies.

Hurricane Hugo ravages the Caribbean and South Carolina.

Earthquake rocks the San Francisco Bay Area.



A dizzying wave of popular uprisings transforms Eastern Europe, and the **Berlin Wall** comes down.

PHOTO: MEL LINDSTROM

1990

BYTE

JANUARY-APRIL

We chronicle IC technology in "The State of Chips." Computers and images come together with sound in February's "Multimedia" In Depth. "The BYTE Unix Benchmarks" tackle a whole new world. Apple's "wicked fast" Mac IIx is our April cover story. And just when you thought that your high-speed 286 was going to last a while longer, we looked at 23 25-MHz 386 motherboards to tantalize you. The quest for speed is never satisfied.

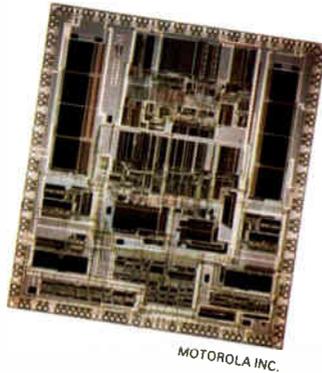
MAY-AUGUST

With the emergence of multimedia, the Commodore Amiga 3000 is perhaps right on time. AST and ALR serve up a pair of 33-MHz dervishes, and we feast on "Desktop Supercomputing." One of the industry's worst-kept secrets, Windows 3.0, is our June cover story. Another "year of the LAN" goes by, and we devote our State of the Art (née In Depth, née Theme) section to networking. We investigate man/machine interfaces in July and devote two months of First Impressions to sample applications for Windows ("looks like we finally got it right") 3.0.

SEPTEMBER

BYTE's 15th anniversary reflects a mature but still-growing industry. How fitting that after 15 years word processing, one of the first and probably most-used applications ever, is this issue's Product Focus. Also, features this month include "The Creation of the IBM PC," written by David J. Bradley, who was there when it all began, and "Personal Computing in Eastern Europe." Now that The Wall is down, what impact will the Iron Curtain countries have on microcomputing?

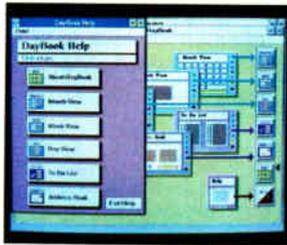
COMPUTER INDUSTRY



MOTOROLA INC.



Motorola unveils the 68040 CPU.

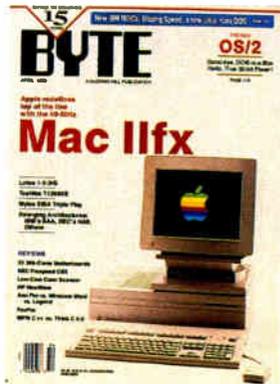


Microsoft announces the much-awaited, overhyped, and exciting Windows 3.0 (shown here running Tool-Book from Asymetrix).

C-Cube introduces an image-processing chip based on the JPEG algorithm.

Radius announces the Pivot display for \$1690.

Lotus ships 1-2-3/G, its spreadsheet for PM.



IBM jumps back into the workstation market with the RS/6000 family.

PHOTO: JACK PURYEAR

Dragon Systems ships the 30,000-word **Dragon Dictate** voice-recognition system, which runs on a fully loaded 386 and costs \$9000.

Sharp demonstrates the **6220** notebook PC, a 4-pound 286 with a backlit VGA screen and a 20-MB hard disk drive for under \$4000.

Q/Cor begins shipping 20-MB "Flextra" floppy disk drives made by Brier.

Lotus and Novell announce plan to merge, which later falls through.

Commodore gets serious with the \$3300 **Amiga 3000**.

Apple unofficially announces **HyperCard 2.0**, which adds multiple windows, color support, and many other improvements.

Borland announces **Turbo C++**.

Eleven companies agree to **DOS Protected Mode Interface (DPMI)**, a standard technique for DOS applications to access extended memory.

Pioneer, LMSI, and Panasonic all announce rewritable **WORMs** at Comdex.

Adobe introduces **PostScript Level 2**, the first major upgrade to the page-description language standard in six years.

IBM unveils the entry-level **PS/1**, a second attempt to crack the home and home-office PC market.

WORLD

Robert Noyce, cofounder of Intel and inventor of semiconductors, dies at 62.

Perrier is recalled for benzene contamination.

Earth Day 1990 is about hope and hype.



WORLD PHOTOS: UPI/BETTMANN



JDR Microdevices®

2233 BRANHAM LANE, SAN JOSE CA 95124

BUY WITH CONFIDENCE FROM JDR!

• 30-DAY MONEY BACK GUARANTEE

• 1 YEAR WARRANTY

• TOLL-FREE TECH SUPPORT

TI MICROLASER™
—FAST, AFFORDABLE AND EXPANDABLE!

EXPANDABLE PRINTER HAS TEXAS INSTRUMENTS QUALITY AND RELIABILITY IN A COMPACT SIZE! UPGRADEABLE TO 4.5MB AND POSTSCRIPT™ • 300 DPI • 6 PPM OUTPUT • 250 SHEET DRAWER

• MANUAL FEED • 40 ENVELOPE AUTO FEED • 5MB RAM BASE UNIT • EMULATES HP LASERJET II

MICROLASER \$1495.00
MICROLASER-PS \$2495.00
WITH-35 FONT POSTSCRIPT™ AND 1.5MB RAM

CITIZEN 200GX COLOR PRINTER

CITIZEN EXPANDS 9 WIRE TECHNOLOGY TO THE CUTTING EDGE! OPTIONAL COLOR KIT PROVIDES VIVID COLOR OUTPUT UNRIVALED IN ITS PRICE RANGE!

• 5 RESIDENT FONTS • 240 X 216 DPI • 213 CPS DRAFT MODE 40 CPS LETTER QUALITY • PARALLEL AND SERIAL INTERFACES • 8K PRINT BUFFER

CTZ-200GX \$199.95
CTZ-200GXCOLOR COLOR ON COMMAND KIT \$59.95

INTRODUCING THE AMAZING CARRY-1 BOOK SIZE PC

THIS HIGH PERFORMANCE 8088 BASED COMPUTER COMPETES WITH FULL-SIZE PCS. STAND IT UPRIGHT, SIT IT UNDER A MONITOR. PUT IT ANYWHERE YOU LIKE—IT'S SO SMALL YOU'LL HARDLY KNOW IT'S THERE! IT'S THE PERFECT SOLUTION FOR A CROWDED DESKTOP. A COST-CONSCIOUS SCHOOL DISTRICT OR A CONVENIENT TRANSPORTABLE HOME COMPUTER.

• 10MHz 4.77MHz 8088-1 CPU
• AMI BIOS ASSURES COMPATIBILITY
• 256K RAM EXPANDABLE TO 640K
• BUILT-IN SERIAL, PARALLEL AND GAME ADAPTERS
• BUILT-IN CGA, MGA DISPLAY ADAPTER
• BUILT-IN 3.5" 720K FLOPPY DRIVE **JUST 7 1/2" X 9 1/2" X 1 1/4"**
• WORKS WITH ANY STANDARD KEYBOARD
• INCLUDES CARRYING CASE, POWER ADAPTOR, MINI-UPRIGHT STANDS

CARRY-1 \$299.95
CARRY-1B \$399.95
ENHANCED VERSION-2 FLOPPY DRIVES (720K) & 640K RAM
CARRY-1K 82-KEY CARRY-1 KEYBOARD \$49.95

TEFAX—FAX, COPIER, SCANNER, PHONE & PRINTER

THE ESSENTIAL SMALL BUSINESS COMMUNICATIONS CENTER! ONE MACHINE CAN REPLACE 5!

• G3 G2 FAX MACHINE • 8.5" SCANNING WIDTH • 200 DPI SCANNER • SAME SIZE COPIER • INCLUDES FAX SOFTWARE FOR IBM & MAC • YOUR PC CAN SEND FAXES AUTOMATICALLY WITH SIMPLE SET-UP

TEFAX \$995.00

KODAK DICONIX 150+ PORTABLE PRINTER

THE PERFECT COMPANION FOR YOUR LAPTOP OR OUR CARRY-1 PC! WEIGHS 5LBS AND MEASURES JUST 6.5" X 11" X 2.1"

• QUIET NON IMPACT INK JET TECHNOLOGY
• UP TO 180 CPS • DRAFT, N.Q. QUALITY AND CONDENSED MODES • USES CUT SHEET OR CONTINUOUS FORM PAPER
• SUPPORTS EPSON FX-80 & IBM PROPRINTER COMMANDS

DICONIX-150 \$399.95

FUJITSU COLOR PLOTTER

COMPACT PLOTTER • HP7475A COMPATIBLE • 0.25MM RES

FPG-315 \$799.00

JETFONT SUPERSET -150 FONTS! \$299.95

2 CARTRIDGES CONTAIN THE EQUIVALENT OF 18 SEPARATE HP CARTRIDGES WITHOUT DOWN LOADING! • FOR HP LASERJET LA SERJET • AND LASERJET II • DRIVERS FOR WORDPERFECT WORD-STAR 2000, IBM DISPLAY WRITE 4 MS WORD WINDOWS 1 2-3, DEASE II AND MORE!

SUPERSET

JETFONT 4 IN 1 BUSINESS TYPEFACES

COURIER 10 & 12, PRESTIGE ELITE & LETTER GOTHIC FONTS

JETFONT-4 \$199.95

JETFONT 12/30 FOR SPREADSHEET OUTPUT

LOTICA FONT FOR HORIZ VERTICAL OUTPUT TO 240 COLS!

JETFONT-12 \$129.95

LOW-COST POSTSCRIPT OUTPUT

FAST POSTSCRIPT COMPATIBLE CARTRIDGE 35 FONTS!

JETPAGE \$499.95

OUTSTANDING SOFTWARE VALUES QUATRO PRO—THE POWER SPREADSHEET!

NEXT GENERATION POWER FOR STANDARD 8088 PCS! BORLANDS VROOMM TECHNOLOGY DELIVERS ADVANCED FEATURES WITHIN 640K RAM!

• 3D & FREEFORM LINKING CONSOLIDATION • HOT LINK UP TO 64 SPREADSHEETS • LOTUS 1 2-3 COMPATIBLE
• BUILT-IN DRAW PROGRAM, BITSTREAM FONTS AND PRESENTATION GRAPHICS

QUATRO-PRO \$359.95

PARADOX 3.0—RELATIONAL DATABASE

A SOPHISTICATED & POWERFUL DATABASE THAT'S EASY & INTUITIVE TO USE!

• FLEXIBLE & FULL FEATURED DEVELOPMENT ENVIRONMENT • WYSIWYG REPORT GENERATOR • AUTOMATIC MULTI USER SUPPORT • INCL APPLICATION GENERATOR

PARADOX \$469.95

WINDOWS 3.0—"MAC" LIKE G.U.I.

THE LATEST GRAPHICAL INTERFACE FROM MICROSOFT

WINDOWS 3.0 \$119.95

RAM CARD FOR HP LASERJET

• FOR HP LASERJET II PRINTERS
• USER EXPANDABLE TO 1 2-4MB (OK INSTALLED)
• USES 1MB 120 NS DRAMS

MCT-RAMJET \$89.95
MCT-RAMJET-P \$89.95
1/2-4MB FOR IIP, USES 1MB DRAMS

REQUEST OUR NEW CATALOG

DFI LOW COST ETHERNET CARD

• 100% HARDWARE COMPATIBLE WITH NOVELL NE-1000 ETHERNET CARD
• FOR THICK OR THIN ETHERNET
• 15 PIN ETHERNET CONNECTOR
• BNC CONNECTOR FOR THIN ETHERNET

DFINET-300 8-BIT VERSION \$199.95
DFINET-400 16 BIT VERSION \$239.95

NEW PRODUCTS FROM PROMETHEUS

9600 BAUD V.32 MODEM WITH SEND/RECEIVE FAX \$699

THIS NEW EXTERNAL MODEM IS V.32 AND V.42 COMPATIBLE. THE EMERGING 9600 BPS STANDARDS. PLUS IT NOW HAS FULL GROUP 3 FAX SEND AND RECEIVE CAPABILITY. THIS MACHINE TRANSFORMS YOUR PC INTO A COMPLETE PERSONAL INFORMATION CENTER

• 9600/4800/2400/1200 BPS DATA MODEM
• CCITT V.32 V.42 ERROR CORRECTION COMPATIBLE
• MNP 5 ERROR CORRECTION AND DATA COMPRESSION FOR THROUGHPUTS UP TO 19200 BPS
• 9600 BPS GROUP III SEND AND RECEIVE FAX
• INCLUDES PRO-COMM COMMUNICATIONS SOFTWARE
• INCLUDES FAX-IT FAX SOFTWARE
• 2 YEAR WARRANTY

PRO-96EF

INTERNAL FAX MODEM \$229.95

• 2400/1200/300 BPS DATA MODEM
• 9600 BAUD SEND/RECEIVE FAX CAPABILITY
• 3088,286,386 COMPATIBLE CARD

PRO-MAXI

MINI 2400 BPS MODEM WITH SEND ONLY FAX \$139.95

THIS TINY EXTERNAL MODEM PACKS A BIGGER PUNCH THAN YOU'D EXPECT! NOT ONLY IS IT A FULL FUNCTION 2400 BPS DATA MODEM BUT IT ALSO OPERATES AS A SEND-ONLY FAX AT A REMARKABLY LOW PRICE!

• 2400/1200/300 BPS DATA MODEM
• CCITT V.22/V.22BIS, BELL 103/212A COMPATIBLE
• 4800 BPS GROUP III SEND ONLY FAX
• MEASURES JUST 6.25 X 3.8 X 2 INCHES
• 8 STATUS LEDS
• INCLUDES PRO COMM COMMUNICATIONS SOFTWARE
• INCLUDES FAX-IT FAX SOFTWARE
• 2 YEAR WARRANTY

PRO-EFXM

MINI-MODEM WITH 9600 BPS FAX-SEND SPEED

PRO-EFXM96 \$169.95

2400BPS MINI MODEM \$119.95

AS ABOVE BUT WITHOUT FAX CAPABILITY

MCT-24E

2400 BPS MNP ERROR CORRECTING MODEM \$249.95

AN ECONOMICALLY PRICED EXTERNAL MODEM THAT NOW INCLUDES MNP-5 ERROR CORRECTION AND DATA COMPRESSION CAPABILITY

• 2400/1200/300 BPS DATA MODEM
• CCITT V.22/V.22BIS, BELL 103/212A COMPATIBLE
• DATA COMPRESSION BOOSTS THROUGHPUT UP TO 4800 BPS
• 8 STATUS LEDS
• AT COMMAND SET COMPATIBLE
• AUTO DIAL AND AUTO ANSWER
• 2 YEAR WARRANTY

PRO-24EMNP

PRO-24E EXTERNAL 2400 BAUD MODEM-NO MNP. \$149.95

INTERNAL MNP MODEM \$189.95

IPLUG-IN CARD MODEM HAS SAME FEATURES AS ABOVE MODEL. FOR 8088, 286/386 COMPUTERS

PRO-24MNP

PRO-24I INTERNAL 2400 BAUD MODEM-NO MNP \$99.95

TERMS: Minimum order \$10.00. For shipping & handling include \$4.00 for ground and \$5.50 for air. Orders over 1 lb. and foreign orders may require additional shipping charges—contact our Sales Dept. for the amount. CA residents must include applicable sales tax. Prices subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities and to substitute manufacturer. All merchandise subject to prior sales. A full copy of our terms is available upon request. Items pictured may only be representative. JDR, the JDR logo, JDR Microdevices, and the MCT logo are registered trademarks of JDR MICRODEVICES, INC.

MON.-FRI. 7 A.M. TO 5 P.M., SATURDAY, 9 A.M. TO 3 P.M. (PST)

ORDER TOLL-FREE 800-538-5000

Copyright 1990 JDR MICRODEVICES.

KEY CODE 10A

Circle 492 on Reader Service Card (RESELLERS: 493)

The Power Of Choice.

From the architects of some of the world's first and fastest i486™ desktop systems comes a whole new revolution in personal computing. AST's Premium® tower series.

Offering unprecedented speed, enhanced I/O, broad expandability and patent-pending Cupid-32™ upgradeability, AST's powerful floor-standing tower series systems provide a whole new alternative to traditional computing in MS-DOS®, Novell® NetWare™ 386

and SCO UNIX™ environments.

If you require one of the world's fastest tower configurations, choose the 33 MHz, i486-based Premium 486/33TE with SCSI support, a 32-bit EISA bus and 128 KB advanced cache.

At the other end of the spectrum is our cost-efficient entry into tower-style computing, the 33 MHz, 80386™-based Premium 386/33T with 64 KB of high-speed cache.

Thanks to the system's Cupid-32 design, you can easily upgrade to EISA or i486 processing whenever you're ready.

No matter which system you choose, you can always depend on the outstanding service and support that makes AST an industry leader. For more information on AST's Premium tower series call 201-866-0200. Or use our electronic Technical Information Network, 714-727-4723.

AST markets products worldwide. Corporate Headquarters: P.O. Box 19658, Irvine, CA 92713-9654. In Europe and the Middle East call 44 81 568 4350. In Japan call 81 3 818 0710. In the Far East call our Hong Kong office at 852 5 806 4333. In Canada call 416-827-7518. In Australia call 61 2 418 7444. AST is a supplier to US government agencies. General Service Contract number G500R9AG36418. PS-01. AST, AST logo and AS, Premium registered and Cupid-32 logo and Cupid-32 trademarks AST Research, Inc. 80386 and i486 trademarks Intel Corp. Copyright 1990. AST Research, Inc. All rights reserved.

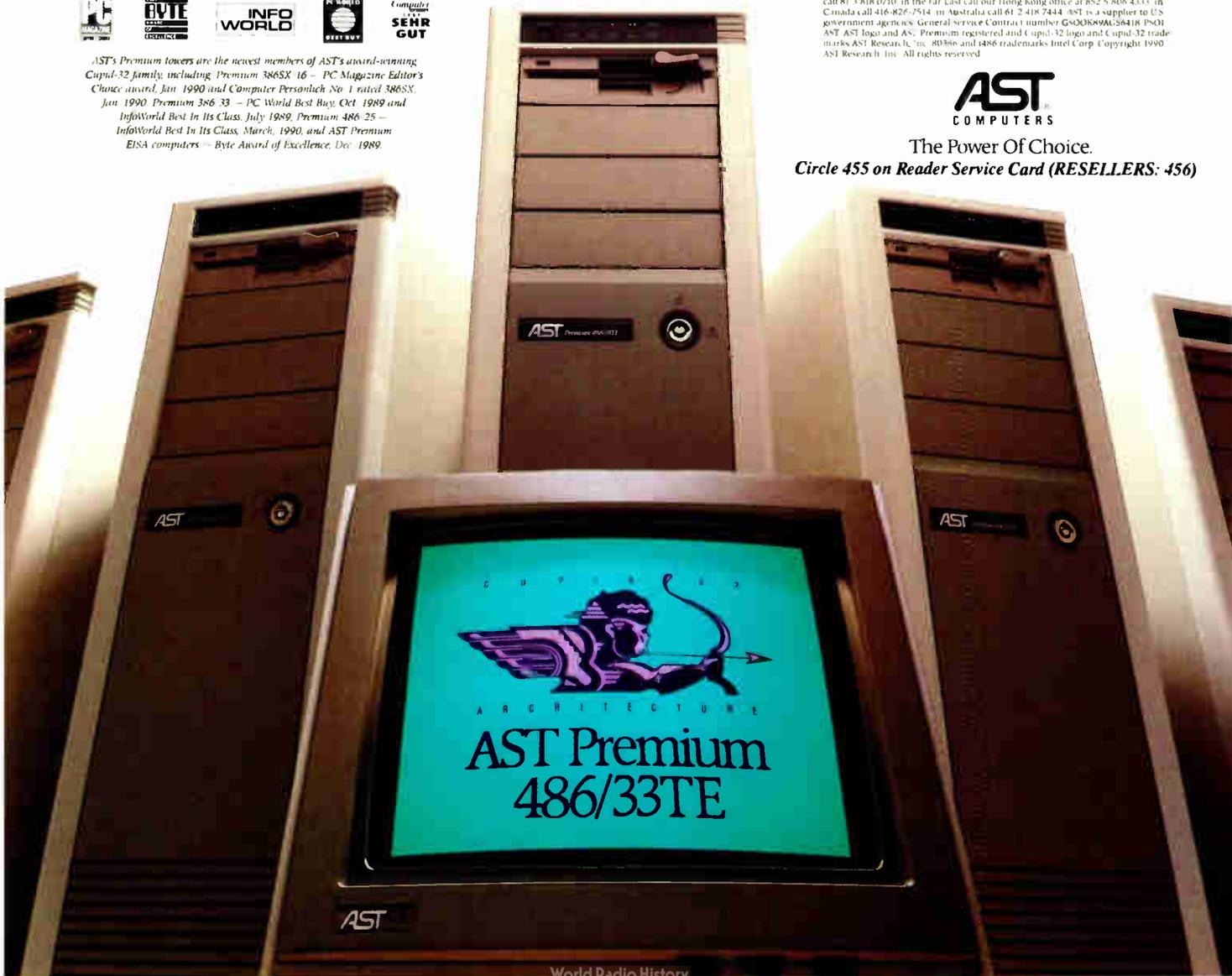


AST's Premium towers are the newest members of AST's award-winning Cupid-32 family, including Premium 386SX 16 - PC Magazine Editor's Choice award, Jan. 1990 and Computer Personal No. 1 rated 386SX, Jan. 1990. Premium 386 33 - PC World Best Buy, Oct. 1989 and InfoWorld Best In Its Class, July 1989. Premium 486 25 - InfoWorld Best In Its Class, March, 1990, and AST Premium EISA computers - Byte Award of Excellence, Dec. 1989.



The Power Of Choice.

Circle 455 on Reader Service Card (RESELLERS: 456)



PERSONAL COMPUTING IN EASTERN EUROPE

The collapse of state-run economies has left Eastern European countries in a state of technological chaos

Colin Barker

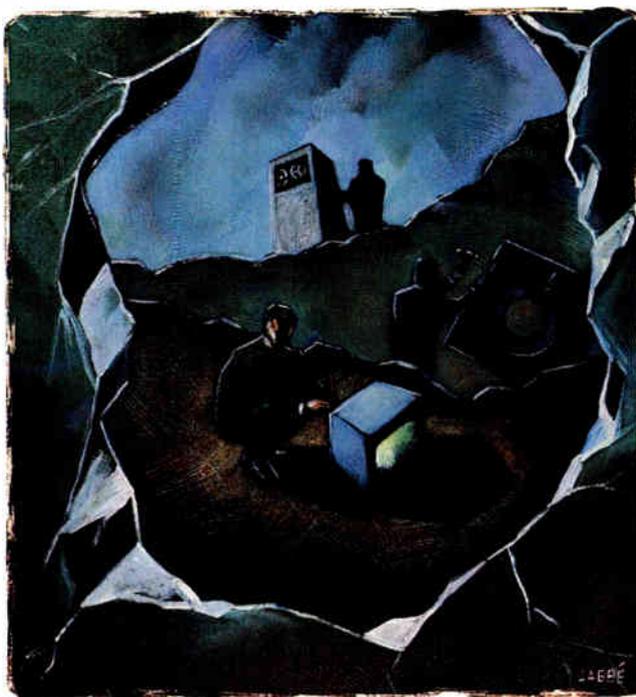
The revolution that spread democracy through Eastern Europe last year—epitomized by the destruction of the Berlin Wall—was driven by a combination of economic collapse and popular discontent. But economic stagnation and unpopular governments are not new in the East (i.e., Eastern Europe).

What gave this movement real force and cohesion across half a continent and seven different countries was technology, especially information technology: TV and radio, telephone lines and fax machines, and personal computers and desktop publishing all made it difficult for dictatorial Communist governments to control the flow of events.

Without complete control of the media for propaganda, even the brute force of a massive secret police force was not enough to suppress popular dissent. Controlling the printing presses is not enough if people can use personal computers to produce inexpensive newspapers and then distribute the copy across telephone lines to the far reaches of their country. Nor does owning the only TV station help, if the public's TVs can also pick up unbiased news from elsewhere.

In 1989, TV made those of us on the other side of the Iron Curtain witnesses to the first

revolution facilitated by the humble PC. Now, as the dust settles on the revolution and the people of Eastern Europe come to terms with both democracy and the massive task of rebuilding their countries after 40-odd years of Communist neglect, a number of questions arise: What role will computer technology play in this rebuilding process? What sort of computer industry do the countries of the Communist bloc have? What sort of industry can they build in the future? How much help do they want (and can they expect) from the West?



Behind the Curtain

Until recently, not much was known about the computer industry of Eastern Europe, since many of the nations took great care to keep their activities a secret. While more information has emerged since *glasnost* began five years ago, there is still much that we in the West do not know.

For example, most observers agree that the countries of the East are five, 10, 20, or even 30 years behind the West in some areas of technology. The minicomputer most used in the East is based on technology first launched in the West in 1975. However, that doesn't necessarily mean that the East will need 15 years to catch up with the latest Western minicomputers.

An incident that occurred in the early 1970s reveals the

continued

confusion surrounding the West's assessment of the computing and electronic capabilities of Eastern Europe: A Soviet pilot defected to the West in one of his country's latest fighter aircraft. Western analysts were amazed to discover that air-to-ground communication was conducted via a VHF radio that used vacuum tubes rather than transistors. Was this aircraft a "plant," designed to make the West believe the Soviets were farther behind in technology than they really were? Or—as they suspected—did Soviet pilots truly rely on obsolete technology for their front-line communications? The question remains unresolved to this day.

Back to the Basics

While the Soviet Union and parts of Eastern Europe can produce some very advanced-looking technology, the secondary technology is way behind the West. As a visitor to Moscow five years ago, I was struck by the relatively good quality of the Soviet-made color TV in my hotel room. Yet I was appalled at a hotel electrical system that was so poorly put together that you needed to wear rubber boots to safely operate the light switches or elevator buttons. The showpiece Park of Economic Achievement's technology pavilion could boast some fairly up-to-date 16-bit computers, but the domestic appliances on sale in the GUM department store would not have looked out of place in a British store in the 1950s.

Similarly, while the large state industries and government departments have some reasonably sophisticated mainframes and minicomputers, personal computers are few and far between. Those personal computers built in the East are crudely

manufactured, and any systems from the West are usually obsolete machines based on Intel 8088 or 8086 processors.

In general, microcomputer use in Eastern Europe and the Soviet Union has been sporadic. There have been a number of reasons for this. One is the Coordination Committee on Export Controls, or COCOM, a body consisting of the NATO countries and Japan and Australia. COCOM was set up in 1949 to coordinate the various countries' export policies. The aim was to prevent the Eastern bloc from obtaining Western technology that could be militarily useful.

COCOM meets from time to time and imposes or lifts restrictions on different products. Generally, the committee lifts restrictions on older technologies as newer ones replace them in the West. For example, until recently, Digital Equipment (DEC) could sell PDP-11s to the East but not VAXes. Anyone in the West can export computers based on 8088, 8086, and 286 processors, but not the 32-bit 386 or i486 processors. The complete range of 32-bit Motorola 680x0 processors was also barred from export, so, while PC compatibles are used in the East, the Mac, the Amiga, and the Atari ST are virtually unknown.

The COCOM restrictions affect almost every type of technology imaginable, from fiber optics to TV. While some products are banned from sale to the East, others are simply controlled. Additionally, while preventing the Communist bloc from buying advanced microprocessors has slowed high technology there, it is the COCOM restrictions on manufacturing technology that have caused most of the problems for Eastern Europe and the Soviet Union.

continued

TOTALLY RADICAL...

The Caching Baby Motherboards A New Concept in PC Design

As if being a Caching motherboard weren't enough, we've redefined the state-of-the-art with our new full-functionality Baby Boards.

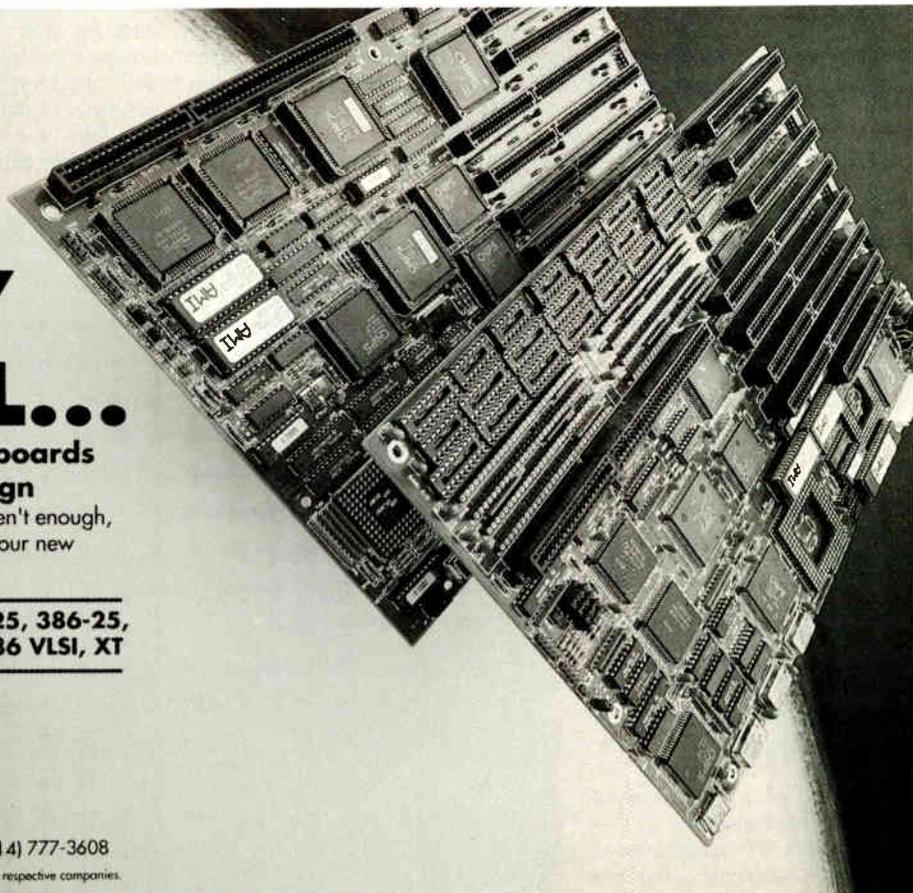
486, Cache 386-33, Cache 386-25, 386-25, 386-20, 3865X, Neat 286, AT 286 VLSI, XT

CACHING

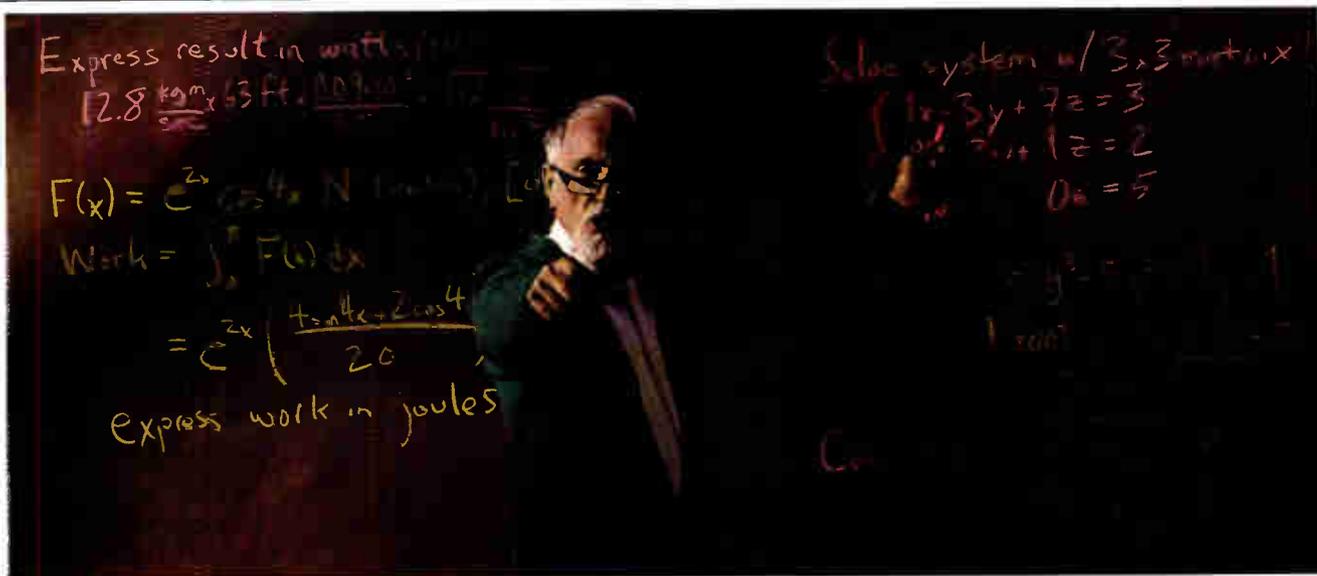
(714) 777-2818

1250 N. Lakeview Ave., #Q
Anaheim, CA 92807 FAX • (714) 777-3608

All brands and product names are trademarks or registered at their respective companies.



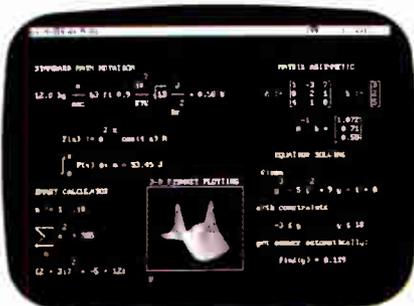
In college, you would have killed for MathCAD. So why aren't you calculating with it now?



100,000 engineers and scientists already let MathCAD do their calculations for them.

Now that college is far behind you, perhaps it's time you graduated from spreadsheets, calculators and programming.

Because in today's working world of engineering and science, there's no time for anything less than MathCAD. The software that lets you perform engineering and scientific calculations in a way that's faster, more natural, and less error-prone than any calculator, spreadsheet, or program you could



MathCAD 2.5 includes 3-D plotting, HPGL sketch import, and PostScript output.

write yourself.

Thanks to MathCAD's live document interface™, you can enter equations anywhere on the screen, add text to support your work, and graph the results.



It also comes complete with over 120 commonly used functions built right in. Perfect for creating complex equations and

formulas, as well as exponentials, differentials, cubic splines, FFTs and matrices.

You get three-dimensional plotting, vivid graphing, and the ability to import HPGL files from most popular CAD programs, including AutoCAD®.

Done calculating? MathCAD prints *all* your analyses in presentation-quality documents, even on PostScript® compatible printers.

All of which has made MathCAD far and away the best-selling math software in the world. In fact, it's used by over 100,000 engineers and scientists — just like you.

There's MathCAD for the PC. MathCAD for the Mac, written to

take full advantage of the Macintosh® interface. And a Unix® version that utilizes the speed and unlimited memory of your Unix workstation.

We also have Applications Packs for Advanced Math, Statistics, Mechanical, Chemical, and Electrical Engineering. Each is a collection of adaptable mathematical models, designed to let you start solving your real world problems right away.



For a free MathCAD demo disk, or upgrade information, dial 1-800-MATHCAD (in MA, 617-577-1017). Or see your software dealer.

Available for IBM® compatibles, Macintosh computers, and Unix workstations.

TM and ® signify manufacturer's trademark or registered trademark, respectively.

1-800-MATHCAD

MathCAD®

MathSoft, Inc., 201 Broadway, Cambridge, MA 02139

PC COMPATIBLE ENGINEERING

Annabooks gives you the **hardware, software, and firmware** information you need to design PC-compatible systems faster and better. And you have control of your design from the ground up - our firmware and software products include **source code!** Plus all the utilities you need. Do hardware design? The AT Bus Design book and the XT-AT Handbook replace a whole shelf of references. Start by getting these books:

AT BiosKit: an AT Bios with source code in C you can modify.

With setup & debug, 380 pages with disk, \$199

XT BiosKit: Includes a debug, 270 pages with disk, \$99

Intel Wildcard Supplement for XT BiosKit: Includes ASIC setup, turbo speeds, also useful with many other modern XT boards. 60 pages with disk, \$49

AT Bus Design: At last here are the complete timing specs to show you how to design ISA and 8/16 bit EISA, \$69.95

PromKit: Puts anything in Eprom or SRAM; DOS, your code, data, you name it! With source on disk, \$179

SysKit: Here's a debug/monitor you can use even with a brand X Bios in your desktop. Runs in ROM or TSR in RAM. Includes source, of course, \$69

XT-AT Handbook: The famous pocket-sized book jam-packed with hardware & software info, \$9.95 ea. or 5 or more for \$5 each.

Software tools:

You need MS C & MASM 5.1 for modifying the Kit products.

FREE Mention this ad when you order any publication and get a free XT-AT Handbook by Choisser & Foster! Hurry before we come to our senses and change our minds.



800-462-1042

In California 619-271-9526

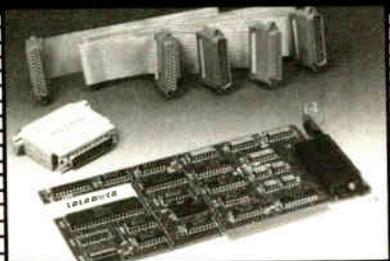


Annabooks

12145 Alta Carmel Ct., Suite 250
San Diego, CA 92128

Money-back guarantee

TELEBYTE



Turn Your PC Into A Low Cost Data Line Monitor

MODEL 902 PC COMSCOPE

- PRINT FEATURE
- HDLC/SDLC
- ASYNC/BISYNC
- TRAP ON ANY 15 EVENTS
- STORE DATA ON DISK
- TIME STAMPING

\$420

MADE IN USA

TELEBYTE
TECHNOLOGY, INC.

270 E. Pulaski Rd., Greenlawn, NY
11740 • 516-423-3232/516-385-8080
1-800-835-3298 • FAX: 516-385-8184

The personal computer is the ultimate statement of freedom in computing, since it puts the power of computing and telecommunications into the hands of the individual.

Working Backward

Many factors contributed to the microcomputer revolution in the West, but one of the most important was the availability of cheap microprocessors. It is one thing to design a microprocessor; it is quite another to manufacture it inexpensively.

Computer scientists in the East can get their hands on any microprocessor in use in the West. However, reverse-engineering a chip once you have it is an incredibly labor- and time-intensive (though relatively unsophisticated) task. Using these techniques, scientists in the East can, and do, work out how to build any Western-designed microprocessor they choose.

The problem comes with the manufacturing process. Almost any type of component can be built well or badly, except a microprocessor. If a microprocessor isn't perfect, it won't work. The plants, machinery, and labor skills required to build microprocessors—especially at their current levels of sophistication—are immense. Manufacture requires ultra-clean rooms with advanced machinery, the purest of chemicals (which have to be specially produced), and an educated and disciplined work force. The countries of the Eastern bloc do not have the plants, machinery, or labor skills to manufacture microprocessors of any design less than 15 or so years old. They desperately need Western help to do this, or they will wind up importing all their chips. Up to now, of course, the COCOM restrictions have made it difficult for them to import any up-to-date processors at all, or even the older processors in any large numbers.

The same is true, to some extent, of microcomputer assembly. The Soviets and others can design microcomputers; they just find it very difficult to *build* them. Again, they are looking for Western help, and there is no shortage of companies in the West who want to help them.

Personal Politics

COCOM and the problems of manufacturing are not the only factors that have slowed the development of the personal computer in the East. Political problems have also played a part. Countries like Romania, Poland, and the Soviet Union have been run as dictatorships, and dictatorships must control information within their societies to survive. By controlling information, they can limit freedom. The personal computer is the ultimate statement of freedom in computing, since it puts the power of computing and telecommunications into the hands of the individual. That is why most of the East's computing effort has been put into mainframe and minicomputer development, and little into personal computers and distributed computing.

The access to and use of large-scale computer systems can be controlled and monitored by the authorities to ensure that they

continued

C8.0/386

Unleash 386 Power on Your Microsoft C Code.

- ✓ Source-level debugger
- ✓ Graphics Library
- ✓ Fast, tight code
- ✓ Generates high-performance code for 32-bit protected mode
- ✓ Microsoft source and library compatible
- ✓ Supports Phar Lap and Eclipse DOS Extenders
- ✓ Protected-mode version of compiler
- ✓ SAA Compatible
- ✓ Run-time Compatible with WATCOM FORTRAN 77 /386
- ✓ 100% ANSI C Compatible
- ✓ Profiler
- ✓ Remote debugging

Experts Agree on WATCOM C:

"When Novell went looking for a 32-bit compiler for use with the NetWare 386 developer's kit, the company selected WATCOM's... It's clear that Novell chose wisely; this product is a winner."

Fred Hommel
BYTE, December 1989

"WATCOM C broke with tradition to make a fast, efficient C programming environment that has other C compiler designers rethinking their strategy."

Bill Machrone
PC Magazine, January 17, 1989

"Good things do get better."

John Dlugosz
Dr. Dobbs Journal, September 1989

Microsoft library- and source-compatibility makes WATCOM C7.0 /386 ideal for porting DOS applications to 32-bit native mode. This compiler enables full 386 performance without 640K limitations.

Richard M. Smith, President
Phar Lap Software, Inc.

"WATCOM's latest release of its rising star is a clear winner...It is a clearly superior value when compared to all compilers..."

Richard Relph
INFOWORLD, May 22, 1989

"...WATCOM C showed shining performance."

Computer Language, Feb. 1989

Also announcing: WATCOM FORTRAN 77 /386

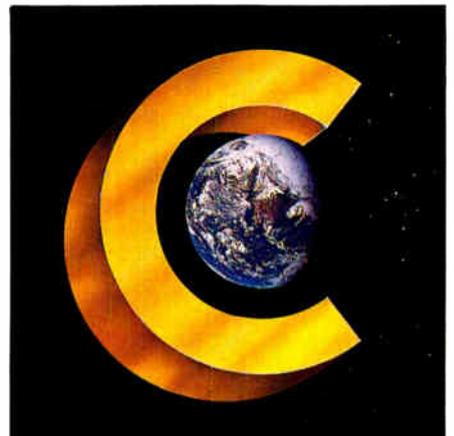
- Based on WATCOM C Technology
- Shares WATCOM C Development Tools
- Supports FULL ANSI FORTRAN 77 Language plus Extensions
- SAA Compatible
- Generates High-performance Code for 32-bit 386 Native Mode

WATCOM C8.0 /386

- 100% ANSI C Optimizing Compiler
- 386 Run-time Library Object Code
- 386 Graphics Library
- Windowed Source Level Debugger
- Profiler, Editor, MAKE and Linker
- Object-code Librarian
- Object-code Disassembler
- Protected-mode version of compiler
- Supports Phar Lap and Eclipse DOS extenders

WATCOM F77/386

- 100% ANSI FORTRAN 77 Optimizing Compiler plus extensions
- 386 Run-time Library Object Code
- Windowed Source-level Debugger
- Profiler, Editor, MAKE and Linker
- Object-code Librarian
- Object-code Disassembler
- Protected-mode version of compiler
- Run-time compatible with WATCOM C8.0 /386



1-800-265-4555

WATCOM

Unleash Your 386, 486 & i860!

NDP Fortran is your key to unlocking the numeric power of Intel's 32-bit CPUs, including the i860. If you're burning up a lot of VAX or Cray time, you should seriously consider the Number Smasher-860. It delivers super-computer throughput, running in an ISA bus, for about the price of a 486 system. With Number Smasher-860 and NDP C or Fortran-860, you can recompile all of your C or FORTRAN programs and run them in any 286, 386, or 486 AT system.

MicroWay's compilers come with the features you need to simplify porting to the 32-bit mode of the 386, 486, or i860, including a 99% VAX/VMS compatible FORTRAN and a dual dialect C which is UNIX System V and ANSI compatible. Each NDP compiler is designed to take maxi-

mum advantage of 32-bit protected mode operation, including the 4 gigabyte address space of the processor, plus access to coprocessors from Intel, Weitek and Cyrix. Each compiler includes a library of 135 character and pixel oriented graphics routines that automatically detect and support the full range of PC display adapters. In addition, we carry a full line of third party libraries and utilities that were ported with our languages.

The new releases of our languages include a linker that uses incremental links to speed up building very large programs, a new inlining facility that makes it possible to inline functions in any of our languages (this is an especially important C optimization) and a true C++ com-

piler that is AT&T version 2.0 compatible. NDP C++ contains a full ANSI C compiler as a subset. NDP C is your choice if you have to compile a mixture of ANSI, UNIX V, or K&R C applications. Finally, ClearView, our new symbolic debugger, uses windowing and a C-like interpreter with FORTRAN extensions that make it easy to debug C or FORTRAN programs without resorting to an assembly language debugger.

MicroWay is still your best source for numeric coprocessors and accelerators. Call for your free copy of "The State of PC Numerics in 1990" by Stephen Fried.

For more information, please call our Technical Support Dept. at (508) 746-7341.

386, 486 & i860 Compilers

Our NDP family of compilers generate globally optimized, mainframe quality code that runs on the 386, 486 or i860 in protected mode under UNIX, XENIX, or extended DOS. The compilers address 4 gigabytes of memory while supporting the 80287, 80387, Weitek, and Cyrix coprocessors. Applications can mix code from all three compilers and assembly language. To simplify your ports, we have just released a full-featured, windowing symbolic debugger, ClearView-3/486, that works with DOS versions of NDP 386 and 486 compilers.

NDP Fortran™ is a full F77 with F66 and DOD extensions that is 99% VMS compatible.

NDP C™ runs in two modes—K&R with Sys V and MSC extensions or 100% ANSI as validated by Plum Hall.

NDP Pascal™ is a full ANSI/IEEE Pascal, with extensions from C and BSD 4.2 Pascal.

NDP C++™ is a fully AT&T v.2.0 compatible C++ compiler (not a preprocessor) that contains a full ANSI C compiler as a C++ subset.

NDP-860 compilers each \$1995
 DOS 386SX versions-NDP Tools included \$595
 DOS 386 versions-NDP Tools included . \$895
 DOS 486 versions-NDP Tools included \$1195
 UNIX/XENIX versions CALL
 NDP VMEM Virtual Memory Manager \$295
 Eclipse or Phar Lap Tools \$495
 NDP Link - Incremental Linker \$295

ClearView-3/486 Debugger™ \$395
 NDP Windows™ Library: \$125, C Source: \$250
 NDP Plot™ \$325
 NDP/FFT™ NDP or 80x87 version ... ea. \$250
 NDP to HALO '88 Graphics Interface \$100
 Media Cybernetics' Halo '88 \$395

NDP NAG™ Workstation library is a subset of the NAG mainframe libraries. It contains 172 routines designed to solve differential equations and eigenvalue problems, perform matrix operations, fit curves, do statistics and regression analysis, etc. \$895

RAMpak™ Your Compaq!

RAMpak™ - one or four meg 32-bit memory expansion module for Compaq Deskpro 386 20/25 One meg .. \$150, Four meg .. \$400

Number Smasher-860™

The Number Smasher-860 is the highest performance coprocessor card ever to run in an ISA or EISA bus or as part of a transputer system. Delivers up to 80 million floating point operations per second at 40 MHz and produces over 10 double precision Linpack megaflops. The board comes standard with an ISA interface, two transputer link adapters, your choice of NDP Fortran, C++, C or Pascal for the i860 running under MS-DOS or UNIX, plus 8 megabytes of high speed memory. 33 MHz \$5995
 40 MHz \$7200 32 MB version: add \$5000

Parallel Processing

MicroWay's IBM compatible Monoputer, Quadputer, Videoputer, and Linkputer boards work together using Inmos transputers to provide expandable, plug-in mainframe performance for your desktop PC.

Monoputer™ — Includes one T800 and up to 16 meg of RAM for parallel code development. The 4 MWhetstones T800 makes it the ideal FORTRAN engine for cost-effective execution of your mainframe programs. from \$1145

Quadputer™ — This board for the AT or 386 can be purchased with 1 to 4 transputers and 1 or 4 meg of memory per transputer. Two or more Quadputers can be linked together to build networks of up to 100 or more transputers providing mainframe power. from \$1845

Linkputer™ — Links up to 8 boards to provide dynamic transputer topologies. \$1500

Transputer Compilers and Utilities

These parallel languages are designed for use with the Monoputer, Quadputer and Videoputer.
 Logical Systems Parallel C \$595
 3L Parallel C, FORTRAN, or Pascal ... \$895
 TBUG — debugger for 3L compilers ... \$330
 Parsec Parallel C/dynamic \$1500
 ParaSoft EXPRESS — Includes transputer communications libraries, parallel code development library, C source level debugger, and system performance monitor. \$1500
 Helios PC/s \$1250
 Nexis Windows File Server. \$495
 T800/NAG™ — Port of the complete NAG mainframe library. Contains 268 functions: \$2750

Number Smasher-486™

Personal Workstation magazine, June 1990, said, "The Number Smasher-486 lives up to its name. Its numeric performance exceeds that of all 25-MHz systems we've tested to date. It gives you top 486 performance for the best price." Number Smasher-486™ is a 25 MHz replacement motherboard for ATs and 80386s. This motherboard supports an optional Weitek 4167 numeric coprocessor and up to 16 megabytes of memory. Running with a 4167, our design delivers up to 10 megaflops. The Number Smasher-486 is priced from \$3195.

Math Coprocessors

WEITEK, INTEL, CYRIX

4167-25 \$1395
 4167-33 \$1795
 3167-20/-25/-33 \$595/ \$895/ \$1295
 mW1167 Micro Channel-16/20 .. from \$795
 mW3167 Micro Channel-25/33 .. from \$1395
 mW3167/80387 Board \$200
 8087 \$80 8087-2 \$115
 80287-8 \$185 80387-16SX .. \$280
 80387-16 ... \$295 80387-20SX .. \$300
 80387-20 ... \$345 80387-25 \$439
 80287XL ... \$210 80387-33 \$540
 287Turbo-20™ \$345
 Cyrix CX83D87 FasMath™ SX16MHz \$275
 20 MHz: \$375 25 MHz: \$460 33 MHz: \$570

386 Your AT!

FASTCache-SX™ — The most cost effective accelerator we have ever manufactured. Plugs into the 286 socket, speeding up all applications by a factor of 2 to 4. Runs all 386 applications, OS/2 and Windows 3.0. Features a 16 or 20 MHz 80386-SX, a 4-way 32K cache (expandable to 64K) and a math coprocessor socket. 16MHz: \$495 20 MHz: \$595

NUMBER SMASHER-386™ — This full-sized card replaces the 80286 microprocessor on your IBM AT or compatible motherboard with an 80386 that runs at 20 or 25 MHz. It runs numerically intensive applications up to a factor of 60 times faster, while maintaining full hardware and software compatibility when running all 386 applications. Options include 64K of high speed cache memory, up to 8 megabytes of 32-bit memory, and an Intel 80387, Weitek, or Cyrix numeric coprocessor. from \$895

**Micro
Way**

World Leader in PC Numerics

Corporate Headquarters: P.O. Box 79, Kingston, MA 02364 USA (508) 746-7341
 32 High St., Kingston-Upon-Thames, U.K., 81-541-5466 USA FAX (508) 746-4678
 Germany 069-75-2023 Italy 02-74 90.749 Holland 40 836455 Japan 3 222 0544

are used only for purposes approved by the State. It is no surprise that, in a society that locks photocopiers and oversees their use, computers and their use are also closely guarded.

But these problems are starting to disappear, although not in a uniform way, across all the Eastern countries. COCOM is relaxing many of its restrictions on Eastern Europe and the Soviet Union. The Intel 386 processors are now derestricted, although there are still tight controls on the i486. The restrictions on machinery and plants for chip and computer manufacture have also been relaxed.

At the same time, many of the political restrictions on the use of computers have gone, although to understand that fully, it is perhaps best to look at some of the individual countries involved. Hungary and East Germany are commonly considered to be the two Eastern European countries that are the most advanced in computer technology.

Hungary: Leading the Eastern Division

Before the events of last year, Hungary was considered to be one of the most repressive countries in the East, yet one of the most economically advanced. These two facts are directly related. Janos Kadar was the man the Soviets put in control of Hungary after the uprising of 1956. In the early 1960s, he struck a deal with Moscow. In return for guaranteeing the complete suppression of opposition to the Communist government, he got a free hand to organize the Hungarian economy. Kadar started, and successive premiers continued, a liberal (for Eastern Europe) policy of encouraging trade and economic ties between Hungarian industry and agriculture and the West. As a result, Hungary has become Eastern Europe's biggest importer of goods from the West and the biggest exporter to the West. Private companies and cooperatives thrive in Hungary, and the institutions and industries there have decades of experience in dealing with the West.

As you would expect, Hungary has a great need for computing technology to keep this economic activity moving and has a long history of dealing with companies like DEC and IBM. Ashton-Tate and Borland, in particular, sell large amounts of software to Hungary, which has been almost unique among Eastern European countries in that it buys—rather than pirates—most of its Western software.

In hardware terms, the most common microcomputers are IBM PC, XT, and AT compatibles—the latter almost entirely based on 286 processors. Like all the countries of Eastern Europe, Hungary is subject to the rules of COCOM, so there are no legal 32-bit computers of any kind—although more than a few VAXes are said to have found their way there via incredibly circuitous routes and with no help from DEC. Most of the personal computers are imported either from Hungary's neighbors, such as East Germany, or from Western Europe, Taiwan, and Japan. What hardware industry the country has concentrates on the mid- to high end of computing, although Muszertechnika, the country's largest computer supplier, has been successful at selling personal computer products in the West. The company sells a range of hardware add-ins, including a SCSI controller for the PS/2s.

But Hungary is best known for the work done by its academics and engineers in computing theory and software development, particularly in AI. John von Neumann (of von Neumann architecture fame) was Hungarian and did much of his work at the University of Budapest, which maintains a thriving computer science department. The most notable commercial computing work to spin off from there is in expert systems, especially in pharmacology.

continued

Don't be a Nerd!

Only real nerds would spend months coding basic functions and classes for their Windows applications when they could be using Drover's ToolBox for Windows™.

Drover's ToolBox™ for Windows

Drover's ToolBox for Windows adds powerful features to your Microsoft Windows™ applications while reducing development time.

- Over 200 functions in a single DLL (Dynamic Link Library).
- 7 new classes for use in dialogs with automatic screen validation.
- Increased functionality of Windows SDK™ and more flexibility for SQL Windows™ and Actor™.
- Converts most C runtime library functions to far pointers.
- Start developing applications right away using standard C conventions.

So, don't be a nerd. At just \$295 (\$885 with source code) and no royalties, Drover's ToolBox for Windows is the best productivity booster yet. Order your copy today.



D R O V E R



Drover Technologies, Inc.
660 White Plains Road
Tarrytown, NY 10591-5134
USA

Phone 914-631-4942
FAX 914-631-7013

East Germany: A Centralized Computer Economy

East Germany has suffered immense political and economic restrictions. Its secret police force was the largest in Eastern Europe, and its economy was rigorously controlled. Despite this, East Germany has the largest computer industry in Eastern Europe. The state-owned manufacturer Robotron makes everything from personal computers to mainframes. These systems are often, but not invariably, imitations of Western systems. Robotron manufactures a range of personal computers and launched a new range of PC compatibles at the CeBit Fair in Hannover this year.

Paradoxically, Robotron has the most to gain and the most to lose in the process of liberalization. The company has developed a mass of software aimed at manufacturing, including MRP II (for material requirements planning), CAD/CAM, and a variety of scientific packages. Some of these are already sold in the West. With teams of skilled programmers, Robotron could become a successful exporter.

But the hardware side, which is the core of the company's business, is more problematic. The hardware is not up to the quality of Western equipment, since Robotron has had a closed market to sell to in the East. As it becomes easier for East Germany's neighbors to buy from the West, that market will start to slow and eventually close unless the company changes rapidly.

That change is likely to happen. As the move to German reunification gathers pace, Robotron will become a Western company. In fact, the West German computer giant, Siemens, has already expressed an interest in buying Robotron. If this

sale goes through, Siemens will become the clear giant of computing in Europe, and Robotron will be a part of that. You can expect to see a lot of software emanating from Siemens, much of which will have been developed in East Germany.

Romania: Lagging Behind

While Hungary and East Germany have shown some promise in the computer field, Romania has lost out. Let a Romanian explain why. Nicora Paulian, whose company, Lixco, is based in Bucharest, makes the following assessment of the computer industry under Ceausescu:

There is a very weak computer culture in Romania, due to the deliberate policy of the Ceausescu regime. For example, there was a "de-electronization program" which banned words like *computer*, *software*, *robot*, and so on from appearing in the mass media. As a result, the computer industry here lags some seven to 20 years behind Western technology. The problems came from the fundamental economics governing the society: central planning. Computing was introduced into the economy by force, so a kind of repulsion developed among people interacting with it. The Ceausescu regime tried to control the movement of data, but in effect the opposite happened as people used computers to exchange information against the regime.

There are some IBM 360-like mainframes and PDP-11-like minicomputers. The majority of microcomputers

continued

This is as low as fax gets: \$195

\$195 9600-bps PC fax board! Wow!

New money-saver: Voice and fax on one line. Retrieve your new faxes from any fax machine in the world!

Put the Frecom FAX96 in your PC and get high speed 9600 bps performance that's fully compatible with Group III fax machines. Send faxes quickly. Receive faxes even while you're doing something else on your PC.

It's Revolutionary! Now you will have over 12 million remote printers for your PC!

You have total control.

Read incoming faxes on your monitor before you decide to print, save or junk them.

Feature package includes:

- . automatic redial
- . automated phone directory
- . broadcast and timed send
- . the world's simplest, easiest-to-use software
- . multiple file send

Installation is quick and easy. So to start faxing from your PC, just call, have your VISA or MasterCard ready, and we'll ship you a Frecom FAX96 complete with a **100% money-back guarantee**. For \$195!

Available Now! The Hottest New Product in Fax Boards!

Frecom 1-Liner! Save hundreds of dollars every year. Put fax, telephone and answering machine on a single phone line. Eliminate fax-switch boxes forever! With **FarFetch Fax** fetch your important faxes from any other fax machine in the world. Includes FAX96.

Only \$295

The Best Buy!

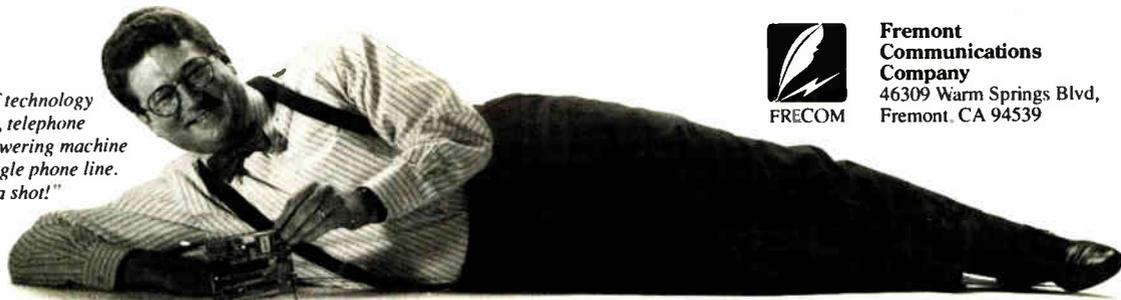
Order phone: 415-438-5000
Dealer inquiries: 415-438-5016
FAX: 415-490-2315

*Patent applied for.

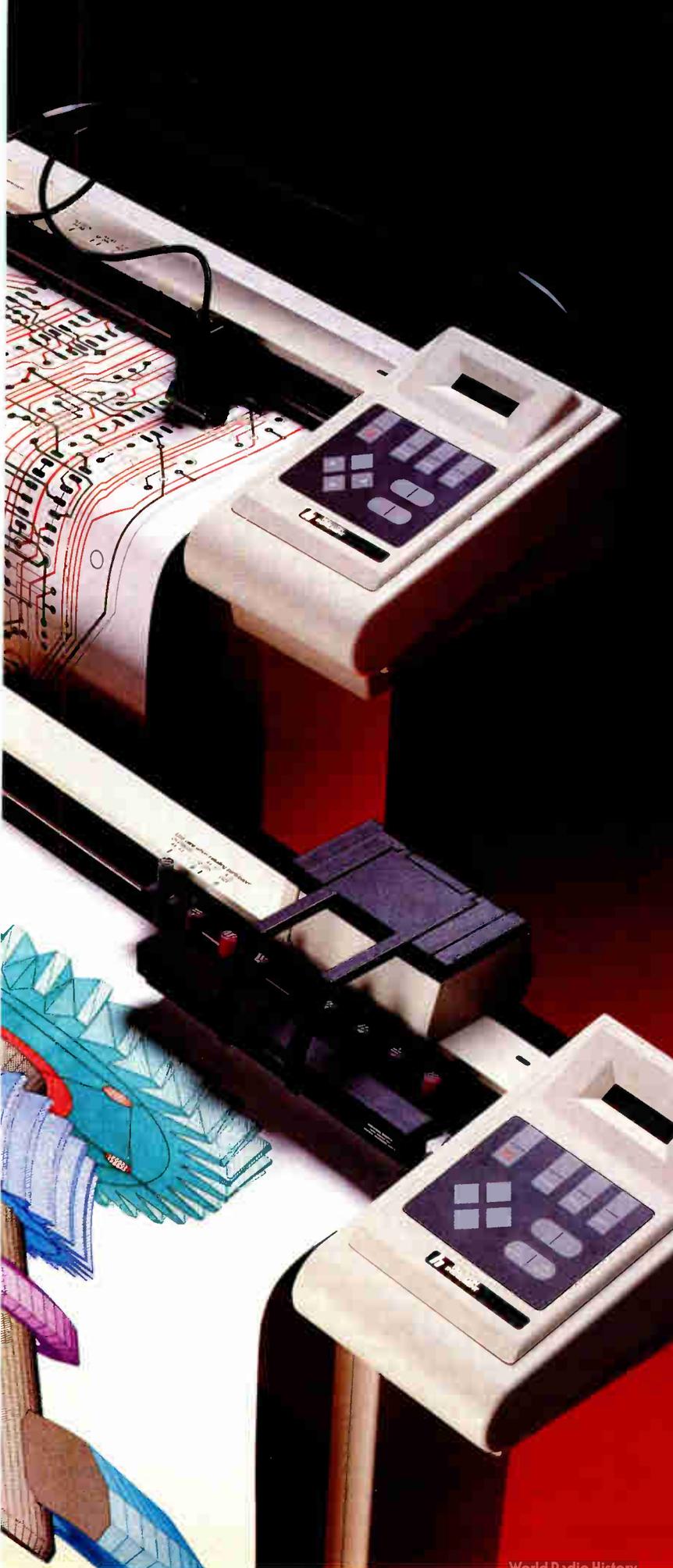


Fremont Communications Company
46309 Warm Springs Blvd,
Fremont, CA 94539

"A lot of technology gets fax, telephone and answering machine on a single phone line. Give it a shot!"



Paul Masters, UC Berkeley MBA and Northern Telcom alum, is President of Fremont Communications



Check out
HI's new DL series

**Large format,
Big features,
Small price.**

- ✓ Eight-pen changer **NEW**
- ✓ LCD user interface display **NEW**
- ✓ One-year warranty **NEW**
- ✓ Plot optimization **NEW**
- ✓ "Quick scale" feature **NEW**
- ✓ Standard media up to 36" x 48"
- ✓ Sizzling speed up to 45 ips
- ✓ High resolution of 0.0005 inch
- ✓ Roll-feed option **NEW**
- ✓ Scanner option
- ✓ 1 Mb buffer option

These are just some of the many standard features packed into HI's new DMP-60 DL series of pen plotters. Based on the popular DMP-60 line, the new DL series delivers a blend of proven performance and state-of-the-art innovation. At a surprisingly low price.

Top of the line. Heavy duty. Large format. Loaded with standard features. Priced as low as \$4,895.*

Check it out by calling
1-800-444-3425 or 512-835-0900.

**HOUSTON
INSTRUMENT™**

8500 Cameron Road, Austin, TX 78753

* U.S. suggested retail price. Subject to change.

Circle 140 on Reader Service Card

Intelligent
Data
Acquisition

System Solutions For Data Acquisition

Onboard Intelligence for
IBM PC/XT/AT/386

Microstar's Data Acquisition Processor™ (DAP™) manages the entire data acquisition and control interface inside a PC. Onboard intelligence in the DAP speeds development and increases performance.

The DAP can be configured easily into a number of instruments, including:

- Spectrum Analyzer
- Instrument Controller
- Transient Recorder
- Digital Signal Processor
- Datalogger

DAPview™ software provides interactive control for data acquisition:

- real time graphics
- disk logging
- pull-down menus
- on-line HELP
- on-line error handling



Call for FREE Demo Diskette
(206) 881-4286

DAP Features:

- On board microprocessor: up to 16 MHz with 512K DRAM
- DAP 2400™ with onboard digital signal processor: 20 MHz for 10 MIPS; up to 96K fast SRAM
- Buffers and processes input data
- More than 100 commands without programming
- Compatible with DAPview, C, Pascal, BASIC, FORTRAN, Lotus 1-2-3, ASYST, ILS, LabWindows
- C language custom commands
- Acquires analog and digital inputs to 235,000 samples/second
- Updates analog or digital outputs to 250,000 values/second

MICROSTAR

LABORATORIES™

2863 152nd Ave. N.E., Redmond, WA 98052
Fax (206) 881-5494

are 8-bit systems based on 8080 or Z80 processors that have a 64K-byte RAM limit and run CP/M. They have stiff keyboards, flickering black-and-white displays, unreliable disk drives and media, and no modems.

There are a few hundred PC compatibles that are manufactured locally, and a few dozen imported ATs. They use MS-DOS. Unix is unheard of, and there are no Macintoshes, Amigas, or Ataris.

The home computer is the Sinclair ZX Spectrum, which has enjoyed tremendous success among hobbyists; its clones are being built by the thousands. If you talk about "personal computing" in Romania you are talking about the Spectrum.

It is felt by many observers that this situation was deliberately encouraged by the regime since there is little "subversive" potential in the Spectrum. Disk drives were hard to find, and printers were not allowed. In Romania you needed a permit from the police just to own a typewriter.

Lixco and other Romanian computer companies are rebuilding themselves in the wake of the revolution. While Paulian acknowledges the problems facing his country as it tries to take its place in the world's computer industry, he believes that there is an abundance of talent and creative ability in Romania's computer engineers and software writers.

The problems faced by Romanians, including Paulian, are immense: a lack of infrastructure, poor electrical supplies, terrible telephone services, few networks, and little data communications. His country's technological development is years behind the West, but all these things can be overcome. His company builds digital circuits and microprocessors. There are also plenty of people writing software. The biggest problem in software up to now has been the impossibility of marketing and selling it. The absence of copyright laws means that piracy is endemic.

Out of Tumult, Opportunities

All the countries of Eastern Europe, to a greater or lesser extent, face the same problems. They are starting the computer revolution from behind. They need resources, expertise, and training. They lack money.

At this writing, East Germany has changed over to West German deutsche marks, but other Eastern European economies are still based on currencies that are not acknowledged on the international foreign exchange markets. Consequently, they have no hard cash with which to pay for things. They can barter for goods, and most of the trade in the computer industry between the East and the West has been done this way through agents. The agents give the Eastern country the computer, take goods in exchange, sell the goods, and then pass on some of the money to the Western computer company. It may not sound like the best way of doing business, but it works.

Most of the economies of the Eastern countries are in disarray. Revolution and the uncertainty that follows it have taken their toll on whatever reserves these countries had. Western computer companies are going to have to make heavy investments in the East if they expect to reap any reward. But there are sound reasons for doing this. Suppliers from the Pacific Rim are already there in force. Most of the PC compatibles used in the Soviet Union come from countries like Taiwan. If the West is not to be left out, it will have to move quickly. ■

Colin Barker is a senior editor for BYTE in London. He can be reached on BIX as "colin.b."

Add Flair!

CORELDRAW!

Add flair to your newsletters, reports, brochures, presentations and other documents — quickly and easily — with CorelDRAW!

Whether you need a headline for your newsletter, a technical diagram, a new logo or a splashy invitation to your next promotion... CorelDRAW will help you add impact, interest and flair.

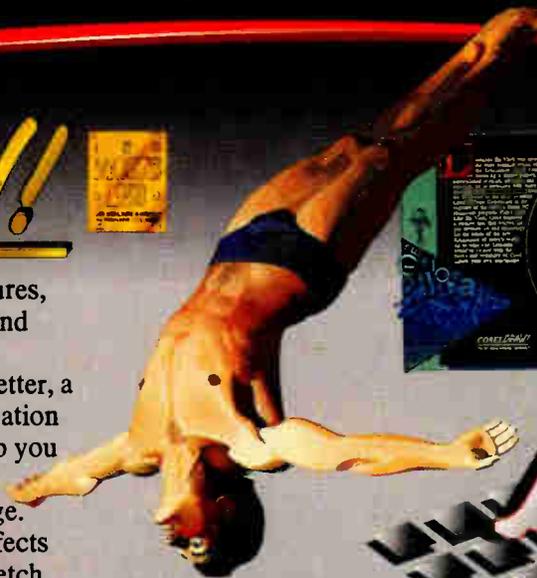
CorelDRAW is the ideal PC graphics package. Right from the start, you can create dramatic effects with text and images. Change colors, rotate, stretch, fit text to a path, kern letters on-screen, edit letter shapes or use a calligraphic pen. The possibilities are endless and exciting.

Running under Microsoft Windows 2.0 and 3.0, CorelDRAW is compatible with packages such as PageMaker, MS Word, and Excel. And extensive import/export options make file transfer easy.

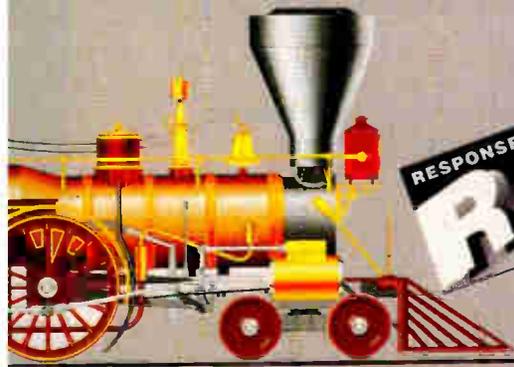
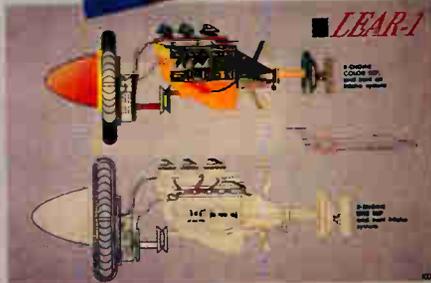
CorelDRAW is value-packed... you get over 100 fonts, 6 megabytes of clipart, a PANTONE color license and the WFNBOSS font conversion utility, which exports fonts to typeface editors and imports fonts from Adobe, Compugraphic, Bitstream and other major vendors. CorelTRACE is an amazing new batch autotracing program that converts bitmapped images to smooth vector art, and it's included free!

So add a wild headline, design a logo or create a masterpiece... it's easy with CorelDRAW!

Windows 3.0 and OS/2 versions available!



SPEC



COREL
Tel: (613) 728-8200 / Fax: (613) 728-9790
1800 Carling Avenue, Ottawa, Ontario, K1Z 8R7



World Radio History

Circle 76 on Reader Service Card

Introducing
the "Pizza Machine"...

Northgate's NEW 286 & 386 SX OmniStations!™

Northgate's Network
Recipe ... Elegance™ 386
and 486 Systems with
"Pizza Machines!"



Any way you slice it...it's loaded!

- ▶ Choose "diskless" or stand alone systems
- ▶ Runs Unix/Xenix, OS2 and DOS
- ▶ Operates under Novell and all network software
- ▶ Flawless software and hardware compatibility
- ▶ Unlimited, 24-hour toll-free technical support
- ▶ 1-year system warranty
- ▶ 5-year keyboard warranty
- ▶ 30-day no risk trial
- ▶ FCC Class B Certified

Runs Unix/Xenix,
OS2 & DOS Operating Systems!

Comes with the works... but doesn't cost a lot of dough!

Get a sizzling slice of REAL LAN station computing power! Northgate *OmniStations* are fast, cost-effective, diskless workstations. They're only 2¼" high, yet don't scrimp on computing power! Choose 286 12 MHz or more powerful 386SX 16 MHz systems.

Private pizza party! "Diskless" *OmniStations* are the ideal way to protect against unauthorized copying or loading of valuable information or programs. Your file server holds all applications and files, and allows your data to be stored and backed up in one place.

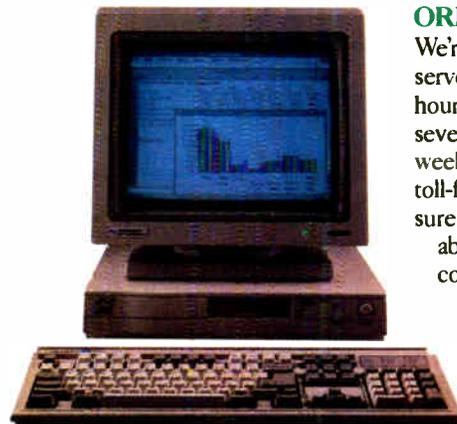
Processing to go! All programs are executed in your network fileserver, giving you superior speed. And, you'll save time because you won't have to reboot and load software.

We use only the finest ingredients! Standard features include: 1Mb of RAM on the motherboard expandable to 4Mb (8Mb in the SX); built in VGA controller with 256Kb RAM (expandable to 512Kb in the SX); hard and floppy disk controller: one full size AT style expansion slot for LAN or modem cards; two serial, one parallel port, mouse port; and math coprocessor support. You also get DOS 4.01, Microsoft® BASIC and Northgate's *OmniKey/101* keyboard.

Want extra "toppings?" Just ask! We can set up your *OmniStation* as fully configured network node or a stand alone system at entry level prices. All you do is plug it in and turn it on. Options include VGA color and monochrome displays, 40Mb hard drive, 3.5" 1.44Mb floppy disk drive, keyboards, and additional memory. And we'll throw in a FREE copy of the NEW Microsoft Windows™ 3.0 with 2Mb and up configurations (SX only).

A guarantee you can sink your teeth into! Use *OmniStation* for 30 days. If it fails to meet your expectations, return it—NO QUESTIONS ASKED!

Northgate support—the perfect dessert! Your system is backed by a one year warranty on parts and labor. Need a part? We'll ship it to you—OVERNIGHT AT OUR EXPENSE—before we receive your part! To top it off, you get the industry's best toll-free technical support AND free deskside service (to most locations) for one full year!



ORDER TODAY!

We're here to serve you 24 hours a day, seven days a week! Call Sales toll-free—be sure to ask about custom configurations, leasing and financing programs.

OmniStation 286/12 MHz Workstation

\$995⁰⁰ Free Delivery
To Your Home
Or Office!
(Monitor extra)

Just \$1295.00 for 386SX/16 MHz model.

Complete Stand Alone Systems

Your Choice	286 Model	\$1695 ⁰⁰
	386SX Model	\$1995 ⁰⁰

Systems include 12" high resolution monochrome monitor, 1.44Mb 3.5" floppy and a 40Mb hard drive.

Easy Financing: Easy payment options. Use your Northgate Big 'N', VISA, MasterCard or lease it. Up to five-year terms available.

CALL TOLL-FREE 24 HOURS EVERYDAY

800-548-1993

Notice to Hearing Impaired: Northgate has TDD capability. Dial 800-535-0602.



"We hear you!"

1 Northgate Parkway, Eden Prairie, MN 55344

Prices and specifications subject to change without notice. Northgate reserves the right to substitute components of equal or greater quality or performance. All items subject to availability. ©Copyright Northgate Computer Systems, Inc., 1990. All rights reserved. Northgate, OmniKey, Elegance, and the Northgate 'N' logo are registered trademarks of Northgate Computer Systems. 60386 is a trademark of Intel. Microsoft and Windows are registered trademarks of the Microsoft Corporation. IBM, OS/2 and AT are registered trademarks of the IBM Corp. All other products and brand names are trademarks and registered trademarks of their respective companies.

THE CREATION OF THE IBM PC

David J. Bradley

A little-known system, the DataMaster, drove many of the design choices for the original IBM PC

In August 1980, I had finished my work on what was to become the IBM System/23 DataMaster. The DataMaster was an Intel 8085-based system intended to run business applications written in BASIC. I had written some of the device-control code for that system and was looking at extending the design to the 8086 architecture.

I had heard rumors of a task force that was looking for a low-cost system design. The project sounded interesting, but I was enjoying the DataMaster work.

Then my manager called me in. He told me that IBM's Boca Raton division had been given the job of building a low-cost system. Management had assembled a team of engineers, and they needed someone to write the control code. I was to join 11 others in daily meetings at 8 a.m.

At that time, the design for the machine existed only as a few descriptive charts. A year later, on August 12, 1981, we announced the IBM Personal Computer. Here is the story of how we made the design decisions that shaped the IBM PC.

Humble Beginnings

The DataMaster program began in February 1978. Many of its design elements—the keyboard, for example—were later used on the IBM PC. This same development effort also produced a group of trained engineers already familiar with personal computer design.

The DataMaster was a single-element design. The one-piece package contained the keyboard, a 12-inch monochrome display, and a pair of 8-inch floppy disk drives. Although this design was suitable for the System/23 business environment, it didn't have the flexibility needed for a personal computer.

The DataMaster's 8-bit 8085 CPU was a very close relative of the 8080 and executed the same instruction set. During the design team's work on the DataMaster, we ran up against the limits of the 64K-byte address space and had to invent an external paging mechanism to address at least 256K bytes of memory. In designing this system, we became familiar with the

Intel architecture and support chips.

The DataMaster system had a built-in BASIC interpreter, just like many of the personal computer designs of the time. During the DataMaster development, we "converged" our BASIC with the BASIC used on the IBM System/34. That change delayed the DataMaster by nearly a year.

That experience taught us two things about getting a product to market rapidly: We needed to use an existing BASIC, and we needed to streamline the IBM development process. Applying what we learned was one of the reasons for the success of the IBM PC. We went to Microsoft for a BASIC interpreter. And we used our own fast-path development process, which included using executives to convince the rest of the corporation that we were on the right track.

The First View

Refinement of the original PC design swapped the positions of the power supply and the expansion cards, allowing the adapters to extend the full length of the box. That move put the power switch in the back corner—a long reach for users.

In the initial design, we included a pair of 5¼-inch floppy disk drives, a horizontal system board, and five expansion slots. Because of our experience with the DataMaster, we made the keyboard and display separate from the computer. The basic logic was to go on the system board, but expansion cards would give each system a unique flavor.

The width and depth of the box had to fit on a standard desktop and still leave room for the keyboard. After subtracting areas for the power supply and disk drives, the remaining space determined the size of the system board and expansion cards.

The initial system design was quite different from the device we finally announced. We shipped all systems with a minimum

continued

The one-piece DataMaster was a business-oriented single-user system. It served as a model for many of the features of the original IBM PC. ►



FEATURE
THE CREATION OF THE IBM PC

of 16K bytes of RAM on the system board. All systems had 40K bytes of ROM, which consisted of a 32K-byte BASIC interpreter and an 8K-byte BIOS. Our first design called for a total of five slots—exactly the same number that ended up in the finished product. We wound up actually developing most of the features on our original list, with the exception of the 8-inch disk drives; also, we changed the printer adapter to an industry-standard parallel port.

A major influence on the system design was the just-enacted FCC Class B requirement for electronic devices in the home. As the industry painfully learned in those early years, “hardening” the system to contain electromagnetic emissions was difficult, and sometimes more art than science. We designed the adapter-card brackets to fit securely in the enclosure to reduce the leakage. Many hours of testing, including some open-field work conducted in the Everglades (where bug removal took on a completely different meaning), were necessary to make the system pass the FCC criteria.

We had learned from the DataMaster development and from the experiences of others that even a company the size of IBM couldn’t develop all the hardware and software to make a personal computer a success. From the beginning, we decided to publish data concerning all the hardware and software interfaces. Anyone designing an adapter or a program to run on the IBM PC would get as much information as we had available. A compilation of all the system specifications used during the system development and testing became the *Technical Reference Manual*.

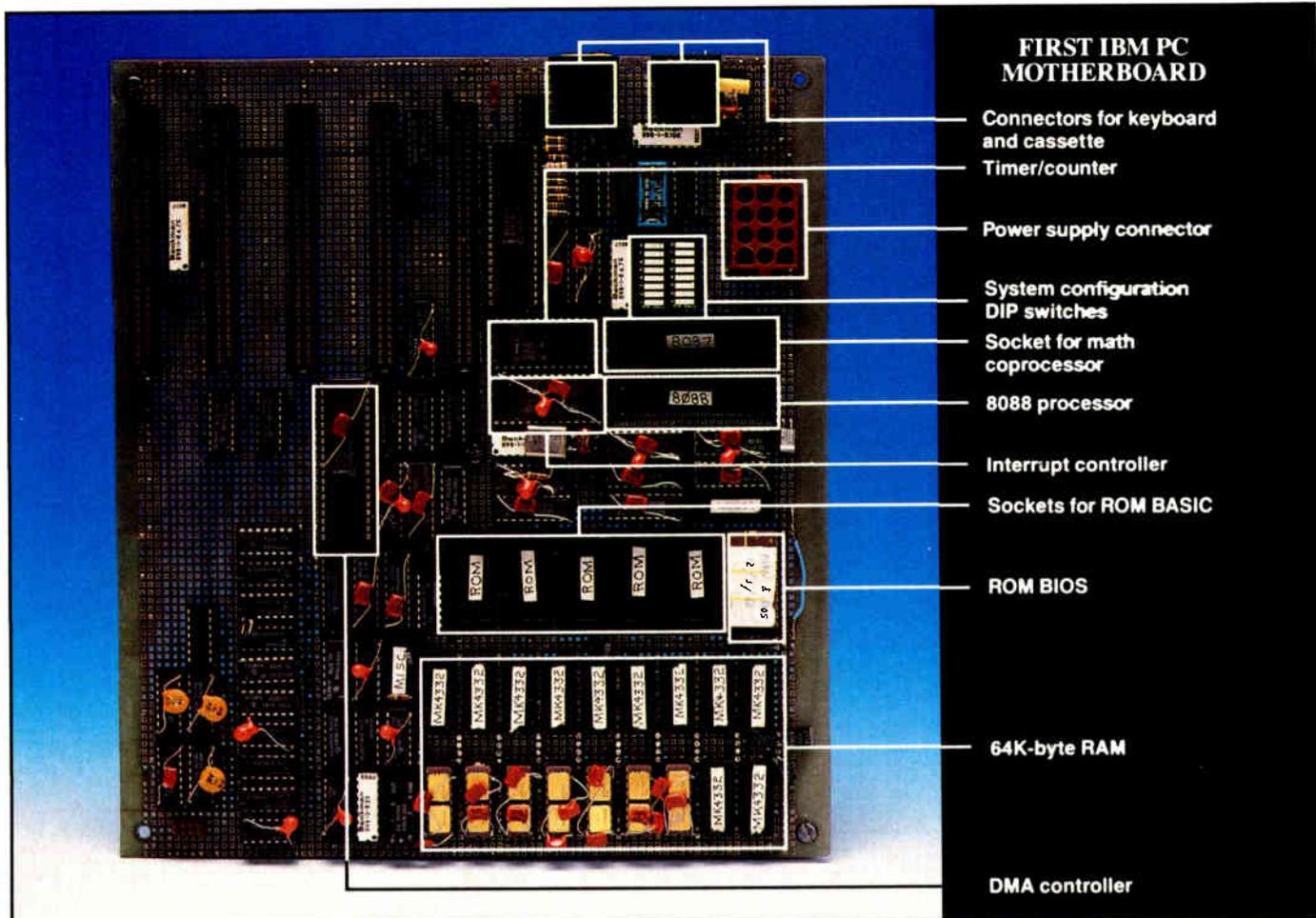
Why the 8088?

There were a number of reasons why we chose the Intel 8088 as the IBM PC’s central processor.

1. The 64K-byte address limit had to be overcome. This requirement meant that we had to use a 16-bit microprocessor.
2. The processor and its peripherals had to be available immediately. There was no time for new LSI chip development, and manufacturing lead times meant that quantities had to be available right away.
3. We couldn’t afford a long learning period; we had to use technology we were familiar with. And we needed a rich set of support chips—we wanted a system with a DMA controller, an interrupt controller, timers, and parallel ports.
4. There had to be both an operating system and applications software available for the processor.

We narrowed our decision down to the Intel 8086 or 8088. The Boca Raton engineers were familiar with these processors and their support chips. For programmers, the 8086/8088 architecture is a straightforward map from the 8080 architecture. The Microsoft BASIC group had already ported its BASIC interpreter from the 8080 to the 8086. There was also a DOS that ran on the 8086. Expansion of the address space was our primary goal. We chose the 8088 because of its 8-bit data bus. The smaller bus saved money in the areas of RAM, ROM, and logic for the simple system.

A bonus we got from choosing this Intel processor was the



numeric coprocessor. The 8087 gave the 8088 a fast partner for floating-point calculations. But since the 8087 wasn't yet available when the PC was announced, we simply left an empty socket on the board and didn't disclose a use for it.

16K Bytes and Up

The IBM PC was offered with 16K bytes of RAM, expandable to 64K bytes on the system board. We used 16K-bit DRAM chips because they were readily available. We built two memory-expansion cards, a 32K-byte and a 64K-byte card. With a fully populated system board and three 64K-byte cards, you could get up to 256K bytes of memory—at that time, an impressive amount for a personal computer.

We made one design choice that was unprecedented in a personal computer: to include parity on the memory. We thought it was very important to detect errors that might be caused by a failure in the memory and not allow the corrupted data to propagate further in the system. We believed it was better to halt the machine than to continue with errors. If an application program wished to change the way the parity error was handled, it could do so by simply changing the nonmaskable interrupt handler.

Why did DOS end up limited to 640K bytes? The answer is surprisingly simple. The 8088 has an address space of 1 megabyte. We reserved the upper 128K bytes for ROM on the system board. We wanted the video memory on the display adapters to be in the processor address space, so we reserved a 128K-byte section of memory for them. Finally, we reserved 128K bytes of memory for ROM or RAM on other adapter cards. At the

time, we thought those allotments were generous.

When you subtract the reserved sections, the remainder is 640K bytes. Since the capacity of the original IBM PC was 256K bytes of RAM, and the norm for systems at that time was 64K bytes, we felt comfortable with the design. Although 640K bytes did become a limitation, so did the other reserved areas. I don't think there was a better way of arranging the memory that would have made a significant difference.

Supporting the Processor

The support chips brought a lot of function to the IBM PC. DMA speeds up the I/O performance by relieving the processor of transferring the data between memory and I/O devices. We wanted the system to be able to perform multiple operations. A good example is allowing the user to type ahead on the keyboard while the disk transfers data. This feature enhanced the system's convenience and utility. We also used DMA for memory refresh, since it already had the control logic to request the bus and provide addresses to memory.

Being able to type ahead also requires keyboard interrupts. Using the eight-level interrupt controller relieved the processor from checking I/O operations continuously.

Even though the hardware and firmware shipped with the system didn't take full advantage of the DMA and interrupt capabilities, we included these functions for others. For example, the BIOS for the serial port didn't use the interrupt capabilities, but the serial communications built into Advanced BASIC did. Serial transmission and reception could take place under interrupt control while the BASIC program was executing.

The three-channel timer/counter let the IBM PC tell time, at least as long as the power was on. It was also the refresh timer and generated tones for the speaker. In addition, the counter could be used for many of the system's timing functions—for example, the code in the BIOS that read the cassette storage device. That code used the timer to determine the length of a bit cycle and decide whether a 1 or a 0 had been recorded.

Color and Text

We designed the IBM PC for two different roles: a business computer and a home computer. To support this versatility, we developed separate video adapters: CGA for the home and the Monochrome Display Adapter (MDA) for business.

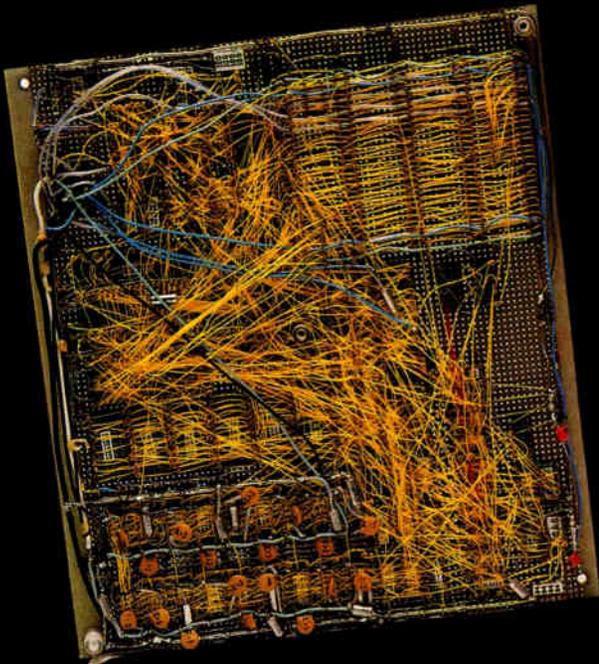
MDA was based on the DataMaster display, which was monochrome and text-only. DataMaster used the Intel 8275 CRT controller to generate the display. While the 8275 cut down on memory contention (by buffering each row of characters internal to the chip), it had two problems: It was limited to 7 bits for each character and so could display only 128 different characters, and it could set character attributes only by sacrificing a character position to the attribute specification. Thus, highlighting a word required a preceding and following attribute byte—one to turn on highlighting, and one to turn it off.

MDA has a single mode, 25 rows of 80 columns of text. We didn't use the DataMaster design because we preferred to do our own—using the Motorola 6845 for video timings—and put memory on the card for character and attribute storage. This design allowed us to have 256 characters, and we could specify the attributes for each character position. MDA was the first multifunction board developed for the IBM PC. It had a single parallel port to connect it to a printer.

For the IBM PC, we needed at least 256 characters to support the major languages, because the *I* in IBM stands for "international." Our experience with the DataMaster gave us a pretty good set to use. We also wanted "business graphics" in

continued

This wire-wrap board was the original planar built to prove the feasibility of the IBM PC design prior to laying out the printed circuit board. A similar one was built and shipped to Microsoft in December 1980 for development of the software. The photo at left shows the top of the board; the photo below shows the bottom.



Subscription Problems?



We want to help!

If you have a problem with your BYTE subscription, write us with the details. We'll do our best to set it right. But we must have the name, address, and zip of the subscription (new and old address, if it's a change of address). If the problem involves a payment, be sure to include copies of the credit card statement, or front and back of cancelled checks. Include a "business hours" phone number if possible.

BYTE

Subscriber Service
P.O. Box 850
Peterborough, NH 03458-0850



the character set (e.g., the lines and corners used to form boxes). We filled the remaining spaces with some word processing marks, Greek letters, and a few math symbols.

We wanted CGA to be able to work with a home TV as well as with a TV-frequency monitor. That criterion pretty much determined all the important things—like the number of dots on the screen. Two of the modes, 40- by 25-character text and 320- by 200-pixel all-points-addressable (APA), are constrained by the limits of a home TV. The remaining two modes, 80- by 25-character text and 640- by 200-pixel APA, require a monitor. The color capabilities were determined by the memory we could afford to put on the board—16K bytes of RAM. That amount of memory allows four colors for the medium-resolution APA and two colors for high resolution.

The organization of the memory, 16K bytes by 8 bits, gave rise to one of the problems of CGA. In 80-column text mode, the adapter had to fetch 160 bytes per line—80 characters and 80 attributes—leaving no time for the processor to read from or write to the display. Any program that went directly to the display memory quickly filled the screen with "snow." The read and write routines in the BIOS waited for horizontal retrace before accessing the memory. The scroll routine in the BIOS, which had to move lots of data, simply turned off the display, did the move, and then turned the display back on. There was a noticeable blink as the screen scrolled, but it was less objectionable than the blizzard that would have occurred otherwise.

Cassettes, Then Diskettes

Because we planned on people using the IBM PC at home, we included a port so a cassette could be used as a storage device. The system was available with no disk drives, 16K bytes of RAM, and Cassette BASIC in ROM. With this configuration, you could load and execute BASIC programs from a standard audiocassette tape player. We did optimize the system design for business use, though, with bays for two floppy disk drives and 64K bytes of RAM on the planar.

Disk-based systems far outsold those without, and just about everyone who bought a cassette system eventually upgraded to disks. Although the cassette port was retained on the PC for compatibility, we removed it from the XT when that was designed.

Bus Architecture: DataMaster Descendent

The IBM PC's bus architecture came from two sources: the DataMaster definition and the new requirements of the 8088. We wanted to keep the bus very similar to the DataMaster's, since we had developed several adapter cards for that bus. Keeping the bus similar would make the adaptation very simple—just a new layout of the cards.

The 62-pin connector also came from the DataMaster. The extensions for the 8088 were obvious—a few extra address lines. The DataMaster used the same interrupt controller and a similar DMA controller, so those signals were already on the DataMaster bus. The final definition changed only five of the originally proposed signal lines.

One thing we didn't foresee when we defined the system bus was the proliferation of adapter cards for the PC. Although the variety turned out to be a good thing because it gave customers a wide choice of options, we hadn't allowed enough I/O addresses for all the cards that eventually were developed.

Original expansion cards decoded only a 10-bit address, and many cards used 8 or 16 addresses. Consequently, almost every card ended up with a set of switches to select the I/O address it would respond to and the interrupt line it would use in a

continued

Video Textbook Training • Video Textbook Training

The Ultimate Training Solution

- The UNIX Operating System, Utilities and Bourne Shell Programming
- The UNIX Operating System, Utilities and C Shell Programming
- The ANS C Programming Language and Libraries
- Programming with QUICK C
- Programming with TURBO C
- Programming with INFORMIX/SQL
- Programming with INFORMIX/4GL
- Programming with ADA
- Programming with C-scape

In-depth training for people who will be developing software using what we teach. Each course consists of 10 VHS video cassettes and includes a workbook. Exercises, solutions and examples available on floppy.

The price of each course is an affordable \$150 plus S/H. Floppy disks are \$25.

Video Textbook Training

200 Lakeside Drive, Building A4
Morgantown, WV 26505
(304) 292-0917 FAX (304) 296-4032

UNIX is a registered trademark of AT&T. INFORMIX/SQL and 4GL are registered trademarks of INFORMIX Software, Inc. QUICK C is a registered trademark of Microsoft Corporation. TURBO C is a registered trademark of Borland International. C-scape is a registered trademark of Oakland Group, Inc.

Video Textbook Training • Video Textbook Training

The backup system that makes *other* backup systems *obsolete*.



COREtape Light. The industry's most reliable 3.5" tape backup. Store 40 to 300+ megabytes — at 4MB/minute!

COREtape *Light* will back up a server from a workstation as well as a workstation's own local hard disk. *Now that's flexibility!*

Based on our award-winning COREfast.



Twice winner of the coveted *PC Magazine Editors' Choice Award* COREfast was enhanced especially for COREtape *Light*.

"With an unbeatable price, flexible and easy to use software...this newcomer has a good shot at making 40MB tape obsolete."

—ROBERT KENDALL
PC MAGAZINE 12-26-89

What it is.

Available in *external* as well as internal models, COREtape *Light* uses standard 40 to 120 MB DC2000 series 3.5" tape cartridges. Typically, 300 MB or more can be backed up with compression onto one 120 MB tape.

In compressed mode, effective speed increases to about 4 megabytes per minute. Random Access Restore locates any file in less than a minute.

Using your 286 (or above) (AT-bus or PS/2) system's existing floppy controller, COREtape *Light* makes installation quick and easy, and keeps a valuable expansion slot free.

Surface-mount technology, a heavy-duty metal frame, and a ferrite head all add up to an *impressive 25,000-hour MTBF* that's *twice as high* as the competition's. So we gave COREtape *Light* an **18-month, full-replacement warranty**.

Net Gain.

Installed in network servers, *multiple* COREtape *Light* units are a very cost-effective alternative to DAT or helical scan. You can back up automatically and unattended at pre-scheduled intervals.

You decide — then see your local distributor!

	COREtape Light	Mountain 8000 Plus	Irwin 2080	Maynard Cartridge
Interface	QIC-80	QIC-80	IRWIN	QIC-02
Capacity w/ Standard Long Length Tape	120 MB	120 MB	120 MB	250 MB
Typical Capacity w/ Data Compression	300 MB	150 MB	not available	not available
Random Access Restore	YES	NO	YES	NO
Ferrite Head	YES	NO	NO	NO
Metal Frame	YES	YES	NO	YES
Warranty	18 mos.	12 mos.	12 mos.	12 mos.

Call for your nearest distributor:



In Europe:

CORE International (U.K.) Ltd.

Phone: (44)-344-861 776

Fax: (44)-344-861 604

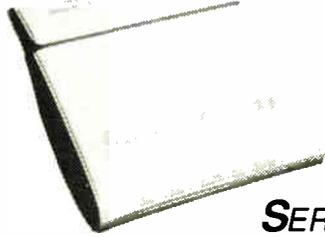
7171 North Federal Highway • Boca Raton, Florida 33487 • 407/997-6055 • Fax: 407/997-6009

Copyright 1990 CORE International. All rights reserved. CORE, CORE International, COREtape, COREtape Light, and COREfast are registered trademarks of CORE International, Inc.

Circle 74 on Reader Service Card (RESELLERS: 75)

World Radio History

Want to save Time, Money,
& Headaches?



GET SUPERSOFT'S SERVICE DIAGNOSTICS

All the software, alignment diskettes, parallel/serial wrap-around plugs, ROM POSTs and extensive, professional documentation to provide the most comprehensive testing available for IBM PCs, XTs, ATs and all compatibles under DOS or Stand Alone. No other diagnostics offers such in-depth testing on as many different types of equipment by isolating problems to the board and chip level.

NEW: SuperSoft's ROM POST performs the most advanced Power-on-Self-Test available for system boards that are compatible with the IBM ROM BIOS. It works even in circumstances when the Service Diagnostics diskette cannot be loaded.

NEW: 386 diagnostics for hybrids and PS/2s!

For over nine years, major manufacturers have been relying on SuperSoft's diagnostics software to help them and their customers repair microcomputers. End users have been relying on SuperSoft's Diagnostics II for the most thorough hardware error isolation available. Now versions of Service Diagnostics are available to save everyone (including every serious repair technician) time, money, and headaches in fixing their computers, even non-IBM equipment.

All CPUs & Numeric Co-processors	All Color Graphics & Monochrome Monitors
System Expansion & Extended Memory	Parallel & Serial Ports
Floppy, Fixed & Non-standard Disk Drives	Mono, CGA, Hercules & EGA Adapters
Standard & Non-standard Printers	All Keyboards & the 8042 Controller
System Board: DMA, Timers, Interrupt, Real-time Clock & CMOS config. RAM	

"EDITOR'S CHOICE" — PC MAGAZINE August 1990

Service Diagnostics for PC, PC/XT, and compatibles only	\$169
Alignment Diskette for PC, PC/XT and compatibles (48 tpi drives)	\$ 60
Wrap-around Plug for PC, PC/XT and compatibles (parallel and serial)	\$ 30
Service Diagnostics for AT and compatibles only	\$169
Alignment Diskette for AT and compatibles (96 tpi drives)	\$ 60
Wrap-around Plug for AT (serial)	\$ 15
ROM POST for PC, PC/XT and compatibles only	\$245
ROM POST for AT and compatibles only	\$245
Service Diagnostics: The KIT (Includes all of the above—save \$502)	\$495
Service Diagnostics for PS/2 models 25/30 50/60 or 70/80 and compatibles (please specify)	\$195
Service Diagnostics for 386 or V2, V30, or Harris, etc. (please specify)	\$195
Diagnostics II is the solution to the service problems of users of all CP/M-80, CP/M-86 and MS-DOS computers	\$125
Alignment Diskette for PS/2 and compatibles (3.5 inch)	\$ 60

To order, call 800-678-3600 or 408-745-0234
FAX 408-745-0231, or write SuperSoft.

your microcomputer repair solution

SuperSoft

FIRST IN SOFTWARE TECHNOLOGY P.O. Box 4178, Mountain View, CA 94040-0178
(408) 745-0234 Telex 270365

SUPERSOFT is a registered trademark of SuperSoft, Inc.; CDC of Control Data Corp.; IBM PC, AT & XT of International Business Machines Corp.; MS-DOS of MicroSoft Corp.; NEC of NEC Information Systems, Inc.; PRIME of PRIME INC.; Sony of Sony Corp.

given system. While the DIP switches were workable, they required the user to review all the documentation every time another card had to be installed. The answer was a programmable method of device selection, which was one of the reasons for the change to the Micro Channel architecture in the PS/2 family.

Keyboard Control

The IBM PC keyboard came from the DataMaster. We changed the key tops to reflect the general-purpose nature of the PC, replacing labels such as HELP with F4. Since the DataMaster keyboard was inside the system box, it used a parallel connection to the system board. For the IBM PC, we made the keyboard separate and connected it to the system via a serial port and a 6-foot coiled cable.

One of the questions often asked about the IBM PC is why we chose the Ctrl-Alt-Del reset sequence. We proposed Ctrl-Alt-Del as a warm-boot sequence to provide some of the capability of a reset switch. It is difficult to activate by mistake, since the keys are widely separated. By storing a special character in a particular memory location, the warm boot would bypass the memory-test portion of the power-on self test (POST), taking less time than turning the machine off and back on.

The difficulty with Ctrl-Alt-Del, however, is that for the reset to work, the system must be capable of receiving input. If the program has gone completely off into the weeds and has disabled the interrupts, the reset won't work. But production software should not exhibit this kind of behavior.

There were two other concerns with the original keyboard: the placement of the Left Shift and Enter keys, and the lack of indicators for Caps Lock, Num Lock, and Scroll Lock. The keys ended up as they did because we wanted to support the international keyboard, which has several additional keys. We improved the layout with the IBM AT keyboard. That keyboard also had the indicator lights for the shift states.

Firmware and Diagnostics

We intended for the PC's BIOS to serve as a buffer between the hardware and a programmer. Some of the things it handles (e.g., sending a character to the printer) are very simple. Other operations (e.g., decoding the scan codes from the keyboard into the desired characters) are very complex. We wanted a programmer to be free to concentrate on the problem, not the hardware.

Another important part of the IBM PC was its diagnostic strategy. The POST annoyed some users because the system came to life slowly. But we thought it was important to test the system before turning it over to an application, reasoning that it was better to find a hardware problem before it caused a mistake in your data.

Industry Revolution

When we first began development of the IBM PC, we didn't appreciate the potential of the product. The company originally estimated it would market a total of about 250,000 units over a five-year period. As it turned out, there were some months when we built and sold nearly that many systems.

IBM has since delivered millions of PCs to the marketplace. The sales estimates may have been faulty, but the product certainly wasn't. I'm very happy to have been a part of it. ■

David J. Bradley is the manager of Advanced Processor Design, Entry Systems Division, at IBM (Boca Raton, FL). He was a member of the original team that designed the IBM PC and has a Ph.D. in electrical engineering. He can be reached on BIX c/o "editors."

Network Users now there's a fax modem that's easy to share.

Now on
Windows 3.0



(Actual Size)

The LIGHTFAX 9624 lets you and your workgroup share the convenience and timesavings of a 9600 bps fax modem. Now everyone on your network can fax documents from their workstations. No more waiting in line at the printer and fax machine before you can send your message. Simply choose the **Print** command in any of your favorite applications to fax your documents. Then, go back to work immediately, because the LIGHTFAX 9624 transmits and receives with **Complete background** operation. The LIGHTFAX 9624 lets you fax what you can **print**, all from the convenience of your individual workstation.

The LIGHTFAX 9624 improves the productivity of networks that use:

- Novell ● AppleTalk ● X-Windows
- TOPS ● UNIX ● NextStep

The LIGHTFAX 9624 is compatible with any computer that uses a standard RS 232 interface, such as:

- PS/2 ● Macintosh ● Amiga
- AT ● Atari

* The LIGHTFAX 9624 is also a standard Hayes Compatible 2400, 1200, 1200/75 and 300 bps data modem.

The LIGHTFAX 9624 has been approved for sale in the United States, Australia, Switzerland, Sweden, South Africa, Singapore, and Taiwan.

Comments from around the world:

-  **"Excellent for Windows users"**
-PC Week, 3/90.
-  **"The light of the world in fax modems"**
-Computer Ware, Italy, 3/90.
-  **"No. 1 in Germany"**
-Modem Contest, West Germany, 11/89.
-  **"The best Modem in the Netherlands"**
-Amiga Magazine, 10/88.

To improve your workgroup productivity, please call 1-800-547-3303 now.

U.S. Dealers near you

General Computer	PA (215)821-5977	MO (301)963-5000
H & H	NJ (609)599-1510	CO (303)759-5686
Mercury Publishing	FL (305)448-5960	TX (214)341-6775
IL (708)597-3840	MO (314)532-6913	CA (415)543-2190
Micro Age	MA (617)595-2300	WA (206)656-9000
OH (513)851-5000	CA (213)384-9555	

Micro Age

CANADA (416)6384740
SWITZERLAND (031) 88 12 55
SWEDEN (07)66 355 30
U.K. (71)518 3131
ITALY (02)48703188
SOUTH AFRICA (011)838 3831
FRANCE (23)78 53 54 46, (1)45 38 70 12
W. GERMANY 0241 76011
JAPAN 03(746)3611

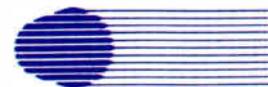
SINGAPORE 744 5533
NETHERLAND 2159 44938, 2463-57211
AUSTRALIA (3) 580 1355
DENMARK (98) 15 13 11
THAILAND 2359020
ICELAND (1) 681665
NEW ZEALAND (09) 522 1459
SPAIN (93)253 71 58
BELGIUM (3) 828 80 48

-Software Developer Hotline-

LIGHTSPEED TECHNOLOGY INC.
7F,NO.12, LANE639, MIN SHEN EAST ROAD, TAIPEI 10446, TAIWAN, R.O.C.
TEL:(886)2-7134586. FAX:(886) 2-7161024

All product names are trademarks or registered trademarks of their respective companies.

* Models vary for different countries.



LIGHTSPEED

Circle 66 on Reader Service Card
World Radio History

Introducing Twice The OCR At Half The Price.

Unbeatable OCR at an unbeatable price.

If you didn't think you could afford the best OCR on the market, think again. Think WordScan,™ Calera's revolutionary new OCR software.

Now it really makes sense to use OCR to eliminate most of the retyping you do every day. Because WordScan's features are the best. At the best price ever.

The end of ordinary OCR.

What makes WordScan extraordinary are its standard features. Like its ability to read virtually any printed document directly into your word processor, desktop publisher, database or spreadsheet more accurately than any other OCR product. Even bad photocopies and faxes!

And WordScan Plus adds even more exclusive features.

Our unique *pop-up editor* makes proofing a snap. It pops up an enlarged image of any questionable word for instant verification, so you

don't have to refer to the original hard copy.

Deferred processing lets you scan documents now, and perform OCR later when you don't need the computer.

You can even "*clip*" selected portions of pages like magazine articles, then

stack them for deferred processing. An important time-saver!

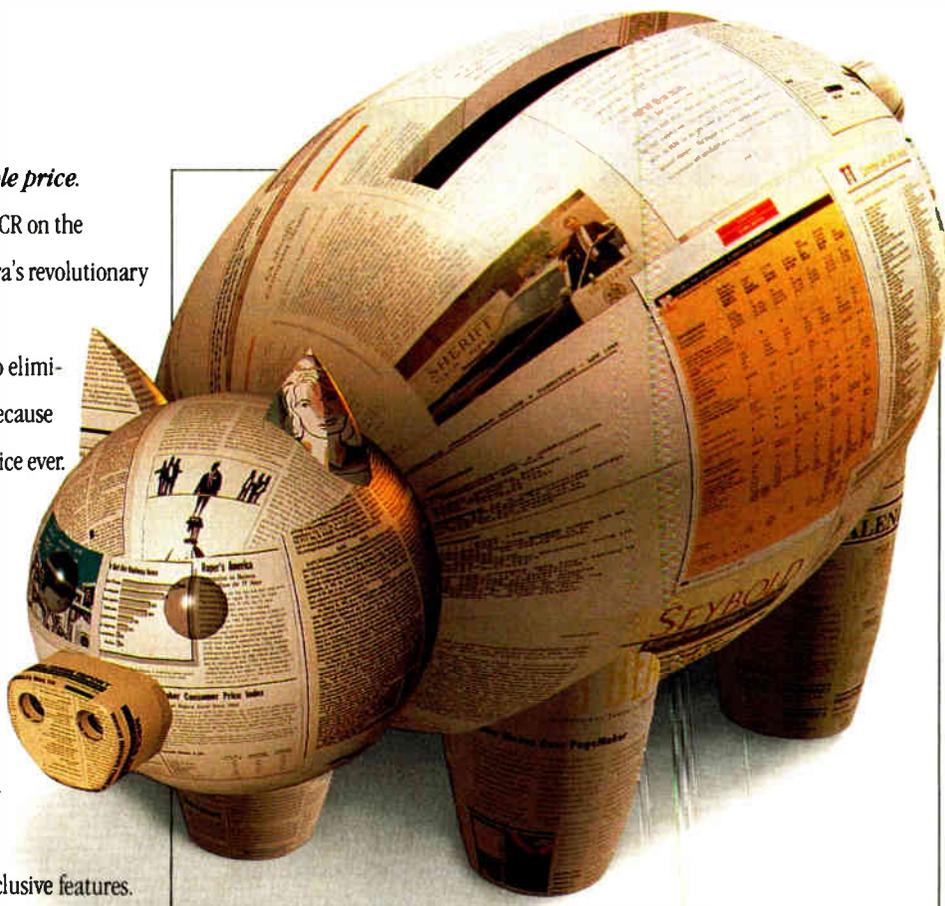
Process multiple documents into separate files automatically. Just put a blank page between documents and WordScan does the rest.

And you can reformat material any way you want with our *style sheet feature*. Another WordScan Plus exclusive!

And the list goes on. *Nobody else can match these features.*

WordScan and WordScan Plus are completely compatible with Windows 3.0 and they do everything with just 2 MB of memory. At about half the price you'd expect to pay for OCR that doesn't do half as much.

WordScan is available now at \$595; WordScan Plus, \$995. Call 800-544-7051 for the name of the Calera dealer nearest you. And don't forget to ask for your free copy of our OCR evaluation booklet.



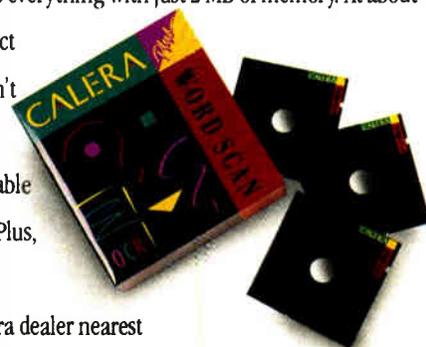
**WE'LL PAY GOOD
MONEY FOR BAD OCR.**

**FOR A LIMITED TIME, TRADE IN YOUR
OLD OCR AND GET HALF OFF THE PRICE
OF WORDSCAN OR WORDSCAN PLUS!**

30-DAY, MONEY-BACK GUARANTEE.

CALL 800-544-7051

FOR DETAILS.



CALERA
RECOGNITION SYSTEMS

2500 Augustine Drive, Santa Clara, CA 95054 USA. 800-544-7051; outside USA, 408-986-8006; FAX 408-986-1440

© 1990 Calera Recognition Systems, Inc. Calera® is a registered trademark of Calera Recognition Systems, Inc. WordScan and TrueScan are trademarks of Calera Recognition Systems, Inc.

Circle 56 on Reader Service Card

World Radio History

FROM A TINY KERNEL . . .

*Getting from OS-9 to OS-9000
involved more than adding three zeroes*

Ben Smith

PART Two

From looking at it, it would be difficult to imagine the tiny Tandy Color Computer as a multitasking powerhouse. With OS-9, however, it can be, and the lessons learned in designing that microkernel operating system have blossomed into commercial-quality software for 386- and Motorola 680x0-based computers.

In 1980, Microware Systems developed OS-9, a multiuser, multitasking operating system for the underrated Motorola 6809 (the processor in the Color Computer). By 1983, the usefulness of the small kernel and modular design had attracted enough serious industrial users that Microware had ported its operating system to the 16-/32-bit Motorola processors. With the popularity of the Motorola VMEbus boards for use in industrial controls, OS-9 became more than an occasional operating system for commercial applications. You can still buy OS-9 (for under \$100) for the Tandy Color Computer, but you can also find it on just about any Motorola-based personal computer, as well as the industrial VME boards. It's also easier to spot in Europe and Japan, areas where OS-9 is more commonly used than in the U.S. It must have something going for it if it is used so widely.

A Quick Look at OS-9

OS-9 has a compact kernel around which you link only the modules you need. Device drivers (and other modules) can be added anytime, without relinking the kernel. Writing device drivers for OS-9 is easy compared to doing so for Unix System V release 2 and lower. Also, OS-9 is fast; it was designed to take full advantage of the capabilities of the Motorola processors. Although the original version of OS-9 was a little ragged and lacked many of the amenities of other operating systems, it has grown to be a rich environment with no significant bugs.

To the user, OS-9 is somewhat like Unix. It has a shell and a scripting language akin to the Bourne shell. Files are arranged in a tree structure, with separate user areas. File access is granted by permission to read, write, and execute for owner,

group, and world. Everything, including devices, is treated as a file. Most utilities have Unix counterparts that behave in much the same way.

The latest release from Microware is so much of an advance that it is no longer called OS-9. Now we have . . .

The Birth of OS-9000

Of course, Motorola is not the only popular manufacturer of high-performance microprocessors. Intel seems to be doing pretty well with the 386—so well, in fact, that 386 systems are inexpensive and widely available. Microware thought that it should offer its real-time operating system to the industrial developers who want to save some money and use the Intel-based PC systems. Hence, OS-9000, a total rewrite of OS-9, was born.

OS-9000 looks pretty much the same as OS-9 to the programmer and user, but now it is written in C (rather than assembly language) for portability. Even at the onset, OS-9000 was available for the Motorola 68020, 68030, and (theoretically) 68040, as well as the Intel 386 and i486.

Even though this is a completely new operating system, it is more stable than most such first attempts. Microware cut its teeth on OS-9, and the effort paid off. But it is a young operating system, and many popular utilities still haven't been brought over from OS-9. Actually, many of the utilities come from the free source code that is available in the Unix community (see The Unix /bin, June, July, and August BYTE). Enough of OS-9000 is conceptually like Unix that porting from Unix to OS-9000 is far easier than porting from Unix to DOS or OS/2.

The OS-9000 development tools are necessarily like their Unix counterparts. Cross-development is not only possible, but encouraged. And Unix isn't the only route to OS-9000; you can also port applications from DOS and OS/2. The idea is that you should be able to develop on any of these other operating systems, using your favorite development tools, and end up with a multitasking, real-time application for your OS-9000 system.

continued

"Highly Recommended" — PC Magazine

The AC outlet for your car!

PowerTrip® gives you AC power from your car's cigarette lighter! Safely runs:

- Computers
- Any 100 watt AC electronics
- FAX machines
- 220 volt version available (US \$299.95)
- only \$199.95!
- Runs for hours with no significant battery drain

ZIRCO Enhancing the Mobile Office

10900 W. 44th Ave. Wheat Ridge, CO 80033 USA
Tel (303) 421-2013 FAX (303) 423-8346

PC Compatible

Single Board Computers for the OEM

DR DOS® Now Available

Quark®/PC +

- NEC V-40® Processor
- Video/LCD Controller
- 8 or 10 MHz Frequency
- Up to 768K Memory

4" x 6"

Quark®/PC II

- 80386 SX based
- EGA® Video/Color LCD Controller
- SCSI Hard Disk Control
- Floppy Disk Control
- Up to 4 Mbytes Memory

4" x 6"

To order or enquire call us today.
Megatel Computer Corporation
(416) 245-2953 FAX (416) 245-6505
125 Wendell Ave., Weston, Ontario M9N 3K9

REPS: Italy 39 331 256 524 Austria 43 222 587 6475
W. Germany 49 6074 98031 Finland 358 0757 1711
U.K. 44 959 71011 Sweden 46 4097 1090
Netherlands 31 838 541 301 Norway 47 986 9970
Australia 61 03 568 0988 Denmark 45 244 0488
France 1 47 46 94 52

Trademarks: Quark - F. + K. Manufacturing Co.
DRDOS - Digital Research Ltd. EGA - IBM Corp. V-40 - NEC Corp.

megatel

ITEMS DISCUSSED

OS-9000 (386 version)\$995
Microware Systems Corp.
1900 Northwest 114th St.
Des Moines, IA 50322
(515) 224-1929
Inquiry 1051.

The networking tools make it a simple BNC twist to extend it out to these other systems.

Of course, there are fine tools on the native system, including a clean version of MicroEMACS, the Unix make project management and file dependency program, and extensive function libraries, including ANSI C, Unix, and real-time programming functions. It also includes a fine source code debugger, and a flexible and efficient C compiler and assembler.

Journey to the Kernel and Beyond

OS-9000 is not really unique in basic design (see Part 1 in this series, "The QNX Operating System," August BYTE). It has a small, fast kernel. The concept of a memory module is central to the design. Memory modules are not limited to executable code, but can also be used for data. In fact, you can design your own module type as long as you follow a few rules of construction. All modules share the same memory map, which is managed by the kernel.

Although access to modules can be controlled in the same way as access to files, any module can generally access any other module. This means different processes can easily share the same data modules. With freedom comes responsibility, and it is the programmer's responsibility to share modules in an intelligent way. The operating system doesn't have enforced layers of memory management. But the programmer is not without the tools: OS-9000 has pipes, named pipes, signals, and semaphores, as well as "events," so different processes can communicate and synchronize their use of the resources.

These tools are called *interprocess communication* mechanisms. Unix developers are familiar with pipes and named pipes, the first-in/first-out methods of IPC. Unix also uses signals to notify one process of independent or special conditions that might need urgent attention. Semaphores are a traditional way for different processes to set and respond to shared flags. The OS-9000 event IPC is like a semaphore, but it is much more sophisticated. Among the many elements in its structure, it has a name, an owner, and a 32-bit value that can be set to any value and incremented. There are nearly two dozen function calls available for creating, linking, signaling, reading, waiting on, and deleting events. Events are used primarily to synchronize concurrent processes that are sharing resources.

All running processes and their associated modules are in memory at the same time. If you want more processes, you add more real memory. But there are system calls and utilities you can use to load and unload modules as you require. Only by keeping everything in real memory, in a constant position, can the operating system make things happen at a predictable time, the tenet of real-time computing.

How Real-Time Can You Get?

OS-9000 on a 386 machine gives you a real-time resolution of 1/100 second. You can be assured that any event will happen within 1/50 second. This is more than fine enough to control many industrial processes directly. This fineness of response time is

continued



FROM TINY KERNELS MIGHTY SYSTEMS GROW

In the UNIX® world, microkernel architecture is still only a germ of an idea. With QNX®, it's been a reality for nearly a decade.

QNX's advanced design has certainly proved fruitful. Our installed base has now grown to over 100,000 systems in factories, laboratories, and offices throughout the world.

Why a microkernel? Because it gives you everything a monolithic "megakernel" can't. It's small, fast, and dedicated. While a typical UNIX kernel attempts to juggle everything under the sun, the QNX kernel concentrates only on scheduling tasks and coordinating message-passing activity. All other OS functions – file handling, device I/O, network management, etc. – are taken care of by separate server tasks.

The result is an efficient, extensible, and verifiable operating system.

You can even customize QNX on the fly. Since you can start and stop server tasks *dynamically*, you can easily add network support, install new devices, or incorporate entirely new system services – *without having to take apart and rebuild the entire OS*. Unlike most operating systems, a microkernel OS is designed to stay out of your way.

In the seamless environment of the QNX network, tasks can reside on any node and can transparently access any resource attached to any node. You can mix and match a wide range of Intel-based PCs, from vintage 8088s all the way up to 486 machines. And since an application can harness the processing power of all the CPUs throughout the LAN, the result is a level of distributed performance you never dreamed possible from a micro environment.

Which is why QNX developers can turn cost-effective platforms into such powerful systems. Like a pair of PCs that run a large-scale international

FAX service bureau. Or a dozen micros that replaced a \$500,000 mini system. With QNX, you can afford to think big.

Need realtime performance? QNX provides priority-driven, pre-emptive task scheduling, and reaches speeds usually reserved for dedicated realtime executives (27 µsec per task switch on a 33 MHz 80386).

Yet QNX is a fully integrated environment in which your development system and your target system are one and the same. With QNX, you can count on a complete OS that includes a robust file system, built-in peer-to-peer networking, and a rich set of development tools to boot. Add to this the appeal of QNX Windows, our new 3-D server-based *OPEN LOOK* GUI, and your applications will take on a whole new dimension.

Are you ready for your next operating system? You could always wait and see what other systems may have in store someday.

Or you could join the growing community of QNX users and realize your potential right now.



For more information or a free demo disk, please phone (613) 591-0931.

Quantum Software Systems Ltd., 175 Terrence Matthews Crescent, Kanata, Ontario, Canada K2M 1W8

QNX is a registered trademark and QNX Windows is a trademark of Quantum Software Systems Ltd. UNIX is a registered trademark and OPEN LOOK is a trademark of AT&T. Intel is a registered trademark of Intel Corporation. © 1990 Quantum Software Systems Ltd.

Circle 247 on Reader Service Card

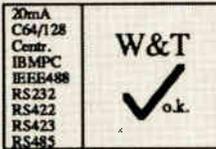
Don't blame your dealer!

Most dealers specialize in selling computers and have no time or personnel to advise you on peripherals. That's why there are companies like W&T. We specialize in making interface products that are fundamental to making systems run dependably, fast and easy to use.

Call or Fax us for a free W&T catalog. Then you can decide whether to order through your dealer (if you like to get everything from the same source), or to order directly from W&T Products. Our products are so easy to use that, if you need any technical support, we can give it to you over the phone.

Check us out:

You can test any product for 14 days, return it for any reason and pay only a \$6 restocking fee per item.



System Installation

RS232 lines can go up to about 50feet, Centronics lines up to about 15feet. For further distances you need line drivers. Be sure to use isolated ones to avoid problems with voltage drops and distant lightning. We manufacture drivers and isolators with up to 50,000 volts isolation. No one else does.

#20001, Centronics line driver 1kV 4KByte	\$189
#80001, RS232 line driver 1kV	\$229
#80050, RS232 line driver 50kV	\$319
#88001, RS232 isolator 1kV	\$129
#88050, RS232 isolator 50kV	\$149

Portable Data Buffers with battery

Instrument readings, drilling templates, programs - you can transport all kinds of data in a small box.

# 22031, Centronics 32K	\$149
# 22127, Centronics 128K	\$319
# 88031, RS232 32K	\$229
# 88127, RS232 128K	\$319

Computers can run up to 95% faster

Your computer is forced to run with the brakes on because standard printer and plotter buffers are far too small. If you print alot a printer buffer can accelerate your system by up to 95% and anyone can plug it in within a few seconds.

# 22064, Centronics 64K	\$149
# 22256, Centronics 256K	\$229
# 22102, Centronics 1024K	\$589
# 88128, RS232 128K	\$229
# 88512, RS232 512K	\$319

The ideal T-switch is the one you don't notice at all

Now there is a fully electronic automatic T-Switch that lets you share one printer between two or four computers. It does not need any operation and not even a power supply.

# 25210, Centronics, 2 PCs share 1 printer	\$ 99
# 25410, Centronics, 4 PCs share 1 printer	\$189

Lifestyle.

Workstyle?

Remember when you could walk into a place of business and immediately recognize what was being done there? People loved their job and surrounded themselves with professionally-related artistic works. Thanks to W&T, this is again possible. We have commissioned West German artists to design artwork based on the PC-Codetable (order #17750), and part of the MS-DOS command set (order #17760). Computer professionals will find these prints to be both practical, and beautiful to display. Either print (approx. 20" by 28" in size) can be hanging in your office for \$29.00. If you wish to surround yourself, both prints can be purchased together for as little as \$50.00.

To order by mail add \$6 shipping and handling. FL residents add 6% sales tax. MSDOS is a trademark of Microsoft Corp., IBM is a trademark of IBM Corp.

We accept MasterCard and Visa.

A: Basic Merton (0222) 9736360 B: Brother Int. (02) 4674211
 CDN: see USA C1: Weber (01) 9302003 D: Wisemann & Theis (0202) 505077 D.K: Janc (86) 479139 E: Neol 88.62.37.52 IS: Thor (01) 681500 MEX: Taise 5184500 N: RamToc (09) 224620 NL: Cat & Korah (010) 4507696 E: Electronix 1-900848 SE: Moretec (9)1626812 SGE: Overseas Trade 2726077 USA: W&T Products 1-800-628-2086

W&T Products Corp.
 P.O. Box 39559
 Ft. Lauderdale, FL 33339

Phone: 1-800-628-2086
 Fax : 1-305-491-5923

W&T
PRODUCTS

a function of the operating system, not some special hardware. Standard Unix, with its kernel-bound I/O and virtual memory, gives you no guarantees as to when an event will occur.

If you want to control devices with millisecond and microsecond precision, you don't do that directly from an operating system. Instead, you use a dedicated processor to control the device, and it communicates with the operating system.

You probably won't be using OS-9000 for your common PC applications, but you would for solving special industrial problems. If you have a high-speed production printing machine, it may be using OS-9000 to control the electron guns to cure the ink. One OS-9000 licensee uses it for remote data collection on relative aircraft and target positions while simultaneously controlling tracking radar and cameras. OS-9000 may have been on the computer at a highway tollbooth that counted your change and raised the barrier. The machinery that manufactures and bonds the plastic film that covers your flooring may have been controlled by an OS-9000 machine. These are applications for a real-time, multitasking operating system.

The value of OS-9000 and similar operating systems lies in more than just the fineness of response time. The completeness of the tool set is just as important. There are many system calls for communication with external events as well as for IPC. This is a controlling operating system; to do its job well, it needs to communicate well.

For Whom and Why

You can use OS-9000 anywhere you want a multiuser, multi-tasking operating system. It has the basic tools and design features for any kind of application. It is particularly well suited for system houses that focus on data acquisition and control of specialized equipment. In this role, it can handle much of the control as well as the human interface. Because of its standard implementation of common networking facilities (TCP/IP and NFS), it is well suited to handle just the control end, leaving the human interface to another operating system.

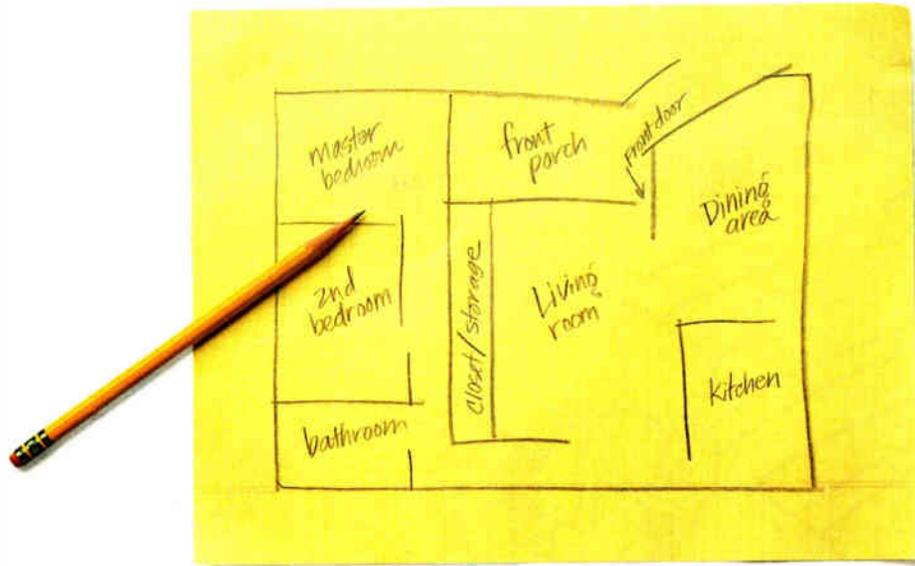
To make the most of the libraries and utilities, you should be well grounded in your understanding of the hardware you will be working with and in general concepts of device drivers. Everything is oriented toward the developer who wants to have the responsibility of tight control over the system.

OS-9000 does not use any of those fashionable abstractions that you find in Mach and QNX. There are no "threads" and "messages in the mailbox." As a developer, you find yourself doing bit shifts and masks. Even though the abstractions of some of those other, small-kernel operating systems make it easy to use them in multiprocessor and distributed computing environments, a performance and code-size price is paid. OS-9000 is valuable to the developer of both Motorola- and Intel-based systems. This is a unique claim for a real-time operating system.

OS-9000 has more than just history going for it. It places a lot of power in the hands of the programmer, but be prepared for the responsibility that accompanies it. If a task *must* be done in real time, OS-9000 can do it, but you must learn to speak to the operating system on its own level. While it lacks the high-level abstractions of more popular commercial operating systems, it delivers on the promise of split-second attention to events and devices. As an operating system, OS-9000 deserves to be judged on its own. ■

Editor's note: Next month, *BYTE's* Tom Yager looks at Theos.

Ben Smith is a technical editor for BYTE. He can be reached on BIX as "bensmith."



Sketch.



AutoSketch.

If you can sketch, you can AutoSketch. Which gives you real CAD power—speed, accuracy and easy revisions—all without a long, drawn-out learning curve.

With AutoSketch version 3, you have our easiest CAD yet with pull-down menus and on-screen icons. You also have DXF™ file

compatibility and associative dimensioning. It's what you'd expect from the makers of AutoCAD®, the world's most popular CAD package.

For a brochure or ordering information, call 1-800-223-2521.

We'll sketch in the details.

U.S. \$249



 .AUTODESK

Autodesk, AutoCAD, AutoSketch and Autodesk logo are registered trademarks and DXF is a trademark of Autodesk, Inc. ©1990 Autodesk, Inc.

Circle 125 on Reader Service Card (RESELLERS: 126)

World Radio History



SURVIVAL MANUALS FOR NETWORK PROS.

Data Communications magazine presents the essential reference tools for the 1990's.

NETWORK MANAGEMENT & MAINTENANCE, VOL. 4.

The latest installment in the highly respected series providing essential insights into fundamental network-management techniques that will serve as benchmarks for the '90s and beyond.

Price: \$34.95. 337 pages. Item #70.

INTEGRATING VOICE AND DATA, VOL. 3.

Collected articles on such diverse topics as T1 basics, a detailed assessment of state-of-the-art fiber optics technology, and an in-depth look at the Integrated Services Digital Network (ISDN).

Price: \$34.95. 319 pages. Item #66.

CONNECTIVITY AND STANDARDS, VOL. 3.

The essential handbook for information managers charged with piloting their networks through the '90s and into the 21st century. In-depth case histories and reports on evolving protocols and standards augment an invaluable collection of articles.

Price: \$39.95. 730 pages. Item #63.

INSIDE X.25: A MANAGER'S GUIDE.

A hands-on guide for engineers seeking to lift the X.25 standard off the bookshelf and into the real world of network problem solving. Provides a historical perspective and introduces the basics of packet switching, open systems interconnection and the X.25 standard. Plus detailed assessments of packet technologies, equipment, and networks.

Price: \$39.95. 300 pages. Item #65.

DATA NETWORK DESIGN STRATEGIES, VOL. 4.

A unique collection of articles presenting the best thinking of the late 1980's on the wide range of network design alternatives that will come into play during the 1990's.

Price: \$39.95. 694 pages. Item #64.

OMNICOM INDEX OF STANDARDS, 1990 EDITION.

Edited by Harold C. Foltz

A totally new edition of the classic reference for instant access to standards of leading U.S. and international organizations, including CCITT, ANSI, ISO, and IEEE. Cross referenced and indexed for quick, easy access.

Price: \$127.00. 955 pages. Item #71.

THE LOCAL AREA NETWORK HANDBOOK, VOL. 3.

The authoritative chronicle of the LAN market of the late '80s. Features insightful articles by LAN pioneers and other experts.

Price: \$39.95. 509 pages. Item #67.

BASIC GUIDE TO DATA COMMUNICATIONS, ED. 2

This updated supplement to the first edition is essential reading for a comprehensive understanding of data communications and a clear, insightful look at emerging trends.

Price: \$34.95. 350 pages. Item #62.

Special Bonus Discount: Deduct 10% on all orders over \$50.00. **Sales Tax:** Add applicable tax for your locality. **Shipping & Handling:** Add \$2.50 per book. **Delivery:** Allow 4 weeks for U.S. orders; international orders allow extra time. **To order by phone:** Call (718) 834-0170. **To order by mail:** Send check and order to: Data Communications, Box 059077, Brooklyn, NY 11205.



SOUNDS OF SUCCESS

Professional sound capabilities, once the exclusive domain of high-end recording studios, are now available to PC users

Dean Friedman

Over the past few years, the advances in micro-computer graphics have been obvious to even the most casual observer: Higher-resolution images, full-motion digital video, and state-of-the-art animations can be seen in everything from business presentations and logos on the evening news to multimedia extravaganzas.

But what of the sounds that accompany those images? Are we stuck with the pitiful beeps and buzzes of the early microcomputer days? Hardly. Thanks to the advent of hardware and software that rival those of the computer graphics explosion, producers of audio/video presentations—everything from computerized slide shows to scores for motion pictures—can have professional sound capabilities available right on their desktops (see the figure).

MIDI Made the Difference

The merging of music and microcomputers began innocently with the establishment of MIDI, the industry standard for music synthesizers. MIDI is a protocol for sending digital information over serial lines between electronic musical instruments and equipment, including computers. The information includes note on and note off, key velocity (speed of keystroke), aftertouch (pressure applied after keystroke), pitch bend, modulation wheel, foot pedal, and sound changes. With MIDI, a musician can play a single keyboard and simultaneously trigger a roomful of synthesizers. MIDI guitars, MIDI woodwind instruments, and even MIDI acoustic voice trackers are also used to control the array of equipment.

MIDI's potential became obvious when programmers began writing applications that took advantage of its ability to interface synthesizers directly with personal computers. The first and most important of these applications was the music sequencer. Today, there are six categories of music software:

- Sequencers
- Editors/librarians

- Notation programs
- Pattern generators
- Film score utilities
- Everything else (for lack of a better term)

The Sequence of Things

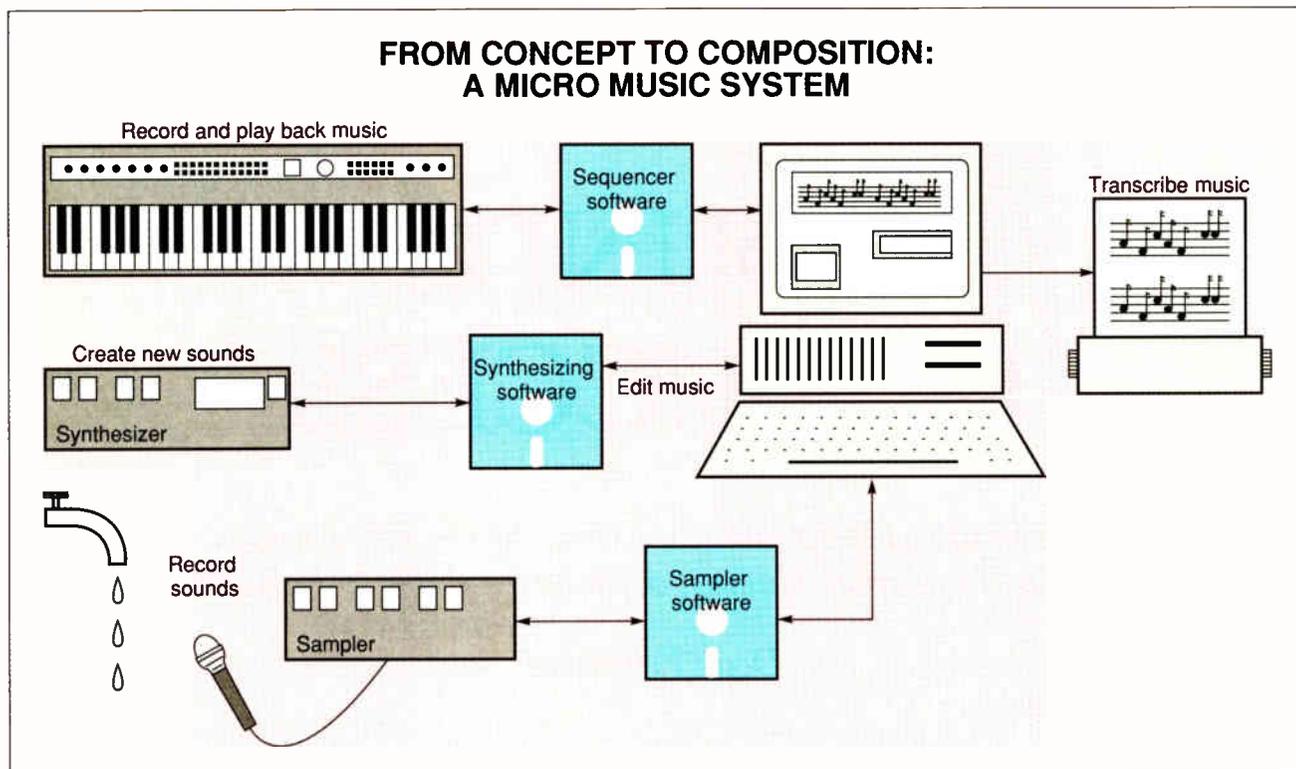
In computer music parlance, a sequencer is a program that records the events and gestures of a musical performance. The electronic equivalent of a player piano roll, music sequencers record the events of a musical performance—but not the actual sounds. The sequencer can play back the instructions to the appropriate synthesizer or sound module, telling it exactly when to trigger its sounds.

Unlike tape, the audio playback from a sequencer never degrades in quality caused by generations of overdubs or by tape wear. The playback from a sequencer is always first-generation. Unlike tape, a sequenced performance can be sped up or slowed down without transposing the music's pitch, and, conversely, a sequenced performance can be transposed without altering its tempo. With analog tape, pitch and tempo are permanently intertwined; changing tempo automatically changes pitch, and vice versa.

One other fundamental difference between a sequencer and tape (analog or digital) is that, while tape permanently records all the elements of a performance, including the sound that was actually made during the performance, a sequencer only records the skeletal outlines of a musical performance; that is, the timings, durations, and numeric values of the keys that were played. With this information, a musician can experiment with different sounds in the same musical piece, auditioning a variety of timbres until he or she finds the one that works best.

The sequencer didn't replace multitrack analog or digital recording formats. Those are still necessary for handling acoustic instruments like voice and guitar, and for mixing down to a final two-track master audio format. But the sequencer allows anyone with a personal computer and a few synthesizers to

continued



The versatility of the personal computer and its graphics screen make it an ideal front end for any electronic music system. Software that performs sequencing, synthesis, sampling, and notation have made it possible to have an entire studio in a box.

prepare, and in some cases even master, a finished album in his or her own virtual studio.

This basic concept spawned a musical revolution. It had the effect of turning the recording industry on its head. In the process, it created a billion-dollar-a-year market for MIDI devices and peripherals. Suddenly, a new world of polyphonic (more than one note), multitimbral (more than one sound), multi-track, digital music systems became available to anyone who could cough up the price of a cheap PC clone (or an even less-expensive Commodore 64) and a few synthesizers.

Recordings that previously would have cost upwards of \$100,000 are now made for only a few thousand dollars, and even less as MIDI software and hardware evolve.

Dedicated music sequencers had existed prior to MIDI, but it was only when the power of a microcomputer with graphics was added to the MIDI network that sequencing packages flourished into elegant and intuitive music-making programs.

Sequencing Software

Although the basic job of sequencers remains the same, the extra features in today's computer-based sequencers bring joy to the work of making music. Four of the five main personal computer platforms have high-end professional music sequencers: the Amiga, Macintosh, Atari ST, and IBM PC. The fifth platform, the NeXT machine, has the best standard hardware with its compact-disk-quality audio, but it suffers from a dearth of commercial music software.

The list of top-notch, high-end professional music sequencing software packages includes Vision by Opcode, Performer by Mark of the Unicorn, Cubase and Pro 24 by Steinberg/Jones, Master Tracks Pro by Passport, Beyond and KCS by Dr. T, Sequencer Plus by Voyetra Technologies, Personal Composer by

a company of the same name, and Cakewalk by Twelve Tone Systems. Used regularly in recording studios around the world, they all provide the means to do graphics editing, since your music sequence is depicted graphically, either in standard musical notation or as rectangles on a pitch/time grid.

The graphics editing tools include the same kinds of cut-and-paste, copy, insert, and delete commands that you'd find on any word processor. The analogy is a good one: Music sequencers let you manipulate and manage music in much the same way a word processor lets you move and manipulate text.

Today's sequencers also offer graphics tools for editing other MIDI parameters, such as aftertouch, key velocity, pitch bend, and modulation wheel moves, as well as a host of continuous and intermittent controller messages. Controller messages include additional and often simultaneous performance parameters such as volume-pedal changes, sustain-pedal events, and patch or sound changes.

In a program like Vision, for example, a pitch-bend movement can be graphically edited by simply drawing or reshaping a curve under the affected note or notes. This type of graphics controller editing represents a vast improvement over the first generation of sequencers, in which the musician had to edit a list of hundreds of numbers.

One of the newest implementations of graphics controller editing is *automated fader mixing*. This feature displays a row of 16 or 32 mixing faders, which the musician can assign to control any of the common MIDI continuous controller parameters (e.g., volume pedal and modulation wheel), as well as additional internal sequencer parameters (e.g., tempo). As an illustration, if the musician assigns faders to the volume levels of all his or her MIDI instruments and then records the sequence

continued

Same Day
Shipping!

ALTEC TOWERS ABOVE THE REST

Now you can have the power and performance of Altec's fully loaded 486 EISA Tower delivered to your door! Check out these outstanding features:

486 EISA TOWER **CALL** for more information

Intel 486-25 CPU □ 4 Meg RAM □ 1.2 MB 5.25" drive □ 1.44 MB 3.5" drive □ 150 MB 18ms ESDI hard drive □ ESDI controller w/32K cache □ 16-bit VGA card □ 14" VGA monitor (1024 x 768) □ 2 serial, 1 parallel & 1 game ports □ 101-key Keyboard □ Genius Mouse □ MS-DOS 3.3 or 4.01 □ Eight 32-bits EISA slots



"AltecZip 386s are solid machines featuring brand-name parts. A good buy, they are clearly affordable"

PC Magazine, May 30, 1989

"Computer users should find Altec machine an excellent value with good performance."

PC Magazine, July 1990

Altec sets the standard for the highest quality design and manufacturing of all our products. We're fast, friendly, and ready to help you select the right features for your needs. Take a look at some of our other great systems:

386/33 VGA **\$3,795**

Intel 386-33 CPU □ 32K Cache □ 4 Meg RAM □ 1.2 MB 5.25" drive □ 1.44 MB 3.5" drive □ 150 MB 18ms ESDI hard drive □ ESDI controller w/32K cache □ 16-bit VGA card □ 14" VGA monitor (1024 x 768) □ 2 serial, 1 parallel & 1 game ports □ 101-key Keyboard □ Genius Mouse □ MS-DOS 3.3 or 4.01
(25 Mhz Cache System deduct \$400)

386/25 VGA **\$2,895**

Intel 386-25 CPU □ 4 Meg RAM □ 1.2 MB 5.25" drive □ 1.44 MB 3.5" drive □ 105 MB 18ms IDE hard drive □ 16-bit VGA card □ 14" VGA monitor (1024 x 768) □ 2 serial, 1 parallel & 1 game ports □ 101-key Keyboard □ Genius Mouse □ MS-DOS 3.3 or 4.01

386/SX VGA **\$1,995**

Intel 386SX-16 CPU □ 2 Meg RAM □ 1.2 MB 5.25" drive □ 1.44 MB 3.5" drive □ 66 MB 25ms hard drive □ 16-bit VGA card □ 14" VGA monitor (640 x 480) □ 2 serial, 1 parallel & 1 game ports □ 101-key Keyboard □ Genius Mouse □ MS-DOS 3.3 or 4.01
(20 Mhz 386/SX version add \$150)

286/12 VGA COMBO **\$1,795**

1 Meg RAM □ 1.2 MB 5.25" drive □ 1.44 MB 3.5" drive □ 40 MB hard drive □ 16-bit VGA card □ 14" VGA monitor (640 x 480) □ 2 serial, 1 parallel & 1 game ports □ 101-key Keyboard □ Genius Mouse □ MS-DOS 3.3 or 4.01 □ Panasonic 1180 printer w/cable □ Surge protector

SUPER SLIM WORK STATION **\$650**

80286-12 CPU □ 1 Meg RAM □ Floppy controller on board □ 2 serial/1 parallel ports □ Monochrome card on board □ Monochrome Monitor □ Arcnet card

Various hard drive capacity available.



Technology Corp.

1-800-255-9971

Altec's Guarantee:

- 30 day money-back guarantee
- 1 year warranty for parts and labor
- Free 4 months on-site service
- Lifetime toll-free technical support



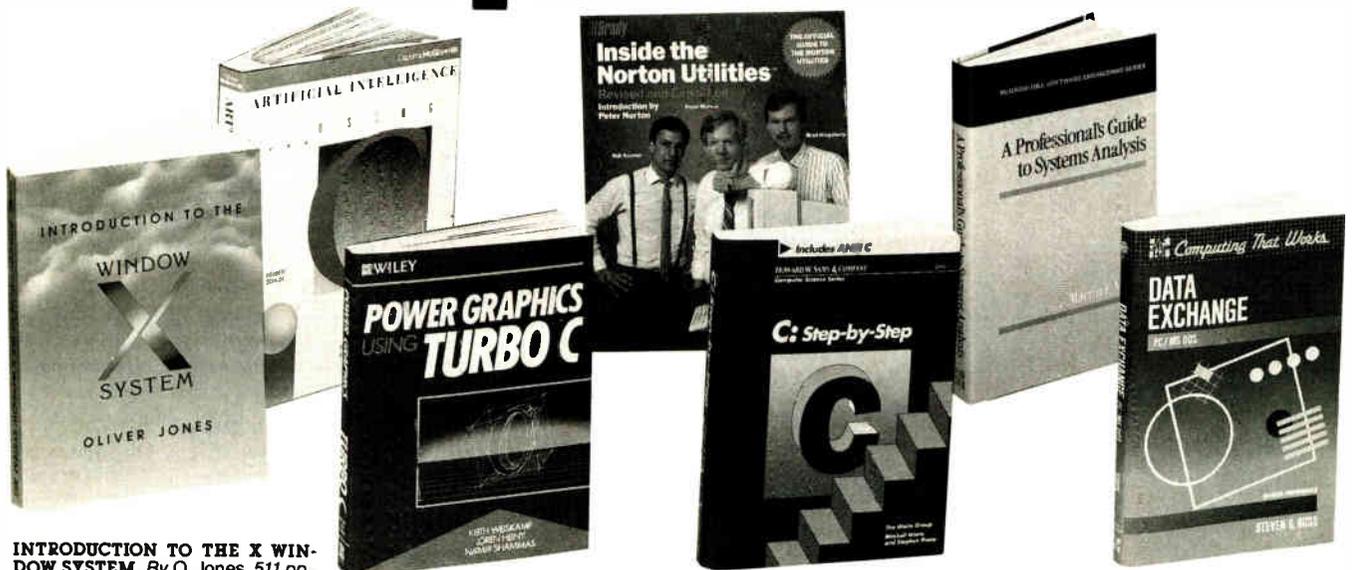
Policy: Same day shipping with standard configurations for orders before 3 PM EST. Shipping and handling extra. Personal and company checks require 10 days to clear. Prices are subject to change, and all items are subject to availability. All returns must be shipped prepaid, insured, in original condition and complete with documentation. All returns must have RMA number. 30 day money-back guarantee does not include shipping.

Altec Technology Corporation • 18555 East Gale Avenue • Industry, CA 91748 • 818/912-8688 • FAX: 818/912-8048

World Radio History

Circle 18 on Reader Service Card

Take any 3 books for only \$1⁰⁰ each



when you join BYTE Book Club[®] VALUES UP TO \$142.85!

- Your one source for computer books from over 100 different publishers
- the latest and best information in your field
- discounts of up to 40% off publishers' list prices

INTRODUCTION TO THE X WINDOW SYSTEM. By O. Jones. 511 pp., illus., softbound. Here's the new portable software standard for workstations, presented in a complete, detailed tutorial. This book will help you harness the system, cut down on redundant workstation events, exploit private/shared color cells, and map strategies. 585109-1 Pub. Pr., \$32.00

INTRODUCING PC-DOS & MS-DOS, Second Ed. By T. Sheldon. 403 pp., illus., softbound. This Second Edition covers all releases through 4.0, as well as Microsoft Windows and DOS-SHELL. Features the same hands-on tutorial format of the First Edition, with expanded coverage of batch file techniques that can dramatically increase your computing speed. 565/651 Pub. Pr., \$29.95

LOCAL AREA NETWORKS: Architectures and Implementations. By J. Martin, with K. K. Chapman. 353 pp., illus. An indispensable reference for all who buy, install, maintain, or manage LAN services. Provides complete coverage of the concepts, architectures, and implementations of LAN technology. 584900-3 Pub. Pr., \$44.00

A PROFESSIONAL'S GUIDE TO SYSTEMS ANALYSIS. By M.E. Modell. 307 pp., illus. Detailed coverage of what you need to know—what questions to ask, how to conduct a cost-benefit analysis, how to document and validate your findings—to design the best systems for your user's needs. 426/325 Pub. Pr., \$37.95

DATA EXCHANGE: PC/MS-DOS. By S. Ross. 426 pp., illus., softbound. Now you can convert files quickly and painlessly from word processing programs to spreadsheets... from spreadsheets to databases... or from databases to word processing programs. Packed with simple, step-by-step instructions that will save you headaches and money. 539/235 Pub. Pr., \$24.95

C: Step-by-Step. By M. Waite and S. Prata. 629 pp., illus., softbound. Mastering C has never been easier! This updated version of the classic *C Primer Plus* includes ANSI C, pointers, structures, bitwise operators, and much more... all in a format that makes learning it faster and easier than ever. 585146-6 Pub. Pr., \$29.95

INSIDE THE NORTON UTILITIES: Revised and Expanded. By R. Krumm. 559 pp., illus., softbound. The "official guide" now covers all the latest upgrades and shows you how to get the most from the Standard and Advanced Editions, the Norton Commander, Editor, Disk Doctor, and the On-Line Guides. 585444-9 Pub. Pr., \$24.95

MVS PERFORMANCE MANAGEMENT. By S. L. Samson. 400 pp., illus. This unique work demystifies MVS and provides strategies for solving performance problems. Extensive coverage of control mechanisms ranges from measurement and modeling to application tuning and workload management. 545/286 Pub. Pr., \$39.95

DESIGN OF COMPUTER DATA FILES, Second Ed. By O. Hanson. 419 pp., illus. This comprehensive book contains lucid descriptions of the latest techniques and storage devices to help you design files for maximum performance at minimum cost. Easy to read, with scores of examples, tables, and illustrations. 585143-1 Pub. Pr., \$37.95

HOW TO BE A SUCCESSFUL COMPUTER CONSULTANT, Second Ed. By A. R. Simon. 280 pp., illus. This new edition of a best-seller is updated to steer your career toward the emerging opportunities of the '90s, including security, microcomputer networking, systems integration, and much more. 575/541 Pub. Pr., \$29.95

POWER GRAPHICS USING TURBO C. By K. Weiskamp, L. Heiny, and N. Shamma. 367 pp., illus., softbound. This easy-to-follow manual is packed with practical examples of actual code, guidelines for programming 2D and 3D graphics using animation, customizing CAD/CAM, the capabilities of the Borland Graphics interface, and more. 585091-5 Pub. Pr., \$22.95

ARTIFICIAL INTELLIGENCE USING C: The C Programmer's Guide to AI Techniques. By H. Schildt. 412 pp., 37 illus., softbound. This hands-on guide shows you how to create your own AI applications and systems using C. After an introductory overview it provides coverage of expert systems, logic, natural language processing, machine learning, pattern recognition, and more, with ready-to-run programs illustrating each topic. 881255-0 Pub. Pr., \$21.95

PROGRAMMING USING THE C LANGUAGE. By R.C. Hutchison and S.B. Just. 519 pp., illus. Whether you want to understand programs in C written by others, or write better C programs of your own, this practical, authoritative book gives you the tools and guidance you need. Coverage includes program organization, sorting algorithms, recursion, linked lists, and more — with many sample programs. 315/418 Pub. Pr., \$29.95

DATA PROCESSING IN UNIX. By R. S. Tare. 438 pp., illus. The only guide you'll ever need to harness the full power of UNIX for database management. It sets out system selection criteria... examines such applications as INFORMIX, INGRES, and UNIFY... and explores flat file systems in UNIX. 628/858 Pub. Pr., \$39.95

CIARCIA'S CIRCUIT CELLAR, Vol. VII. By S. Ciarcia. 256 pp., illus., softbound. The latest volume in this best-selling series provides schematics, operating explanations, and step-by-step building instructions for a wide range of projects—from video digitizing to multitasking process control. 109/699 Pub. Pr., \$19.95



TURBO PASCAL EXPRESS, Revised Ed. By R. Jourdain. 584963-1 Pub. Pr., \$39.95

COBOL II: Programming Techniques; Efficiency Considerations; Debugging Techniques (Includes Release 3.1). By H. Bookman. 065/330 Pub. Pr., \$39.95

ADVANCED MS-DOS BATCH FILE PROGRAMMING. By D. Gookin. 585018-4 Pub. Pr., \$24.95

ARTIFICIAL INTELLIGENCE & TURBO C. By C. F. Chabris. 585052-4 Pub. Pr., \$24.95

POWER GRAPHICS PROGRAMMING. By M. Abrash. 585443-0 Pub. Pr., \$24.95

32-BIT MICROPROCESSORS. Edited by H. J. Mitchell. 425/85X Pub. Pr., \$49.95

ADVANCED 80386 PROGRAMMING TECHNIQUES. By J. L. Turley. 881342-5 Pub. Pr., \$22.95

NETWORKING SOFTWARE. By C. B. Ungaro. 606969-9 Pub. Pr., \$44.95

80386: A Programming and Design Handbook, 2nd Ed. By P. Brumm and D. Brumm. 585077-X Pub. Pr., \$24.95

PRINCIPLES OF ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS DEVELOPMENT. By D.W. Rolston. 536/147 Pub. Pr., \$47.95

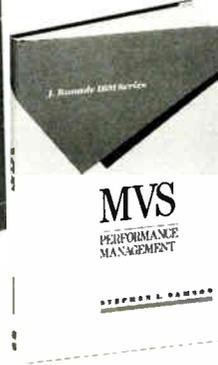
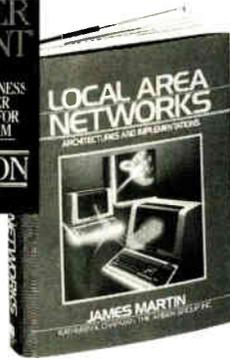
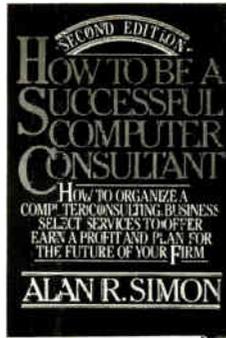
VM PERFORMANCE MANAGEMENT. By T. Eddolls. 189/668 Pub. Pr., \$39.95

DB2/SQL: A Professional Programmer's Guide. By T. Martyn and T. Hartley. 406/669 Pub. Pr., \$39.95

DATA COMMUNICATIONS: A User's Guide, 3rd Ed. By K. Sherman. 585384-1 Pub. Pr., \$34.00

OPERATING SYSTEMS. By M. Milenkovic. 419/205 Pub. Pr., \$44.95

IBM PS/2: A Reference Guide. By T.J. Byers. 095/272 Pub. Pr., \$39.95



1-2-3 RELEASE 3: The Complete Reference. By M. Campbell. 881318-2 Pub. Pr., \$28.95

GRAPHICS DESIGN AND ANIMATION ON THE IBM MICROCOMPUTERS. By J. Sanchez. 585375-2 Pub. Pr., \$28.00

MASTERING ORACLE: Featuring Oracle's SQL Standard. By D. J. Cronin. 585034-6 Pub. Pr., \$24.95

SECURITY IN COMPUTING. By C.P. Pfleeger. 584941-0 Pub. Pr., \$44.00

VS COBOL II FOR COBOL PROGRAMMERS. By P. Kavanagh. 335/710 Pub. Pr., \$39.95

C: The Complete Reference, 2nd Ed. By H. Schildt. 881538-X Pub. Pr., \$28.95

INTRODUCTION TO SNA NETWORKING: A Guide for Using VTAM/NCP. By J. Ranade and G.C. Sackett. 511/446 Pub. Pr., \$39.95

ONLINE COMMUNICATIONS SOFTWARE. By R. Ashley, J. Fernandez, and P. Ashley. 024/634 Pub. Pr., \$27.95

Any 3 books for \$1.00 each... if you join now and agree to purchase two more books—at handsome discounts—during your first year of membership.

ADVANCED GRAPHICS IN C: Programming and Techniques. By N. Jonsson. 881257-7 Pub. Pr., \$22.95

THE PAUL MACE GUIDE TO DATA RECOVERY. By P. Mace. 584926-7 Pub. Pr., \$21.95

STRUCTURED WALKTHROUGHS, 4th Ed. By E. Yourdon. 585016-8 Pub. Pr., \$28.50

C CHEST AND OTHER C TREASURES FROM DR. DOBB'S JOURNAL. Edited by A. Holub. 584807-4 Pub. Pr., \$24.95

EGA/VGA: A Programmer's Reference Guide. By B. D. Kiewer. 350/892 Pub. Pr., \$32.95

FILE ORGANIZATION FOR DATABASE DESIGN. By G. Wiederhold. 701/334 Pub. Pr., \$44.95

STRETCHING TURBO C. By K. Porter. 584967-4 Pub. Pr., \$24.95

Clip & Mail

BYTE BOOK CLUB®

P.O. Box 582

Hightstown, NJ 08520-9959

Please enroll me as a member and send me the three choices I have listed below. Bill me only \$3.00, plus local tax, postage and handling. I agree to purchase a minimum of two additional books during my first year as outlined under the Club plan described in this ad. Membership in the club is cancellable by me any time after the two book purchase requirement has been fulfilled. A shipping and handling charge is added to all shipments.

Indicate in the boxes the code numbers of the books you want.

Signature _____

Name _____

Address / Apt. # _____

City / State / Zip _____

This order subject to acceptance by McGraw-Hill. All prices subject to change without notice. Offer good only to new members. Foreign member acceptance subject to special conditions.

BYCA-030

Here's how BYTE Book Club® works to serve you:

- **Important information . . . we make it easy to get!** Today, professionals who perform best are those who are best informed. For reliable, hands-on information, turn to the Byte Book Club. Every 3 or 4 weeks (12-15 times a year), members receive the Club Bulletin offering more than 30 books — the best, newest, most important books from all publishers.
- **Dependable service . . . we're here to help!** Whether you want information about a book or have a question about your membership, just call us toll-free or drop us a line. To get only the books you want, make your choice on the Reply Card and return it by the date specified. If you want the Main Selection, do nothing — it will be sent to you automatically. (A small shipping and handling charge is added to each shipment.)
- **Club convenience . . . we do the work!** You get a wide choice of books that

simply cannot be matched by any bookstore. And all your books are conveniently delivered right to your door. You also get 10 full days to decide whether you want the Main Selection. (If the Club Bulletin ever comes late and you receive a Main Selection you don't want, return it for credit at our expense.)

- **Substantial savings . . . and a bonus program too!** You enjoy substantial discounts—up to 40%!—on every book you buy. Plus, you're automatically eligible for our Bonus Book Plan which allows you savings up to 70% on a wide selection of books.
- **Easy membership terms . . . it's worthwhile to belong!** Your only obligation is to purchase 2 more books — at handsome discounts — during the next 12 months, after which you enjoy the benefits of membership with no further obligation. You or the Club may cancel membership anytime thereafter.

Fill out the card and mail today! If the card is missing, write to:

BYTE Book Club®, P.O. Box 582, Hightstown, New Jersey 08520-9959

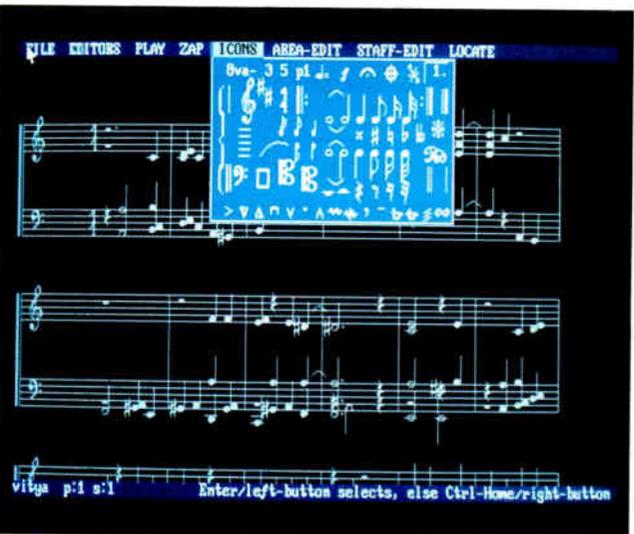
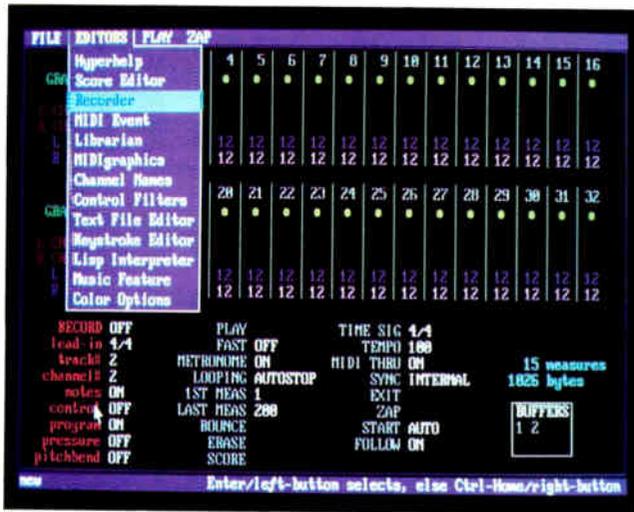


Photo 1: *Personal Composer* is the first PC-based music workstation program. It combines a 32-track MIDI recorder/sequencer (top) with an event editor (middle) and a score editor (bottom). Each part of the program affects the other so that a musician can start with either of the editors or the recorder and end up with both a publishable score and the MIDI sequences that perform it. Since *Personal Composer* is Lisp-based, it is fully extensible.

of individual fader moves, he or she can program the volume mix as part of the sequencer. The automated mix will keep all relative volume levels in balance throughout a dynamic piece.

Libraries of Sound

Synthesizers and samplers (a close relative) store the instructions used to create a sound in memory. These instructions are called patches or programs. They contain the voice settings that define each individually stored sound. With the pitifully small display on most keyboards and sound modules—30 to 80 characters—it is very difficult for the musician to edit or design a sound. A typical synthesized sound may have as many as a hundred different variables to describe its harmonic content, filter and amplitude envelopes, pitch, volume, and so on. It's hard enough to be aware of all the relationships of these variables. It is extremely difficult if you can't see the values all at once.

Voice-editing software displays all of a synthesizer's internal voice parameters simultaneously on a single monitor. What's more, editors can depict complex voice parameters graphically far better than the built-in LCDs of the synthesizer. It's far easier to understand an envelope when you can see its shape than when all you see is a list of numbers.

Some voice editors use the computing power of the computer to manipulate voicing parameters in ways the synthesizer can't. For example, a random-voice-generator option can produce variations on a sound by manipulating the parameters automatically within a specified range.

Once sounds are defined, you can store them using a companion to the voice editor, known as a librarian. This utility is simply a database for storing and retrieving patches or sounds. Many synthesizers can store no more than 100 different sounds internally, but a computer with a librarian can store thousands of patches on a single disk. You can also sort, search, copy, and delete patches.

In the past, owing to the unique architecture of each synthesizer, editors/librarians were instrument-specific. Every time a new synthesizer was released, software houses scrambled to be the first to sell software for it. The recent trend is toward developing more generic editors/librarians. Such programs either come bundled with multiple editors or include a MIDI toolkit that you can use to design your own editor or librarian templates. Some examples are *MIDI Quest* by Sound Quest, *GenEdit* by Hybrid Arts, *X-or* by Dr. T. Master by CMS, *Galaxy* by Opcode, and *Super Librarian* by Pixel Publishing.

The Final Score

Since the first hint of MIDI's phenomenal success, electronic musicians have fantasized about being able to sit down at a keyboard, play a performance, and instantly print out a music manuscript in perfect standard musical notation. Easier said than done. It's easy enough to teach the computer to recognize pitch, time, duration, and other objective values. But such decisions as how measures should be divided, where bar lines should go, which notes should be beamed together, and what kinds of expression markings are needed are all subjective. Such decisions are generally too daunting for the computer to make on its own. Therefore, some editing is usually necessary before a manuscript can be considered complete. It's this post-input step that has given notation packages a reputation for being a real bear to learn.

Some notation programs require input in the form of sequencer files, rather than using live keyboard input. The notation package needs to compile these files before it can produce the music notation. Some of the notation packages have you

continued

Use Northgate™ *OmniKey*™/101-I or 101-N Risk Free For 60 Days!



OmniKey/101-I



OmniKey/101-N

Two models with 20% smaller footprint and F-Keys on top!

Why two models ...

Many people have become accustomed to the standard IBM layout with F keys on top. For you, we've duplicated ... well nearly ... IBM's layout, but with a couple of improvements.

IBM puts BACKSLASH near BACKSPACE and ENTER keys. By doing so, they must reduce the size of one of the two keys.

Northgate believes BACKSLASH is better located on the bottom row next to right hand SHIFT key. This gives you both a double wide BACKSPACE and large L-shaped ENTER key.

Same crisp feel that made Northgate keyboards famous! ALPS tactile mechanical key switches let you know each keystroke has registered with a precise "click". You'll type faster and more accurately—with NO EXTRA EFFORT!

OmniKey/101-I has 12 F-keys across the top and inverted T cursor control keypad. A near duplication of IBM's layout.

OmniKey/101-N improves even more over the standard IBM! You get an independent cursor keypad with diamond-shaped cursor control layout. PLUS, we've conveniently placed the ESCAPE key next to #1. And, you get an extra ASTERISK key on bottom row to speed wildcard commands.

That's not all! *OmniKey/101-N* also has Northgate's exclusive F13 Period/Comma Lock key—locks out <<>. You'll never type U>S>A>, when you want U.S.A.!

Race through spreadsheets! Change repeat/delay rate from 3-120 CPS inside DOS or a program—just hit F14!

Try one for yourself! If you're not 100% satisfied your *OmniKey/101* lives up to everything we promise, return it. We'll refund all your money, including ground shipping charges.

Both *OmniKey/101* models feature:

- ◆ Compatible with virtually all PC/XT/AT personal computers; PS/2 compatible with adaptor
- ◆ Small footprint 18½" L x 7" W; 20% smaller than IBM's 101 at 19%" L x 8%" W
- ◆ 12 function keys across the top
- ◆ Interchangeable Caps Lock and left Ctrl key
- ◆ Separate calculator-style numeric keypad with added equals key—handy for spreadsheet users
- ◆ LED indicators: shows Scroll, Caps, Number Lock status at a glance
- ◆ Double injected key caps for long life and durability
- ◆ Keys color-coded for use in Word Perfect
- ◆ FCC Class B Certified

Backed by the industry's strongest warranty—five full years! If you have any problems due to materials or workmanship Northgate will promptly repair or replace your *OmniKey/101* FREE!

Order *OmniKey/101-I* or *OmniKey/101-N* today!

Another "Smart Tool for Business"™

ONLY **\$89⁰⁰** FOB Minneapolis, MN

Call for the Dealer Nearest You or Place Your Order Direct

800-526-2446 HOURS: Mon.-Fri. 7 a.m. - 9 p.m.; Sat. 8 a.m. - 4 p.m. Central

Notice to the Hearing Impaired: Northgate now has TDD capability. Dial: 800-535-0602. FAX Your Order 612-476-6443. Dealer and distributor pricing available call: 800-328-5564. Charge it on VISA or MasterCard.



"We hear you!"

1 Northgate Parkway, Eden Prairie, Minnesota 55344

©Northgate Computer Systems, Inc. All rights reserved. Northgate, *OmniKey* and the Big 'N' logo are trademarks of Northgate Computer Systems. All other product brand names are trademarks or registered trademarks of their respective owners. Specifications subject to change without notice. All models subject to availability.

Circle 207 on Reader Service Card

World Radio History

A MESSAGE TO OUR SUBSCRIBERS

FROM TIME TO TIME WE make the BYTE subscriber list available to other companies who wish to send our subscribers material about their products. We take great care to screen these companies, choosing only those who are reputable, and whose products, services, or information we feel would be of interest to you. Direct mail is an efficient medium for presenting the latest personal computer goods and services to our subscribers.

Many BYTE subscribers appreciate this controlled use of our mailing list, and look forward to finding information of interest to them in the mail. Used are our subscribers' names and addresses only (no other information we may have is ever given).

While we believe the distribution of this information is of benefit to our subscribers, we firmly respect the wishes of any subscriber who does not want to receive such promotional literature. Should you wish to restrict the use of your name, simply send your request to the following address.

BYTE MAGAZINE
Subscriber Service
P.O. Box 850
Peterborough, NH 03458-0850 

perform your music directly into the program, and then, after a brief compilation period, they display it in notated form. Several notation programs (e.g., C-Lab's Notator, and Coda's MusicProse and Finale) can actually display your performance in notated form as you perform it.

There are some combination sequencer/notation packages on the market. Personal Composer (see photo 1) was the first successful sequencer for the PC, and it has always offered notation as an integral part of its package. Notator and Mark of the Unicorn's Performer 3.4 have fluid, high-end sequencers that can display notation in real time.

The problem with some of the most powerful notation packages is that they are painfully difficult to learn. A professional notation package like Finale is one of the most feature-packed notation packages on the market, but it might take an experienced computer musician up to three months to become proficient. For some users, this learning curve can be justified in view of its enormous power and flexibility.

Fortunately for those of us who barely take time to read the introduction to the manual, the newer notation packages are designed with friendlier and more considerate user interfaces. MusicProse provides a simpler user interface than its predecessor but has less powerful features.

Releasing scaled-down versions of complex programs is becoming something of a fashion in music software applications. While offering reduced features, these versions maintain file compatibility with their more powerful counterparts, but they have a much flatter learning curve. Some examples are EasyVision, Opcode's introductory version of Vision; Easy Performer, Mark of the Unicorn's introductory version of Performer; and Tiger Cub, Dr. T's introductory version of Beyond.

One drawback of composing with computers is that there is no way to derive inspiration by bouncing musical ideas off other musicians. A slew of music applications referred to as Random Pattern Generators and Compositional Aids respond to this shortcoming. While they don't necessarily replace a live musician, random pattern generators do succeed in turning the personal computer into a contributing partner in composing and performing. These applications apply random pattern algorithms to thematic source material. This source material is altered according to parameters established by the composer. Being able to apply the randomizing power of the computer within defined musical limits enables a composer to creatively generate new textures and forms within a theme. In the hands of a musician, this powerful tool can yield impressive results that would not have developed by more conventional means.

Some good programs are Sybil by Scorpion Systems; Jambox, Upbeat, and M by Intelligent Music; Sound Globbs by Twelve Tone Systems; and MIDI Mouse by Dr. T. Sybil is unique in that it offers dynamic real-time performance features. M is one of the finest examples of an interactive pattern generator. It has an appealing and intuitive user interface for modifying musical material.

Some recent sequencer programs have random pattern generators, although they tend to be less powerful than the stand-alone packages. A standout is the creatively designed music sequencer called Bars & Pipes by Blue Ribbon Bakery. It has a number of built-in randomizing tools, as well as the means to create your own pattern-generating tools from scratch.

In Sync

To score soundtracks to film and video, it is critical to accurately lock a sequencer's timing onto the pulse of an audio- or videotape machine or another sequencer. Early sequencers

continued

Use Northgate™ OmniKey™/102 Risk Free For 60 Days!



Original Northgate design with function keys on the left!

First keyboard to get back to basics with 12 function keys on the left—the way many users prefer! In fact, readers of *Computer Shopper* voted *OmniKey/102* their **Best Buy!***

Touch that leads to better typing! The secret? *OmniKey's* ALPS tactile mechanical key switches let you know each keystroke has registered with a precise "click." No need to slow down to "eye check" the monitor—increases your typing speed with **NO EXTRA EFFORT!**

Find out for yourself ... order your *OmniKey/102* **NOW!** If you're not 100% pleased, return for full refund—including ground shipping charges!

Backed by the industry's strongest warranty—five full years! If you have any problems due to materials or workmanship, Northgate will promptly repair or replace your *OmniKey/102* **FREE!**

OmniKey/102
Another "Smart Tool
for Business"™

ONLY

\$9900
FOB
Minneapolis, MN

Look at all these outstanding *OmniKey/102* features:

- Compatible with virtually all IBM-type personal computers, including: PC/XT/AT and PS/2 systems
- Interchangeable left CTRL, ALT and CAPS LOCK keys. Keep them as shown or put them in a standard IBM enhanced layout; CAPS LOCK next to "A"; ALT next to space bar, CTRL under SHIFT. On the right, ALT and CTRL interchange, too
- Swap the right Backslash and Asterisk keys—it's up to you!
- Twelve F-keys on the left—for quick access to CTRL, ALT, SHIFT combination commands!
- Inverted T-shaped cursor control keypad
- Separate calculator-style numeric keypad with added equals key—great for spreadsheet users!
- Large L-shaped Enter, double size Backspace, two oversized Shift keys—easy to hit ... reduces typing errors!
- LED indicators: shows Scroll, Caps, Number lock status at a glance
- Double injected key caps for long life and durability
- ALPS click/tactile mechanical key switches for a crisp, responsive feel and faster, more accurate typing
- Non-skid design! *OmniKey/102* has a heavy steel base for durability. Weighs 4.6 lbs.—won't slide around no matter how fast you type!
- Keys color coded for use in Word Perfect
- FCC Class B Certified

Call for the Dealer Nearest You or Place Your Order Direct

800-526-2446 HOURS: Mon.-Fri.
7 a.m. - 9 p.m.; Sat.
8 a.m. - 4 p.m. Central

Notice to the Hearing Impaired: Northgate now has TDD capability. Dial 800-535-0602. FAX Your Order 612-476-6443. Dealer and distributor pricing available. Call 800-328-5564. Charge it on VISA or MasterCard



"We hear you!"

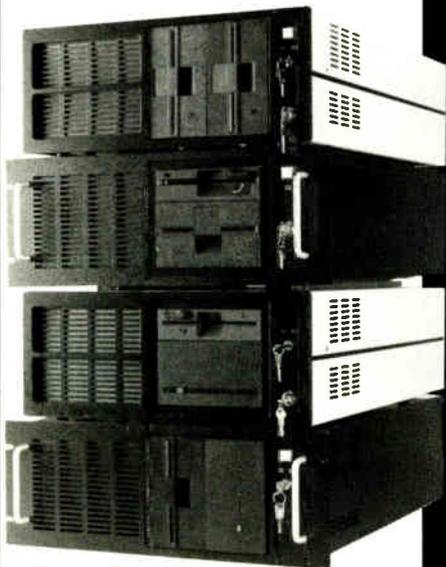
1 Northgate Parkway, Eden Prairie, Minnesota 55344

©Northgate Computer Systems, Inc. All rights reserved. Northgate, OmniKey and the Big 'N' logo are trademarks of Northgate Computer Systems. All other product brand names are trademarks or registered trademarks of their respective owners. Specifications subject to change without notice. All models subject to availability. *Best Buy for input device, *Computer Shopper*, December, 1989.

Circle 208 on Reader Service Card
World Radio History

Rack & Desk PC/AT Chassis

Integrand's new Chassis/System is not another IBM mechanical and electrical clone. An entirely fresh packaging design approach has been taken using modular construction. At present, over 40 optional stock modules allow you to customize our standard chassis to nearly any requirement. Integrand offers high quality, advanced design hardware along with applications and technical support *all at prices competitive with imports. Why settle for less?*



Rack & Desk Models

Accepts PC, XT, AT Motherboards and Passive Backplanes

Doesn't Look Like IBM

Rugged, Modular Construction

Excellent Air Flow & Cooling

Optional Card Cage Fan

Designed to meet FCC

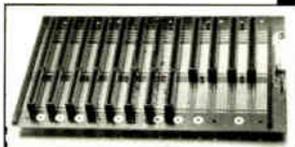
204 Watt Supply, UL Recognized

145W & 85W also available

Reasonably Priced

Now Available

Passive Backplanes



INTEGRAND

RESEARCH CORP.

Call or write for descriptive brochure and prices:
8620 Roosevelt Ave. • Visalia, CA 93291

209/651-1203

TELEX 5106012830 (INTEGRAND UD)

FAX 209/651-1353

We accept Bank Americard/VISA and MasterCard

IBM, PC, XT, AT trademarks of International Business Machines
Drives and computer boards not included.

FEATURE SOUNDS OF SUCCESS

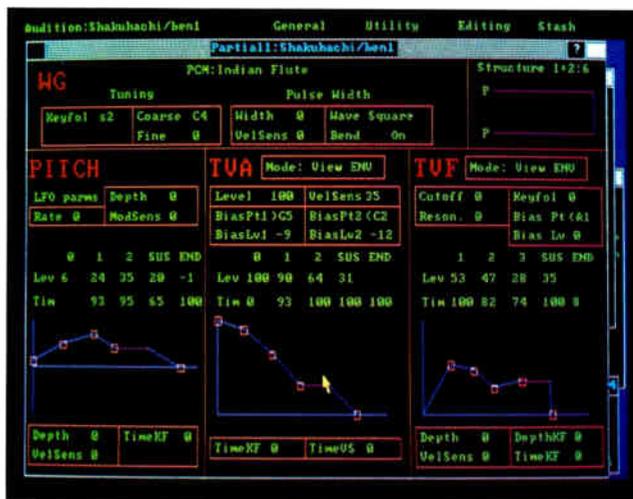


Photo 2: A synthesizer and software, such as Dr. T's MT-32 Editor/Librarian (shown here), allow you to create entirely new sounds that can then be used in musical compositions.

accomplished this by locking onto an analog pulse on one of the tracks of the tape, a method known as FSK (Frequency Shifted Keying). It worked well but was prone to dropping out of sync, and it required that both the sequencer and the tape machine always started from the beginning of a performance.

Today, the preferred method of synchronization is via SMPTE (Society of Motion Picture and Television Engineers) coding. As is obvious from the name, this is the time code standard used in TV and film. It specifies time in frames per second. Most current sequencers address SMPTE time code either directly or indirectly via another standard, MIDI time code, that divides time into beats per quarter note.

The synchronous lock-on is achieved with an SMPTE-to-MIDI converter, which translates the musical timing divisions of MIDI time code into the video- or film-frame realm of SMPTE. Synchronization is accurate to the resolution of a frame. It can begin anywhere instead of requiring a simultaneous start from the beginning of a piece.

All high-end music sequencers have this important synchronizing ability, but sequencers alone don't address all the specialized, complex needs of a musician who is adding sound to visuals. As a result, a new category of music software known as cueing software has quickly evolved. These programs are designed to work hand-in-hand with a music sequencer to automate as much of the scoring process as possible.

Opcodes's Cue, Passport's Clicktracks, and Dr. T's Hitman all share the following features:

- They provide a fast and easy way to identify and tag the beginnings and ends of cues in a film (i.e., the points in a film that require music).
- They help calculate optimum tempos, enabling the composer to catch the maximum number of hits (synchronized musical/video events) during a cue.
- They can perform instantaneous time-format conversions, allowing you to translate a single cue point into NTSC or PAL video frames, film frames, or beats per minute.

Some of these programs have limited sequencing features themselves, allowing you to trigger single MIDI events or even

continued

C Why dBASE programmers are excited!

Build a multi-user, 85K, dBASE compatible application using pulldown menus, popup windows, and data entry from pick lists.

Portable

When you are done, port your application to Unix, Microsoft Windows and OS/2 without modifying a single line of code.

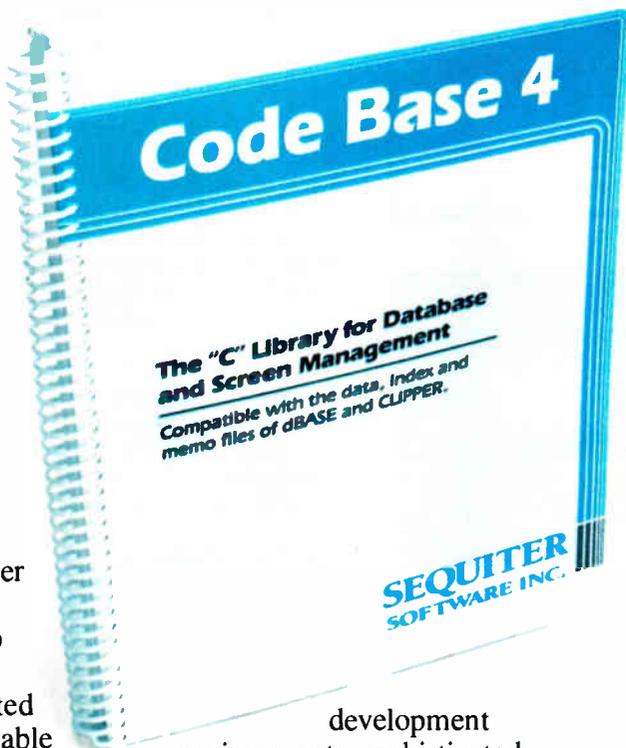
Then watch as your application runs many times faster than corresponding dBASE, Clipper or Foxbase programs.

Finally, you can keep all the profits after you have distributed unlimited numbers of your executable programs royalty free.

Compatible

Code Base 4 lets you access and modify the data, index and memo files of dBASE III, dBASE IV, or Clipper. Consequently, you can take advantage of dBASE compatible tools such as R&R Relational Report Writer.

Switch between Turbo C, Quick C, and Microsoft C. Take advantage of integrated



development environments, sophisticated debuggers, and programs which compile and link in seconds.

Learn Code Base 4 by consulting the comprehensive 206 page user's guide while interactively executing Code Base 4 routines from a learning utility. Then try example programs from the diskettes or the user's guide. You will easily remember the Code Base 4 routines which

correspond directly to familiar dBASE commands.

Source Included

As you become an expert Code Base 4 user, you will find yourself examining the source code as you read about the internal operating principles of Code Base 4.

Enjoy the benefits of complete dBASE functionality, including data entry, windows, menus, multiple index files per database, dBASE expression evaluation, fields, filters, relations, reindexing, and editing.

Order Today

Order Code Base 4 at \$295 and you will soon know why Sequiter Software Inc. and most software dealers are happy to give a 30 day money back guarantee!!

Call (403) 448-0313
Fax (403) 448-0315

SEQUITER 
SOFTWARE INC.
P.O. Box 5659, Station L
Edmonton, Alberta
Canada T6C 4G1

Circle 265 on Reader Service Card

popular PC environment and Microsoft® Windows, using a structure called «hyperstructure». HyperMap® has unlimited applications. Some examples are in Office automation, Industry, Tourism, Real-Estate agencies, Banks and Insurance companies, Education, Museums, etc. Hyper-Map® is an environment which has all the necessary tools to create and query hyperstructures. HyperMap® permits acquisition of TIFF (enlarged version), PCX and BMP images and DXF or WMF graphics formats as well as editing of images and

graphics, texts and data bases can be integrated in a 3D documentation structure through which the user can move to consult information related with them. HyperMap® has a set of tools to query and visualize images as well as to consult information within the hyperstructure through node or zone consulting or querying of the associated data base. HyperMap® also has tools for measuring distances, etc. in images and graphics, as well as for printing, restoring, etc., images and graphics.



Valencia, 93, Pral. 1a.
08029 Barcelona, Spain.
Tels.: + 34 (3) 323 63 22 - 323 63 65
Fax: + 34 (3) 451 22 82
Telex: 52766

SPONSORED BY
COPCA
COMITÉ OLÍMPICO PARALÍMPICO DE ESPAÑA

Circle 339 on Reader Service Card
World Radio History

Read Mac Disks in a PC MatchMaker

complete sequences created in a dedicated sequencer. All the

FEATURE

SOUNDS OF SUCCESS

ITEMS DISCUSSED

Here is the contact information for all the products mentioned in this article. The superscripts refer to the machines that each product runs on: the Amiga (Am), the Atari ST (At), the IBM PC (PC), the Macintosh (M), and the Apple IIGS (GS).

AmigaVision^{Am}
Commodore Business Machines
1200 Wilson Dr.
West Chester, PA 19380
(215) 431-9100
Inquiry 1052.

Bars & Pipes^{Am}
Blue Ribbon Bakery
1248 Clairmont Rd.
Atlanta, GA 30030
(404) 377-1514
Inquiry 1053.

Beyond^{Am,At,M,PC}
Hitman^{At}
KCS^{Am,At,M,PC}
MIDI Mouse^{Am,M}
MT-32 Editor/Librarian^{At,PC}
Tiger Cub^{Am,At,M,PC}
X-or^{At,PC}
Dr. T
220 Boylston St.
Chestnut Hill, MA 02167
(617) 244-6954
Inquiry 1063.

Cakewalk^{PC}
Sound Globes^{PC}
Twelve Tone Systems
165 Bedford St.
Burlington, MA 01803
(617) 273-4437
Inquiry 1054.

Clicktracks^M
Master Tracks Pro^{Am,Gs,M,PC}
Passport
65 Miramontos St.
Half Moon Bay, CA 94019
(415) 726-0280
Inquiry 1055.

Cue^M
EasyVision^M
Galaxy^M
Vision^M
Opcode
3641 Haven Dr., Suite A
Menlo Park, CA 94025
(415) 369-8131
Inquiry 1056.

Cubase^{Am,At}
Pro 24^{Am,At}
Steinberg/Jones
17700 Raymer St., Suite 1001
Northridge, CA 91325
(818) 993-4091
Inquiry 1057.

Director^M
MacroMind
410 Townsend St., Suite 408
San Francisco, CA 94107
(415) 442-0200
Inquiry 1058.

Drummer^{PC}
Cool Shoes Software
P.O. Box 391
Burlington, MA 01803
(617) 229-9942
Inquiry 1059.

Dynamic Drums^{PC}
New Wave Software
P.O. Box 438
St. Clare Shores, MI 48080
(313) 771-4465
Inquiry 1060.

Easy Performer^M
Performer^M
Performer 3.4^M
Mark of the Unicorn
222 Third St.
Cambridge, MA 02142
(617) 576-2760
Inquiry 1182.

Finale^M
MusicProse^M
Coda
1401 East 79th St.
Minneapolis, MN 55425
(800) 843-2066
Inquiry 1061.

GenEdit^{At,M}
Hybrid Arts
8522 National Blvd.
Los Angeles, CA 90232
(213) 841-0348
Inquiry 1062.

HookUp^M
HIP Software
117 Harvard St., Suite 3
Cambridge, MA 02139
(617) 661-2447
Inquiry 1064.

Jambox^M
M^{Am,M,PC}
Upbeat^M
Intelligent Music
116 North Lake Ave.
Albany, NY 12206
(518) 434-4110
Inquiry 1065.

Mandala^{Am}
Very Vivid, Inc.
P.O. Box 127, Station B
Toronto, Ontario,
Canada M5T 2T3
(416) 686-7850
Inquiry 1066.

Master^{M,PC}
CMS
382 North Lemon Ave.
Walnut, CA 91789
(714) 594-5051
Inquiry 1067.

MIDIBASIC^{M,PC}
Altech Systems
122 Faris Industrial Park Dr.
Shreveport, LA 71106
(318) 226-1702
Inquiry 1068.

MIDI Quest^{Am,At,M,PC}
Sound Quest
1573 Eglinton Ave. W, Suite 200
Toronto, Ontario,
Canada M6E 2G9
(800) 387-8720
Inquiry 1069.

Monitor^{PC}
Bartleby Software
P.O. Box 671112
Dallas, TX 75367
(214) 363-2967
Inquiry 1070.

Notator^{At}
C-Lab/DigiDesign
1360 Willow Rd., Suite 101
Menlo Park, CA 94025
(415) 327-8811
Inquiry 1181.

Personal Composer^{PC}
Personal Composer
2448 76th Ave. SE
Mercer Island, WA 98040
(800) 446-8088
Inquiry 1183.

Sequencer Plus^{PC}
Voyetra Technologies
333 Fifth Ave.
Pelham, NY 10803
(914) 738-4500
Inquiry 1184.

Showmaker^{Am}
Gold Disk
P.O. Box 789, Streetsville
Mississauga, Ontario,
Canada L5M 2C2
(416) 828-0913
Inquiry 1185.

Super Librarian^{Am,At,M,PC}
Pixel Publishing
1573 Eglinton Ave., Suite 3
Toronto, Ontario,
Canada M6E 2G9
(416) 785-3036
Inquiry 1186.

Sybi^{At,M,PC}
Scorpion Systems
175 Fifth Ave., Suite 2624
New York, NY 10010
(415) 864-2956
Inquiry 1187.

Synthia^{Am}
The Other Guys
P.O. Box H
Logan, VT 84321
(800) 942-9402
Inquiry 1188.

incorporating music into multimedia environments will spawn more applications for integrating music with video, graphics, and other media. But it appears that the basic music software tools—the sequencer, the voice editor/librarian (see photo 2), and the notator—are already mature.

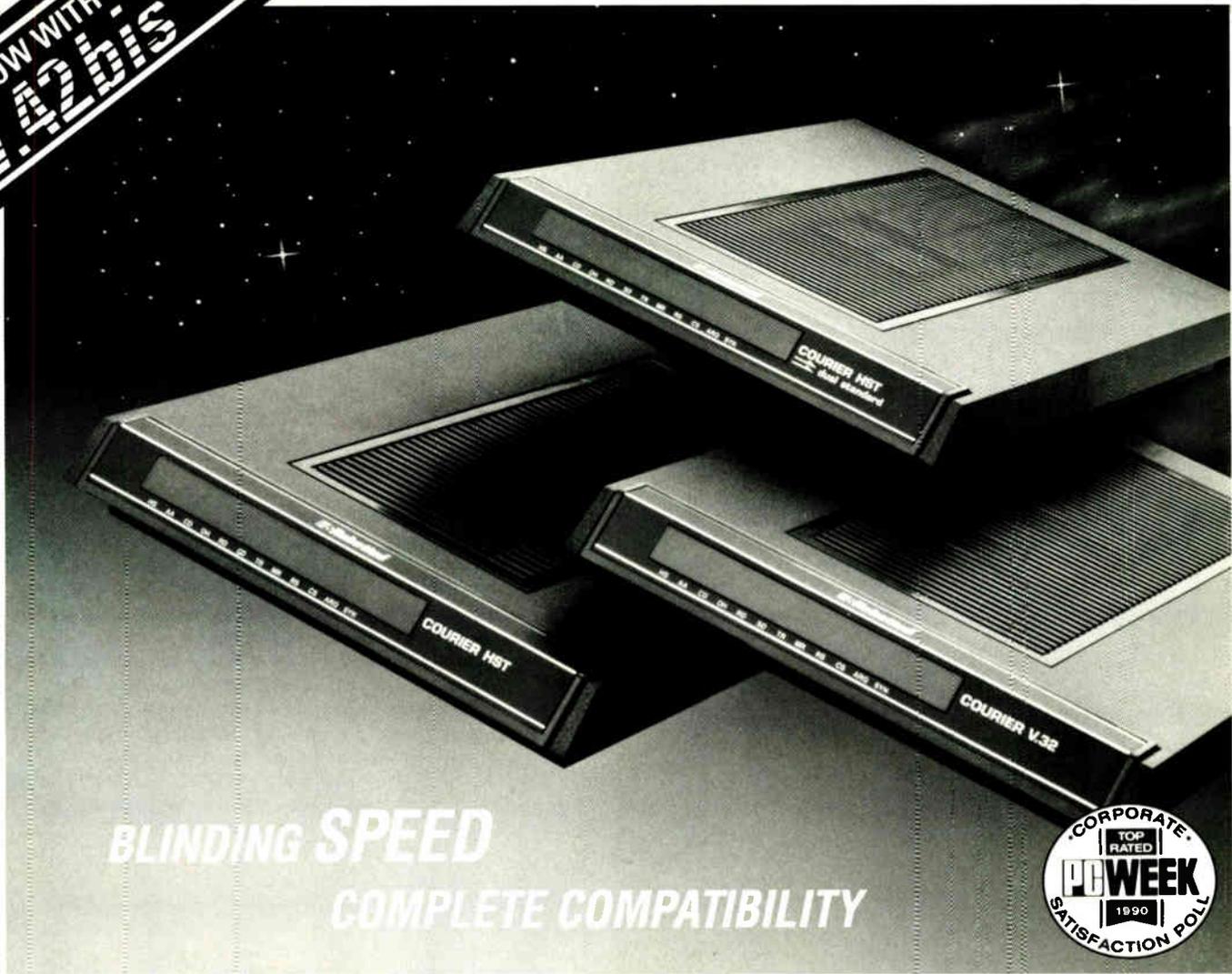
The next music software evolution is just now getting off the ground. It is occurring in tandem with an evolution in music hardware: software/hardware packages for digital multitrack recording direct to disk. Opcode and DigiDesign are working together to create a system that will access and control DigiDesign's Soundtools system—a two-track, 16-bit, CD-quality digital recording module—from within Opcode's Vision sequencer. The merging of sequencing and digital recording represents the birth of the music workstation, and the ultimate realization

of the home recording-studio-in-a-box fantasized by every musician that's ever yearned to produce master recordings.

In a world that is increasingly defined by how well we learn to communicate with and relate to computers, being able to work with them as fluid musical instruments and creative partners capable of warmth and subtlety of expression offers hope that our futures might not be as sterile and unfeeling as many sometimes fear. ■

Dean Friedman is a composer living in Peekskill, New York. Among his many compositions is the 1970s hit "Ariel." He is also the designer of the Nickelodeon game "Eat-a-Bug." Currently he is writing film and TV scores. He can be reached on BIX c/o "editors."

NOW WITH
V.42bis



BLINDING SPEED
COMPLETE COMPATIBILITY

Introducing the high speed modems from U.S. Robotics Now with V.42bis

Until now, high speed modem users had the best of one world. They either had speed or compatibility. U.S. Robotics just changed all that.

THE BEST OF ALL WORLDS...

With the new line of high speed modems from U.S. Robotics – the Courier HST, the Courier HST Dual Standard and the Courier V.32 – you can now have both the highest speeds and the most compatibility.

For speed – it's the Courier HST which delivers throughput up to 35,500 bits per second with MNP® level 1-5 error control and V.42bis. And it still costs less than \$1,000.

For Compatibility – the Courier V.32 provides CCITT standard modulations from 300 bps to 9600 bps for under \$995. And with MNP levels 1-5 and V.42bis you will get complete data integrity plus throughputs approaching 24,000 bps.

For the best of all worlds – it's the Courier HST Dual Standard, combining the blinding speed of the Courier HST with the compatibility of the V.32. At \$1,295, it costs less than some featureless V.32-only modems.

U.S. ROBOTICS – THE EXPERT'S CHOICE

You would expect the broadest high speed modem line from U.S. Robotics. We manufactured our first HST in 1987, and it quickly became the standard on over 8,000 bulletin boards and for over 40,000 users. Rated #1 by *Data Communications* magazine, it confirmed what our customers knew all along – U.S. Robotics delivers the best modem value. And we've been doing that for 13 years – for over 1,000,000 customers.

When you look for high speed modems, don't settle for half a solution. Look to U.S. Robotics. Call today for details on the high speed modems that give you the best of all worlds.

Call 1-800-Dial USR. (1-800-342-5877)

U.S. Robotics®

The Intelligent Choice in Data Communications

8100 North McCormick Boulevard, Skokie, Illinois 60076

U.S. Robotics, Courier and HST are trademarks of U.S. Robotics, Inc. Other computer and software names identified by ® or ™ are trademarks of their respective manufacturers. Prices are suggested retail prices in U.S. Dollars.

For sales in the United Kingdom, please call Miracom, Ltd., Ipswich, England. Telephone: 0473 233888. For Canadian sales, call 1-800-553-3560.

PostScript Power To The People!

The QMS-PS® 410 Printer. Developed by the greatest minds in the industry. . . Yours.

Before engineering the QMS-PS 410, we performed one very important task. We listened. Then we took everything we heard, added a few surprises, and built a revolutionary laser printer with a suggested retail price of just \$2795!

You said make it Adobe® PostScript®. So we did. And now you can enjoy the design flexibility only PostScript offers as well as 45 resident typefaces and thousands of PostScript software applications.

You said make it reliable. So we used the Canon® LX print engine manufactured by the undisputed world leader in high-quality, easy-maintenance print engines.

You said make setup easy. So we made it truly and completely plug-and-play. Out of the box, it connects to IBM® PC's and compatibles, Apple® Macintoshes™ and mini and mainframe computers.

You said make it flexible. So we added HP® LaserJet® Series II emulation to support non-PostScript printing applications.

You said make it simple. So we gave the QMS-PS 410 the intelligence to actually "think for you" by automatically switching between emulations and interfaces! This printer has ESP (Emulation Sensing Processor), which interprets incoming data and *automatically* chooses the appropriate printer language. And you can send data *simultaneously* to its AppleTalk®, serial and parallel interfaces! There's no need to change switch settings or send complicated software commands.

You said make it fast. So we created a super-fast controller with a 68020 processor and third generation QMS® ASAP™ technology (Advanced Systems Architecture for PostScript), which incorporates the latest in component and controller design.

You said make it expandable. So we made a variety of options available, including an HP-GL® emulation card, Adobe typeface cards, HP compatible font cards, memory upgrades and extended paper handling capabilities.



Call Now and Let the QMS-PS 410 Liberate You!

1-800-523-2696

In Europe (31)-30/420129

You see, listening to you gave us the insight to develop a printer that offers real world solutions to real world problems. And the QMS-PS 410 delivers PostScript power to the people by giving you more solutions than any other printer on the market. Affordable. Reliable. Flexible. Solutions that set you free!



POSTSCRIPT®

QMS 

The following are trademarks or registered trademarks of their respective companies: QMS, the QMS logo, QMS-PS and ASAP of QMS, Incorporated. IBM of International Business Machine, Incorporated. Adobe, PostScript and the Adobe PostScript logo of Adobe Systems, Incorporated. Canon of Canon USA, Incorporated. Apple, AppleTalk and Macintosh of Apple Computer, Incorporated. HP, HP-GL and LaserJet of Hewlett-Packard Company. Centronics of Centronics Data Computer, Incorporated.

Circle 235 on Reader Service Card (RESELLERS: 236)

World Radio History

OF MONITORS AND EMISSIONS

The least-changed computer peripheral is about to change

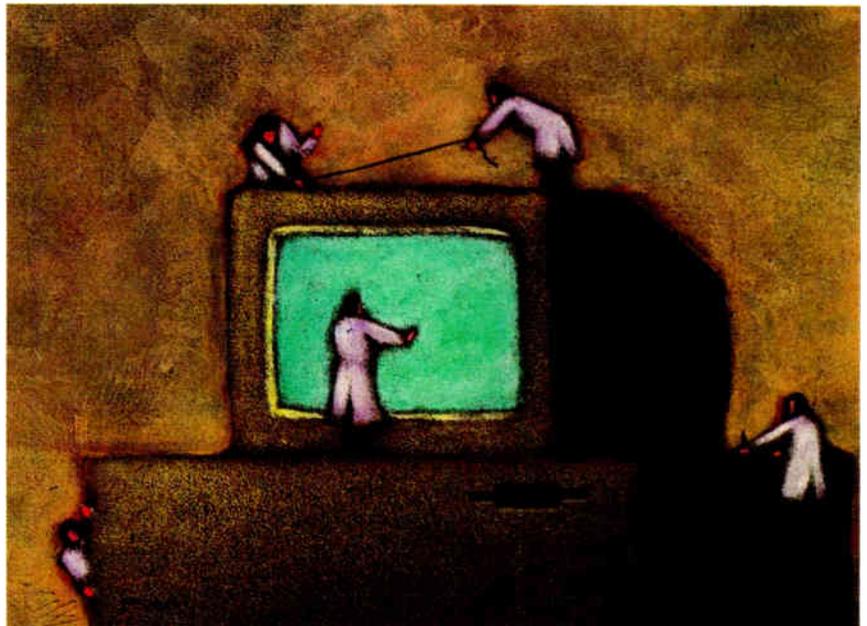
Unless you've confined your computing to an abacus, where the only emissions are splinters, you've probably heard about the controversy surrounding extremely low-frequency (ELF) and very low-frequency (VLF) magnetic emissions from video monitors. Whether the health hazards being blamed on such emissions are real or not, many manufacturers—especially those outside the U.S.—have begun producing so-called low-radiation monitors. In this month's Under the Hood, I'll take a look at display monitors and the steps that are being taken to reduce emissions from them.

Electronics and Emissions

Before you can reduce emissions from a video display terminal (VDT), you have to be able to identify the types of emissions and their origins. You should also observe the effects of such emissions and understand any regulations that apply.

Most electronic equipment produces two kinds of emissions: electric and magnetic. These emissions are emitted or radiated as electromagnetic energy fields. It is generally accepted that if the electromagnetic energy field produces ions while passing through matter, it is an ionizing field. If not, it is a nonionizing field. X-rays are an example of ionizing electromagnetic fields used to treat some medical conditions. Nonionizing fields are lower-frequency fields including ELF, VLF, radio, TV, and microwave communications.

To prevent misunderstandings, the scientific community generally refers to the propagation of nonionizing energy as emissions and the propagation of ionizing



energy as radiation (see the text box "Clarifying the Confusion" on page 446). Therefore, it's inaccurate to consider ELF and VLF emissions as somehow related to ionizing radiations, such as those generated by x-ray or nuclear sources.

The electric and magnetic emissions generated by electronic equipment can be carried along conductors, such as power and interconnecting cables. Some components generate emissions during their normal circuit operation.

You've observed at least some effects from both of these types of emissions. The phenomenon is called electromagnetic interference. An example of conducted EMI is the disruption of TV reception by noise on the power line created by an electric shaver, a blender, or other electric devices. You've probably also noticed EMI as noise interference in audio systems, video displays, and telecommunication equipment.

Some earlier computer systems caused so much interference that you couldn't operate them in the same room with your radio or TV. Eventually, these systems were taken off the market because they couldn't be made to comply with emission requirements. Manufacturers found it was more cost-effective to design systems from the beginning to comply with regulations. You may begin to see this approach used to reduce video monitor ELF and VLF emissions.

The huge volume of complaints about EMI caused regulatory agencies worldwide to take action (see the text box "Who's Monitoring the Monitor Standards?" on page 448). One such U.S. agency is the Federal Communications Commission (FCC). One of its charters is to regulate the emission levels from computing equipment so they don't interfere excessively with licensed broadcast services.

continued

Clarifying the Confusion

Attenuation The decrease in amplitude of an electromagnetic emission during its transmission from one point to the next.

Deflection circuit A set of coils installed on the neck of a CRT. They control the movement of the electron beam across the CRT face when they are energized by the sweep frequency.

Electric field An electric flux density produced by a varying voltage.

ELF Extremely low frequency—the frequency range from 3 Hz to 3000 Hz.

EMC Electromagnetic compatibility—the ability of different electronic devices to work together without causing interference to each other.

EMI Electromagnetic interference—emissions that cause electronic equipment to malfunction.

Emission An act of dispersal. This term generally refers to electromagnetic energy.

EMS Electromagnetic susceptibility—how easily the operation of an electronic device is disrupted.

Filament voltage A voltage applied to the filament of a CRT. It heats the cathode to a point where electrons are emitted and then accelerated to hit the CRT's phosphor-coated face.

Hertz The basic unit of measure for frequencies (i.e., cycles per second).

Ionizing Any electromagnetic or particulate radiation capable of directly or indirectly producing ions in its passage through matter.

Isotropic probe A probe that has equal emission reception in all directions.

Magnetic field A state produced by a varying current flow in a conductor, which can induce a voltage in a second conductor.

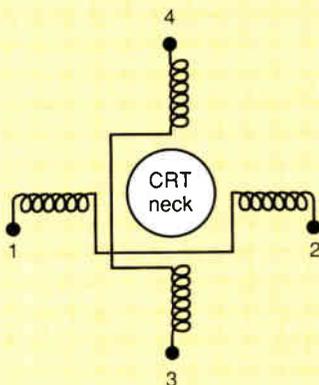
Nonionizing Any electromagnetic radiation or emission incapable of directly or indirectly producing ions when it passes through matter.

Radiation 1) The emission of electromagnetic energy. 2) Moving nuclear particles.

Sweep frequency The amplitude-varying voltage applied to the deflection coils to move the electron beam across the CRT face. Horizontal frequencies range from 15,000 Hz to 32,000 Hz, and vertical sweep frequencies range from 50 Hz to 90 Hz.

VLF Very low frequency—the frequency range from 3000 Hz to 30,000 Hz.

CRT MAGNETIC FIELD SYSTEM



Horizontal control is applied to pins 1 and 2

Vertical control is applied to pins 3 and 4

Figure 1: A CRT magnetic deflection system positions the electron beam on the face of the CRT. Sweep frequency circuits apply voltages to the horizontal and vertical deflection coils to position the electron beam.

FCC regulations set levels of conducted emissions over the frequency range of 450 kHz to 30 MHz and for radiated emissions from 30 MHz to 1000 MHz. They selected these frequency ranges to be sensitive to areas where receiving equipment exhibited electromagnetic susceptibility. The goal is to achieve electromagnetic compatibility, a condition that allows a variety of electronic equipment to operate in close proximity without interference.

Basic VDT Operation

The CRT is the main component in most VDTs. It has an electron gun that emits a beam of electrons. The beam is accelerated by a high voltage applied to the tube and strikes the CRT's phosphor-coated face. This coating glows when struck by the electron beam.

Control circuits are needed to adjust the intensity of the beam and move it across the tube's face to create a usable video display. Voltages are applied to the control grid to adjust the brightness of the CRT screen. The focus control adjusts the size of the electron beam image on the face of the CRT. The movement of the electron beam across the face of the tube is controlled by voltages applied to the horizontal and vertical deflection system (see figure 1).

The horizontal coils are energized by a sweep frequency that ranges from 15,000 Hz to 32,000 Hz, depending on the VDT's design. The resulting varying magnetic field moves the electron beam from side to side. A vertical sweep frequency ranging from 50 Hz to 90 Hz is applied to the vertical deflection coils, causing the electron beam to move up and down.

The majority of the emissions in the VLF region are a result of drive voltages applied to the horizontal deflection coils. Emissions in the ELF band come from two primary sources: the vertical deflection coils, which are energized at rates of from 50 Hz to 90 Hz; and power supply components, which generally operate from either 50 Hz or 60 Hz. Studies have shown that the emissions from color monitors are higher than those from similar-size monochrome monitors because of the higher operating voltages on color CRTs.

Research on the effects of low-level magnetic fields has gone on for many years and still goes on. Part of this research is focused on the effects of varying or pulsating fields, such as those found in the magnetic fields emitting from the CRT's deflection coils. There has been very little agreement on the

continued

DAMARK

INTERNATIONAL, INC.

THE "GREAT DEAL" CATALOG
1-800-729-9000

ORDER TODAY!

MURATA

PROFESSIONAL FAX/PHONE/COPIER MACHINE

- 9600 baud fax machine, full-featured telephone and photo-copier.
- Automatic paper cutter crops incoming faxes to proper length.



- 15-page auto document feeder.
- 16-level grayscale.
- Voice/fax switch.
- Answering machine connection.
- 50-number autodialer.
- 164 ft. paper roll.
- Send faxes after hours with delayed dialing command.
- Advanced polling.
- Voice prompt.
- Auto/manual answer.
- Normal, fine and superline transmission.
- Full-featured telephone.
- Convenient copier.
- Remote diagnostics and repair—Murata fixes most problems over the phone line.
- Compatibility: CCITT Group 3 and Group 2.
- English/Spanish operation.
- Dim.: 16.1" x 12.6"D x 7.3"H.
- Model #: M1850.

DAMARK \$ **699.99**
PRICE

Item No. B-2279-149203
Insured Ship/Hand.: \$29.00

Factory New!
Factory Perfect!

FAMOUS MAKER

286 AT COMPUTER WITH 14" HIGH RESOLUTION VGA COLOR MONITOR w/30MB HARD DRIVE



- 80286 microprocessor. 12.5 6.25MHz switchable.
- One MB RAM on motherboard, expandable to four MB.
- 30 MB hard drive.
- One 5.25" 1.22MB floppy drive.
- High resolution VGA monitor. 640 x 480.

• Socket for 80287 math co-processor.

- 16 bit VGA card; 800 X 600 resolution.
- IBM compatible.
- 3 expansion slots—two 16-bit and one 8-bit.
- 1 serial port.
- 1 parallel port.
- PS/2 compatible 6-pin mouse port.
- Real time clock/calendar.
- Phoenix 286 ROM BIOS.
- AT style 101-key enhanced keyboard.
- Includes MS-DOS 4.01 with DOS Shell utilities and GW BASIC™.
- PC dim.: 4-1/4"H x 15"W x 15-1/2"D.
- Monitor dim.: 13.9"W x 14.7"D x 14.1"H.
- Mfr. Sugg. Retail: **\$2,094.00**

DAMARK \$ **999.99**
PRICE

Item No. B-2279-149047
Insured Ship/Hand.: \$49.00

One Year Mfr. Warranty!
Factory New!
Factory Perfect!

SmartMax

Fax/Phone Auto Switch



FACTORY NEW!
FACTORY PERFECT!

- No need for a dedicated fax line.
- Fax/phone auto switch allows your new fax to share existing phone line.
- Works on all Group 3 fax machines.
- Single switch to lock out either voice or fax calls.
- Front panel status lights indicate modes of operation.
- SmartMax handles power outages by automatically switching to phone-only mode.
- Allows manual override so you can send a fax to the person you're talking to on the phone.
- 24-Hour customer service line.
- Easy installation.
- UL listed.
- FCC certified.
- Dim.: 4" x 7" x 1-1/2".
- Wt.: 2-1/2" lbs.
- Model #: MX 1030.
- 2 Yr. Mfr. Warranty!

Mfr. Sugg. Retail: **\$245.00**
DAMARK \$ **99.99**
PRICE

Item No. B-2279-128934
Insured Ship/Hand.: \$7.50

TOSHIBA

24-PIN DOT MATRIX PRINTER

- 24-pin letter quality printer.
- Print speed: 216 CPS draft; 72 CPS letter quality. 32K buffer.
- Built-in rear tractor.
- Friction feed.
- Auto loading, single sheet guide for letterhead & cut sheets and friction feed.
- Front panel LCD display includes: type fonts, pitch, emulation, lines per inch, quiet mode and page length.
- 360 x 360 graphics.
- Tractor feed and tear bar for continuous forms.
- IBM emulation.
- Single or continuous feed paper loading.
- Parallel/serial interfaces included.
- Model #: P321SL.
- Dim.: 16.3"W x 3.9"H x 15"D.
- One Year Limited Mfr. Warranty!
- Factory New! Factory Perfect!



Sheetfeeder

- Model #: MS-17.

Mfr. Sugg.: **\$349.00**

DAMARK \$ **69.99**
PRICE

Item No. B-2279-149450
Insured Ship/Hand.: \$6.00

Mfr. Sugg.: **\$1019.00**

DAMARK \$ **299.99**
PRICE

Item No. B-2279-149468
Insured Ship/Hand.: \$29.00

KRAFT SYSTEMS INC.

TRACKBALL

- Smooth moving Trackball mouse.
- 100% IBM compatible.
- Variable resolution up to 1150 D.P.I.
- Complete one-handed control.
- Easy to install; just insert disk and follow step-by-step menu driven instructions.
- Includes one 5-1/4" disk and one 3-1/2" disk.
- Includes Telepaint™ software with two 5-1/4" disks.
- Microsoft compatible. Software driver included.
- System requirements: IBM or compatible PC. DOS 2.0 or higher.
- Includes 9 to 25 adapter cable for installation on any RS232 serial port.
- 5 Year Limited Mfr. Warranty!
- Factory New!
Factory Perfect!



Includes Telepaint™ Software

Mfr. Sugg. Retail: **\$169.90**

DAMARK \$ **49.99**
PRICE

Item No. B-2279-148684
Insured Ship/Hand.: \$6.00

Emerson

2400 BAUD HAYES COMPATIBLE EXTERNAL MODEM



2400 BAUD

- Fully Hayes compatible, runs most popular communications software.
- RS-232C data interface.
- 8 status indicators and 6 self test modes.
- Auto or manual answer selectable.
- 2" speaker with volume control.
- Front panel LEDs.
- Includes phone cable, user's guide and power adapter.
- Dim.: approx. 1-1/2" x 5" x 10".
- Model #: 2400EX.
- Two Year Mfr. Limited Warranty!
- Factory New!
Factory Perfect!

Mfr. Sugg. Retail: **\$199.99**

DAMARK \$ **99.99**
PRICE

Item No. B-2279-141655
Insured Ship/Hand.: \$6.50



FOR FASTEST SERVICE CALL TOLL FREE

1-800-729-9000

CUSTOMER SERVICE: 1-612-531-0082

NAME _____
ADDRESS _____
CITY _____ ST _____ ZIP _____
PHONE _____

Check/Money Order VISA SIGNATURE _____
 MasterCard Discover CARD NO. _____ EXP. DATE _____

Send To: DAMARK INTERNATIONAL, INC., 7101 Winnetka Ave. N., Minneapolis, MN 55428-1619

QTY	DESCRIPTION	ITEM #	S/H/I	PRICE

DELIVERY TO 48 U.S. CONTINENTAL STATES ONLY



SUB TOTAL

in MN add 6% Sales Tax

Total S/H/I

GRAND TOTAL

B-2279

Copyright 1990 DAMARK INTERNATIONAL, INC.
All Rights reserved.

Who's Monitoring the Monitor Standards?

In the past few years, improvements in display technology have rapidly taken place, and today, computer designers have many options. There are several advantages to each type of display. But as displays have evolved, so has concern over the emissions from CRTs and how to measure them.

In 1988, a standard was adopted by a Swedish commission regarding methods for measuring electrostatic fields and electric and magnetic alternating fields. While this regulation applies only to equipment imported into, or used in, Sweden, it does serve as a model for other countries, and we will probably see similar regulations enacted elsewhere.

In addition, some Taiwanese periph-

eral manufacturers have already embraced the concept of designing for reduced low-frequency emissions by beginning to produce lowered ELF displays. It is expected that VDT manufacturers worldwide may follow this lead.

In the U.S., IEEE Committee P-1140 has been formed and is meeting to review ANSI standard C95.1. It will evaluate measurement techniques and frequency coverage of the standard. One of the committee's action items is to consider increasing the standard's frequency range. Some members are proposing that the range be extended down to as low as 50 Hz. It is possible that a first draft could be finished by mid-1991.

Interest in the ANSI standard rewrite primarily concerns how it applies to

computing equipment, though C95.1 will also apply to other equipment that operates within this standard's frequency range. The probable effect of the ANSI standard rewrite will be consideration of emissions and their levels in the lower end of the spectrum. Doubtless, all electronic manufacturers will be closely monitoring the outcome of the committee's deliberations.

Reducing ELF emissions is somewhat similar to reducing hydrocarbon emissions on automobiles. The basic operating characteristics of a vehicle are relatively unaffected by the modification. The same is true of a VDT. The reduced-emission CRT video monitor's operation remains essentially the same as the unmodified model.

SOURCES OF MAGNETIC FIELDS IN VIDEO DISPLAY UNITS

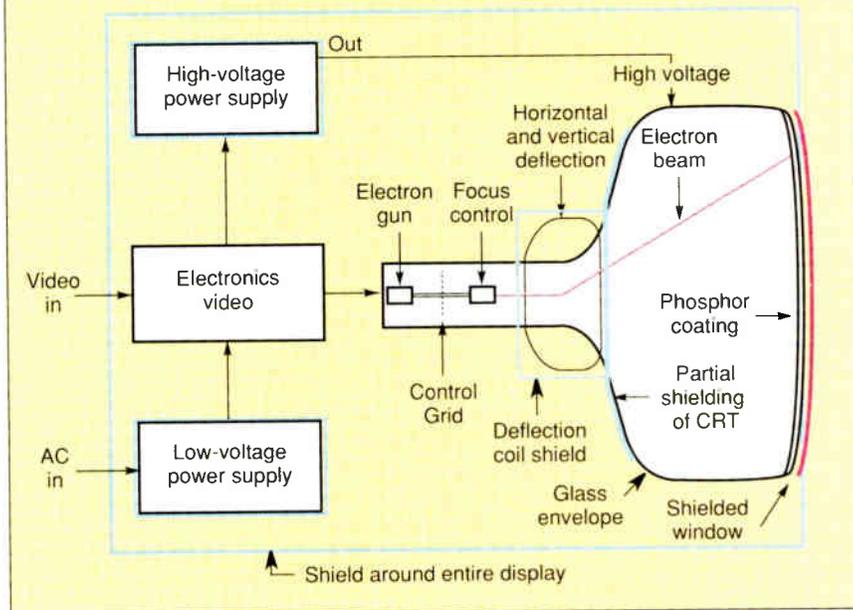


Figure 2: The face of the CRT is shielded with a well-grounded EMI window. The CRT glass envelope, deflection coils, power supplies, and the terminal itself are shielded with metals that have good ferromagnetic properties and good conductivity, such as iron and nickel.

High- and Low-Frequency Emission Control

Computers are brought into compliance with earlier EMC regulations by applying techniques of circuit design that minimize the source of emissions and provide improved filtering and additional shielding. Radiated emissions requiring suppression were electric and could be shielded with thin sheet metal, metal screen, or even sprayed-on coatings. These techniques do not significantly contribute to the weight of the device, nor do they present unachievable constraints on the material selection or design of equipment enclosures.

By nature, electric and electrostatic fields are high-impedance and are easily contained by shields or screens. EMI-shielded windows are available that fit over the face of a CRT (see figure 2). An EMI-shielded window is a metal screen bonded to, or a thin-film metal deposit on, a glass CRT cover. Such shields will reduce VLF electric emissions by a factor of over 1000. The screen's attenuation of VLF magnetic emissions is so small as to be almost unmeasurable.

In contrast, magnetic fields are low-impedance. Reducing magnetic emissions begins with selecting the appropriate materials. Highly conductive materials, such as copper or aluminum, are excellent choices for reducing electric emissions but not magnetic emissions. Magnetic emissions are best reduced by using ferrous materials. Other materials can be used, but the electric

continued

validity and magnitude of the problem. Only a few countries, with Sweden in the forefront, have actually initiated standards regulating the levels of emissions in the VLF region.

What kinds of options are available to designers who are seeking to reduce the ELF and VLF magnetic emissions from VDTs? Unfortunately, there aren't many choices.

Recording the Past... ...Plotting the Future



Our reputation precedes us! From 5 subsidiaries and 35 distributors in more than 40 countries worldwide, thousands of customers purchased more in 1989 than ever before. And they were able to choose new products from an ever-expanding array of plotters, penless plotters, digitizers, recorders and supplies.

The Graphtec reputation is one of building products that work well and last a long time. We earned that reputation the hard way, by delivering over 40 years of the best innovation, support, and after-sales service in the industry.

To see what we mean, look no further than our KW series of digitizers. These precision instruments come in a full range of sizes, from A3 to A0. Designed for professional use, they include such features as electromagnetic cross-transmission coordinate sensing, for ± 0.25 mm accuracy and 0.025 mm resolution, a range of cordless cursors and styli for tangle-free operation, emulation of other industry-standard protocols, and an RS-232C interface.

Choose the Graphtec reputation, and get Graphtec quality.



GRAPHTEC CORPORATION Mita 43rd Mori Bldg., 13-16, Mita 3-chome, Minato-ku, Tokyo 108, Japan Tel:(03)453-0511 Fax:(03)453-7187
 U.S.A.: American Graphtec, Inc. Tel:(714)261-7568 Fax:(714)833-7568
 Europe: Graphtec Europe GmbH Tel:(040)511-5059 Fax:(040)511-9155
 Australia: Southern Graphtec Pty. Ltd. Tel:(02)748-4888 Fax:(02)748-4882
 United Kingdom: Graphtec (UK) Ltd. Tel:(0270)625-115 Fax:(0270)626-733



BIX IS GLOBAL

BIX is BYTE's Information Exchange, a worldwide computer conferencing system devoted to the exchange of microcomputer information.

When you use BIX, you leap borders of geography and time to exchange information, opinions and ideas with a "living database" of the world's most knowledgeable microcomputer users.

BIX covers the world.

Our *Microbytes* news service, backed by BYTE and McGraw-Hill, provides

worldwide daily news coverage of major events in the microcomputer industry plus listings of thousands of new products from vendors around the globe. Scores of companies now use BIX to provide technical support for their hardware and software products worldwide.

BIX saves you time.

BIX resources help you get the micro-related information you need right away, regardless of your location. BIX electronic mail lets you send private messages to

other BIX users worldwide. For more information on how to join and use BIX from your country, read the BIX message in this issue (see Advertiser Index for page number), or contact us today.

BIX

BYTE INFORMATION EXCHANGE

One Phoenix Mill Lane
Peterborough, NH 03458 USA
(603) 924-7681 (Our overseas
helpline number)
8:30 AM-11:00 PM
Eastern Time
(-5 GMT) Weekdays



While modern displays have high resolution and excellent color ranges, most are still built with CRTs that are really just big, obtrusive electron tubes.

and magnetic attenuation ratios will be similar to those of iron.

One way to shield against magnetic emissions is to place a 0.254-mm-thick iron sheet 10 cm from a 20,000-Hz emission source. The theoretical attenuation of the electric emission in this example will be by a factor of about 560 trillion. However, the attenuation of magnetic emissions is only about 1000. The attenuation of magnetic emission is even less as the frequency is lowered. The 60-Hz attenuation ratio is less than 3 for the above material.

Measurement Techniques

The analysis of electric and magnetic emissions from electronic equipment begins with the proper selection of the antenna/probe. The probe measures only selected electric or magnetic fields. It must not respond to spurious emissions that will interfere with the accuracy of the measurements.

The probe should be almost isotropic so that its response to an emission field is not dependent on the position of the probe. The design uses three dipoles for electric fields and three loops for magnetic fields, with one aligned with each of the x-, y-, and z-axes to achieve near-isotropic operation.

This is the preferred isotropic probe technique for manufacturing instruments that are used to test compliance with ANSI standard C95.1. This standard addresses safe levels of human exposures to radio-frequency electromagnetic fields in the frequency range of 300 kHz to 100 GHz. It starts at a higher frequency, and the field-strength levels are much higher than those from VDTs.

Currently, IEEE Committee P-1140 is

working on an update of ANSI C95.1 (see the text box "Who's Monitoring the Monitor Standards?").

Equipment Changes

The computer industry has undergone tremendous changes since users first fired up their 16K-byte machines with their cumbersome cassette-tape storage and small TVs used for video display. Today's computers are much faster and more efficient, and they have almost un-

limited storage capabilities. Yet the VDTs retain more similarities to those old TVs than differences.

While modern displays have higher resolution and excellent color ranges, most are still built with CRTs that are really just big, obtrusive electron tubes. At least they are relatively inexpensive and they can produce large, full-color images. The tube size usually determines the VDT's overall dimensions and

continued

8051 68HC11
THE LEADING IN-CIRCUIT EMULATOR TECHNOLOGY.

Nohau EMUL-PC, the PC based in-circuit emulators which find bugs other emulators can't.

- Very easy to learn and use.
- Source Level Debugging in C or PL/M.
- 48 bits wide 16K deep trace buffer.
- Complete 8051 family and 68HC11 family support.

CALL TODAY FOR YOUR FREE VIDEO AND SOFTWARE DEMO (408) 866-1820.

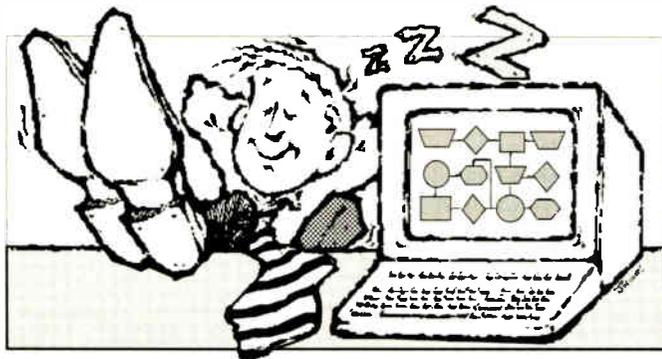
NOHAU
Nohau Corporation
51 E. Campbell Ave.
Campbell, CA 95008
Tel. (408) 866-1820
Fax (408) 378-7869

Australia (02) 654 1873, Austria (0222) 38 76 38, Benelux + 31 1858-16133, Canada 514 689-5889, Denmark (02) 65 81 11, Finland 90-452 1255, France (01)-69 412 801, Great Britain 0962-73 31 40, Israel (03) 48 48 32, Italy (011) 771 00 10, Korea (02) 784 784 1, New Zealand (09) 392-464, Portugal (01) 83 56 70, Sweden, Norway (040) 92 24 25, Singapore 065 284-6077, Spain (93) 217 2340, Switzerland (01) 740 41 05, Taiwan (02) 7640215, Thailand (02) 281-9596, West Germany 08131-1687, USA FAX (408) 378-7869.

Circle 204 on Reader Service Card

SEPTEMBER 1990 • BYTE 451

Shh!



Don't tell your boss about EasyFlow!

Don't say how much time you saved on flowcharts and data flow diagrams. **EasyFlow**, unlike most "screen draw" programs, is dedicated to fast composition and modification of flowcharts and data flow diagrams.

Don't breathe a word about the automatic line routing, automatic text centering, the slick cut & paste or how you created charts and then cleanly moved them into a desktop publishing program.

Tell your boss you had to sweat bullets to come up with these amazing results.

Don't point out that **EasyFlow** works with most matrix printers, laser printers and plotters.

Keep the 200 page manual out of sight. Don't get caught with one of the 350 context sensitive help messages on your screen.

Don't let the boss know that **EasyFlow** only costs \$149.95 and that RUSH delivery is available.

Do tell the boss you are a hard working genius but don't mention the other 80,000 geniuses whose bosses don't know either.



Flowcharting Made Easy.

HavenTree Software Limited

P.O. Box 1093 -A Thousand Island Park, NY 13692
Order Desk: 1-800-267-0668 Info: (613) 544-6035 ext.80
Fax: (613) 544-9632

From our fax to yours... Info Fax: (613) 544-2049

weight. The tube requires a filament voltage, a high-voltage power supply, and deflection circuits, all of which can contribute to the VDT's ELF and VLF electromagnetic emissions.

Redesigning current video monitors could include adding shielding to the CRT body, magnetic deflection coils, and power supplies, and enclosing the entire monitor (see figure 2). The additional shielding, however, would add weight, increase cost, and make cabinet designs harder to modify. Better approaches include improving the circuit design, finding new ways to sweep the electron beam over the CRT face, or employing electrostatic deflection systems such as those used by most oscilloscopes.

Alternate Video Displays

Alternate display technologies are evolving in three main areas: gas-plasma, electroluminescent, and LCD, which is used in many portable computers. This reduction in display excitation voltage will reduce the magnitude of display-related electromagnetic emissions.

The size and resolution of today's alternative displays are not equal to those of CRTs, but they are rapidly improving. Some manufacturers are responding to the debate about low-frequency emissions by offering VDTs with specified lower-level magnetic emissions. Two Taiwanese companies offering such monitors are ADI Systems and Copam Electronics. Both are medium-size monochrome monitors.

Other manufacturers are beginning to offer flat-panel displays such as the Philips PM 12522. This unit is advertised as being completely free of emissions and generating virtually no heat. It has a 640-by-480-pixel, 12-inch LCD screen.

The future of monitors is wide open, with many possibilities in the offing. Already being considered are holographic and optical-projection monitors that will produce three-dimensional displays. Emission levels should be lower, because this type of equipment will be easier to shield than current CRT monitors. Tomorrow's displays will have greatly reduced ELF and VLF magnetic emissions by using either redesigned CRT displays or alternate display technologies. ■

Bill McGinnis is manager of the RF Measurements and Analysis Section for the Southwest Research Institute, a nonprofit R&D organization in San Antonio, Texas. He has over 25 years of experience with electromagnetic compatibility measurements, analysis, and design. He can be reached on BIX c/o "editors."

The Cream.

The Crop.



There are plenty of places to get information in this industry. Too many. But if you want the best quality information, there's only one that rises to the top: **BYTEWEEK**.

BYTEWEEK is a weekly newsletter from the same professionals who produce BYTE Magazine. Each week, the most important news and information from the previous week is presented in a readable and concise manner. BYTEWEEK offers you what no other publication can: timely news on the rapidly-evolving computer industry as it happens with the interpretation and evaluation that only BYTE's experienced editorial staff can provide.

Subscribe now and take advantage of a special subscription rate of \$395 (\$495 outside the U.S. and Canada). Your subscription to **BYTEWEEK** also includes a free subscription to **BIX**, BYTE's exclusive on-line conferencing system. *Don't miss this opportunity!*

For fastest service, call toll-free **1-800-258-5485** (in N.H., call **603-924-9281**) and charge to a major credit card or we'll bill you.

BYTEWEEK

One Phoenix Mill Lane, Peterborough, NH 03458.

BYTEWEEK offers a money-back guarantee if you are not completely satisfied.

Clip Coupon Here



YES! Sign me up as a subscriber to the Cream of the Crop, BYTEWEEK at the special subscription rate of \$395 a year for 50 issues (\$495 a year outside the U.S. and Canada).

Name _____
Title _____
Company _____
Mail Address _____
City/State/Zip _____
Business Phone _____

MasterCard VISA
 Check enclosed Bill me

Card # _____
Exp. _____
Signature _____

BYTEWEEK

One Phoenix Mill Lane
Peterborough, NH 03458



The joy of C-scape

Elegant graphics and text

The C-scape™ Interface Management System is a flexible library of C functions for data entry and validation, menus, text editing, context-sensitive help, and windowing. C-scape's powerful Look & Feel™ Screen Designer lets you create full-featured screens and automatically generates complete C source code.

C-scape includes easily modifiable high-level functions as well as primitives to construct new functions. Its object-oriented design helps you build more functional, more flexible, more portable, and more unique applications—and you'll have more fun doing it.

The industry standout. Many thousands of software developers worldwide have turned to the pleasure of C-scape. The press agrees: "C-scape is by far the best. . . . A joy to use," wrote IEEE *Computer*. Major companies have selected C-scape as a standard for software development.

C-scape's open architecture lets you use it with data base, graphics, or other C and C++ libraries. C-scape runs in text or graphics mode, so you can display text and graphics simultaneously. To port from DOS or OS/2 to UNIX, AIX, QNX, or VMS, just recompile. C-scape also

Graphics. Run in color in text or graphics mode. Read images from PCX files.

Object-oriented architecture. Add custom features and create reusable code modules. C++ compatible.

Mouse support. Fully-integrated mouse support for menu selections, data entry fields, and to move and resize windows.

Portability. Hardware independent code. Supports DOS, OS/2, UNIX, AIX, VMS, others. Autodetects Hercules, CGA, EGA, VGA. Supports Phar Lap and Rational DOS extenders.

Text editing. Text editors with word wrap, block commands, and search and replace.

Field flexibility. Masked, protected, marked, required, no-echo, and named fields with complete data validation. Time, date, money, pop-up list, and many more higher-level functions; create your own.

Windows. Pop-up, tiled, bordered and exploding windows; size and numbers limited only by RAM.

Menus. Pop-up, pull-down, 123-style, or slug menus; create your own.

Context-sensitive help. Link help messages to individual screens or fields. Cross reference messages to create hypertext-like help.

Code generation. Build any type of screen or form with the Look & Feel™ Screen Designer, test it, then automatically convert it to C code.

Screen flexibility. Call screens from files at run time or link them in. Automatic vertical/horizontal scrolling.

International support. Offices in Berlin, Germany, with an international network of technical companies providing local training, support and consulting.

supports Phar Lap and Rational DOS extenders.

Trial with a smile. C-scape is powerful, flexible, portable, and easy to try. Test C-scape for 30 days. It offers a thorough manual and function reference, sample programs with source code, and an optional screen designer and source code generator. Oakland provides access to a 24-hour BBS, telephone services, and an international network of companies providing in-country support. No royalties, runtime licenses, runtime modules. After you register, you get complete library source code at no extra cost.



Call 800-233-3733 (617-491-7311 in Massachusetts, 206-746-8767 in Washington; see below for International). After the joy of C-scape, programming will never be the same.

DOS, OS/2 (Borland and Microsoft support): with Look & Feel, \$499; library only, \$399; UNIX, etc. start at \$999; prices include library source. Training in Cambridge and Seattle each month. Mastercard and Visa accepted.



Oakland Group, Inc. 675 Massachusetts Ave., Cambridge, MA 02139 USA. FAX: 617-868-4440. **Oakland Group, GmbH.** Alt Moabit 91-B, D-1000 Berlin 21, F.R.G. (030) 391 5045, FAX: (030) 393 4398. **Oakland International Technical Network** (training, support, consulting): Australia Noble Systems (02) 564-1200; Benelux TM Data (02159) 46814; Denmark Ravenholm (042) 887249; Austria-Germany-Switzerland ESM 07127/5244; Norway Ravenholm (02) 448855; Sweden Linsoft (013) 111588; U.K. Systemstar (0992) 500919. Photo by Jessica A. Boyatt; Kanji by Kaji Aso. Picture shows a C-scape program combining data entry with video images loaded from PCX files. C-scape and Look & Feel are trademarks of Oakland Group, Inc.; other trademarks belong to their respective companies. Copyright © 1990, by Oakland Group, Inc. Features, prices, and terms subject to change.

Circle 212 on Reader Service Card
World Radio History



VIRTUALLY VIRTUAL MEMORY

Now you can write programs to get at all that high-priced memory

These are the days of DOS extenders, of the mutated MS-DOS. If you could hear the dialogue of an interaction between modern applications and MS-DOS, it might go something like this:

MS-DOS: "I have all this data I need to put in memory, but I seem to have run out of usable RAM."

Application: "No problem, here's an extra 2 megabytes. I'll put the data there for you."

MS-DOS: "Two megabytes! How'd you do that?"

Application: "Never mind, just give me the data and don't ask for details."

This is information-hiding on a grand scale. MS-DOS is unaware of any memory lurking past 1 MB, and all these TSR programs and EMS drivers transport data in and out over that border like worker termites tending to an imprisoned queen. It's a grim scene, but you can at least comfort yourself by witnessing all the useful work that MS-DOS continues to do.

Some time ago, I put together a memory management system that uses handles as a means of coping with memory fragmentation in MS-DOS. (See "If Memory Serves . . ." August 1989 BYTE.) The system works well enough, but it suffers from the same memory restriction that MS-DOS does: The upper limit is 640K bytes, less the memory used by the operating system and application code. Since knocking down walls seems to be a trend these days, I decided



that it was time to breach the 640K-byte barrier.

This month, I'll present an upgraded version of my handle-based memory management system. The upgrade consists of swap capabilities: This new memory manager uses EMS memory (if present), as well as a swap file on the disk. (See the text box "Using EMS" on page 459 for an explanation of how expanded memory is implemented.)

The Swap

The insides of this version of my memory manager operate much like the previous incarnation. Your application makes a request for a chunk of memory. The manager carves a slice out of the heap, tags the slice with an m-node, and passes the m-node's address back to your program. When your program is done with a piece of memory, your application informs the memory manager accordingly, and the memory chunk's associated m-node is

flagged to indicate the memory block is not in use. Memory allocation and release is dynamic.

As before, when the memory manager receives a request that cannot be fulfilled, it attempts to compact the heap in order to consolidate separate "bubbles" of unused memory into a large contiguous free block. This is fine as long as the net amount of memory requested does not exceed the limit of the heap. Once requests do exceed heap size, you're simply out of luck.

Now, however, I've given the memory manager an extra option: It can attempt to swap unlocked blocks either into EMS RAM or off to the disk. Naturally, for the sake of speed, the memory manager will take a crack at EMS first. Blocks that are swapped to EMS or to disk release their memory back into the heap so that the request that triggered everything can be fulfilled.

continued

It works like this: Suppose the application program makes an 8K-byte request, and that the map of memory usage looks something like the diagram in figure 1a. Since the largest free block is only 3K bytes, the memory manager performs a compaction. The result is shown in figure 1b. Once again, the memory manager looks for a free block to satisfy the 8K-byte request, but it discovers that the largest free chunk it has been able to scrounge together is 6K bytes. It's time to do some swapping.

So, the memory manager starts at the top of the m-node list and works its way down, keeping a running total of free and unlocked memory. Once this total meets or exceeds the requested amount, the memory manager begins swapping used blocks out to EMS or disk, consolidating the freed memory as it goes. In the example in figure 1c, the memory manager swaps out the 6K-byte block referenced by m-node A and combines it with 6K bytes of already-free memory, for a total of 12K bytes. The 8K-byte request can now be satisfied.

Notice that the memory manager

moves down from the top of the m-node list in its search for blocks to swap (another payoff for having the m-nodes on a doubly linked list). The selection method used is a first-fit algorithm, since it stops as soon as it's found a contiguous set of blocks that satisfies the original request. An advantage of this technique is that it saves the memory manager from having to perform another compaction after the swap. Newly freed blocks are immediately concatenated to already-free memory that has bubbled up to high memory in the preceding compaction.

Since the m-node of a swapped block is pulled out of the list altogether, the application had better not lose the m-node number. Of course, this is true of m-nodes in any case—if you forget an m-node number, there's no real way to get it back. However, in the original memory manager, m-nodes were kept on one of two lists: an in-use list of m-nodes referencing blocks in the heap, and a "free" list of m-nodes that weren't attached to any heap memory blocks. The free list supplied m-nodes to the in-use list as the heap was carved into more numerous

pieces. Now, m-nodes swapped out to EMS (or to the disk) simply hang around in limbo until the application requests the data that the m-nodes are riding herd on.

The M-Node

My original version built a doubly linked list of pointer blocks that I dubbed m-nodes. Each m-node was 4 words big and consisted of the following:

- a base address, which pointed to the start of the referenced memory block;
- a length word, which indicated (in paragraphs) how big the referenced memory block was;
- a next m-node field, which pointed to the following m-node in the doubly linked list; and
- a previous m-node, which pointed to the preceding m-node in the list.

My program kept m-nodes arranged in memory so that as you traversed the list "upward," you moved through m-nodes that referenced memory blocks stored at

continued

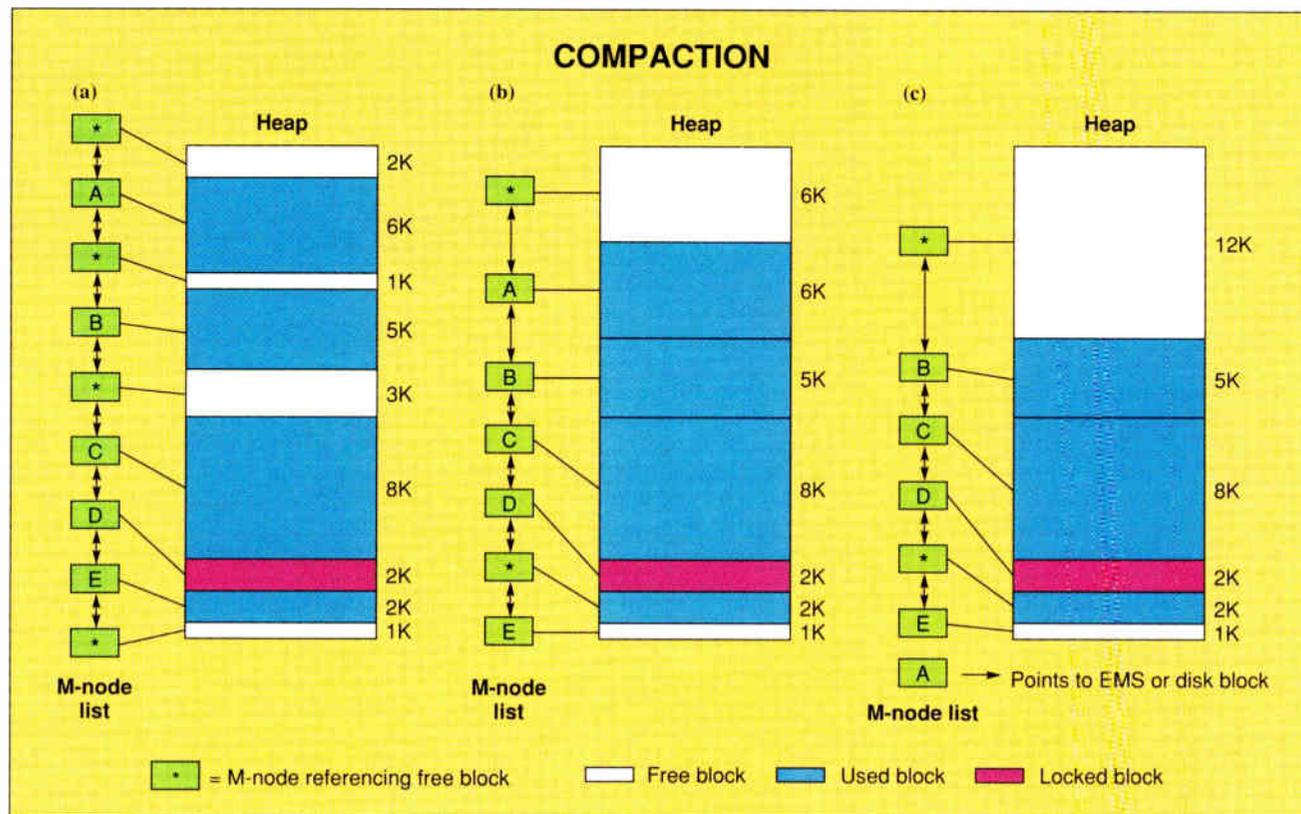


Figure 1: Swapping memory out of the heap begins when a memory request comes in.

(a) The request is for 8K bytes, and no free blocks of 8K bytes exist. (b) The memory manager compacts the heap, freeing a block of 6K bytes. Not good enough, so (c) the manager swaps a 6K-byte block out to EMS memory or disk. A 12K-byte block is now available, and the 8K-byte request is granted.

Object/1 reduces OS/2 and SQL Server programming to this.



Graphic User Interface applications have made life "point and click" simple for end users.

But not for programmers. Conventional languages are simply not well suited to developing applications in the fast-growing graphical environment.

Object/1 changes all that. It is the first and only development tool specifically created to work with Presentation Manager, and other

graphical interfaces such as WINDOWS and X Windows.

Object/1 provides you with a rich object-oriented programming language, a debugger and other utilities, and a sophisticated forms painter that enables you to build graphical front ends for your applications. What's more, Object/1's interfaces to database engines like SQL Server and MDBS IV allow you to write OS/2 applications by pointing and clicking instead of writing miles of code.

How good is new Object/1? According to Steve Ballmer, Executive

VP of Systems Software for Microsoft, "Object/1 makes it easy to develop applications that combine the power of Microsoft SQL Server with the graphical user interface of OS/2 Presentation Manager." And Object/1 was named 1989 Product of the Year by the Swedish magazine *Data Teknik* while it was still in beta testing.

Call **1-800-323-3629** for a free technical white paper on new Object/1. International inquiries, call (317) 447-1122. With today's skyrocketing demand for GUI applications, it's time to get clicking.



Object/1 • MDBS IV • KnowledgeMan/2 • GURU
1834 Walden Office Square, Schaumburg, IL 60173
(800) 323-3629/(708) 303-6300/FAX (708) 303-6830

mdbs, Object/1, MDBS IV, KnowledgeMan/2, and GURU are registered trademarks of mdbs, Inc. Other brands and product names are registered trademarks of their respective holders.

Circle 332 on Reader Service Card (RESELLERS: 333)

World Radio History

higher and higher addresses. Furthermore, adjacent m-nodes referenced adjacent memory blocks. That—and the fact that the m-node list was doubly linked—made the compaction algorithm easier to code.

I borrowed the most significant bit from the next and previous m-node point-

er words to act as status indicators. I used one to indicate when the m-node was pointing at a used block, and another to indicate if the block was locked (i.e., could not be moved during compaction).

As far as the m-node is concerned, not much has changed in this updated version (see figure 2). The only real alter-

ation is that I've now stolen 2 bits each from the top of the next and previous pointers. (In case you're worried that this has reduced the number of m-nodes that the linked list can bear, don't. Fourteen bits is still enough to reference 16,000 m-nodes, the maximum number that you'd be able to fit in a single 64K-byte segment anyway.)

The 2 bits at the high end of the *previous m-node* field are the status bits, as before; they tell if the block is in use and, if so, whether it is locked or movable. The two highest bits of the *next m-node* field indicate the current location of the memory block that the m-node references, whether it's in system memory, EMS memory, or the swap file. Whenever the system has swapped out a memory block and the application program tells the memory manager to go fetch that block, the memory manager looks at the location bits to see where it put the data. Consequently, the format and contents of the base address pointer change if the referenced block is either in EMS or on the disk.

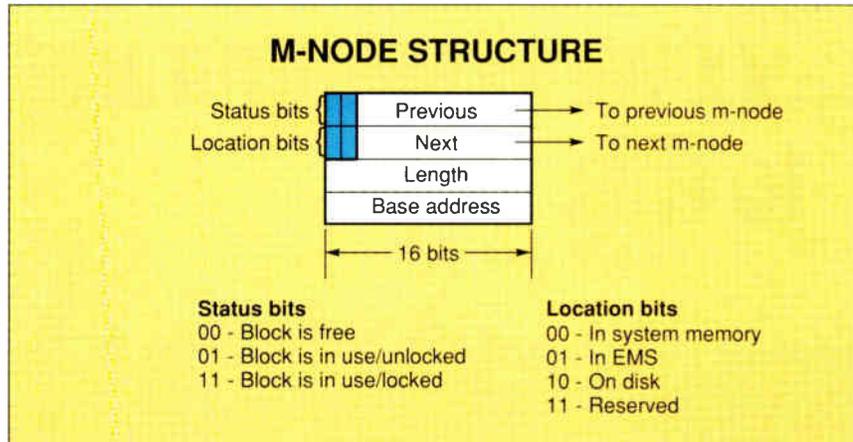


Figure 2: M-nodes are "tags" for memory blocks, whether those blocks are in the heap (in system memory), in EMS memory, or on the disk.

EMS and MATs

Rather than attempt to treat EMS memory as an extended heap, the memory manager subdivides each 16K-byte page of EMS memory into 128 blocks of 128 bytes (see figure 3). The first two blocks on an EMS page (i.e., at the lowest memory address) hold a table of 16-bit pointers. I'll call this table and in honor of the disk file allocation table), and I'll refer to the pointers as MAT entries. Each MAT entry "manages" one of the 128 remaining blocks in the page.

MAT entries serve as members of linked lists. The low 9 bits of a MAT entry hold the next EMS page in the list, while the high 7 bits hold the 128-byte block number on that page. When you initialize the memory manager, all the EMS memory it is able to obtain is free, so all MAT entries are placed on a single, huge, free list. As the manager moves data into EMS, it pulls MAT entries off the free list one by one, copies data into the corresponding block in EMS memory, and links the MAT entries into another list anchored by an m-node.

This explanation demands an example. Suppose the memory manager has determined that it must move a 256-byte memory block into EMS memory. The program checks at the head of the free MAT entry list and, from that, determines the page and block number of the first free MAT entry. The program then

continued

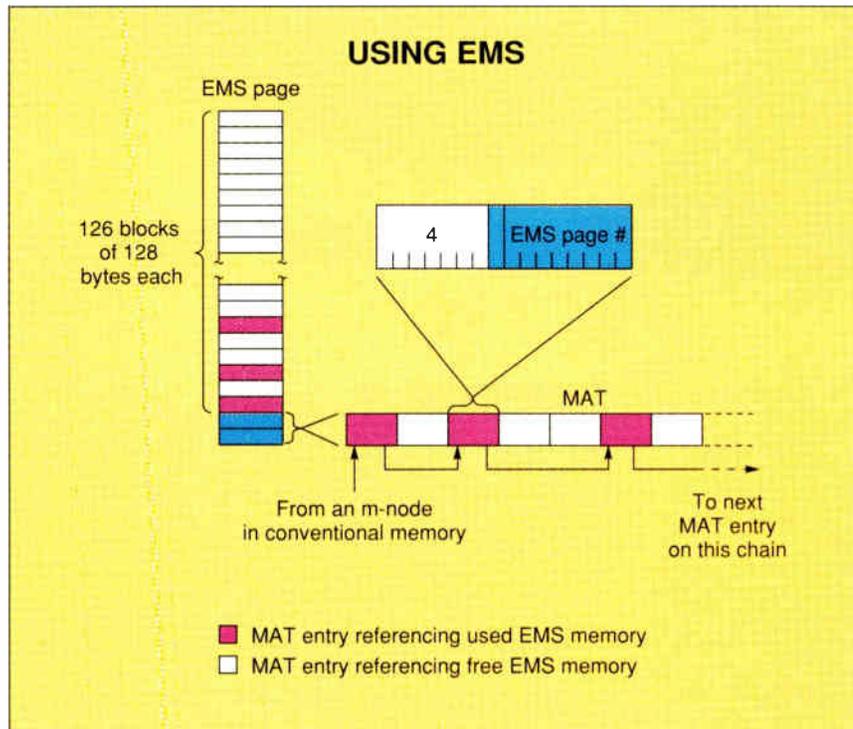


Figure 3: Each 16K-byte EMS page is divided into 128 blocks of 128 bytes each. In this figure, a chunk of heap memory has been swapped to EMS memory, and its data occupies EMS blocks 2, 4, and 7 on this EMS page. The MAT entries form a chain, linking the pieces of the data. Each MAT entry carries the EMS page number and block offset of the next entry in the chain, so MAT entry chains can stretch across several EMS pages.

Using EMS

The memory manager described in this month's article uses a subset of all the functions provided by EMS 4.0. Furthermore, the technique by which the memory manager swaps data between the heap and EMS is not the only way to do it; depending on the final application, there could well be more efficient uses of EMS as swap space than the one I've chosen.

It's easiest to think of EMS memory as memory that's "off to the side"; DOS isn't aware of it until the expanded memory manager (EMM) goes to get it. You can have up to 32 megabytes of EMS memory available (my memory manager will attempt to grab, at most, 8 megabytes), carved into blocks of 16K bytes each. Such a block is referred to as a *page*.

Before a program can use EMS, it must first verify that an EMS driver is present in the system. You do this by calling function 35H of the standard DOS INT 21H; this is the DOS function for retrieving an interrupt vector. Specifically, you're looking for the interrupt vector for interrupt 67H—the interrupt that an EMM drive (if present) will connect through. So, the call looks like this:

```
MOV     AL,67H
MOV     AH,35H
INT     21H
```

and when it returns, the ES register will contain the segment where the driver starts. Ten bytes into that segment, your program should find the string "EMMXXX0." If that string isn't there, no EMS driver is in the system. Usually, this is sufficient to proceed. But if a program is overly cautious, it might execute an INT 67H with the AH registers loaded with a 40H. This is the EMS *get status* function; it returns information in the AH register that indicates whether the EMS hardware and software are operating properly.

Your program's next job is to find out if there's enough EMS memory free for whatever task the application has lined up. For this, you call the EMS *get unallocated page count* by issuing an INT 67H with the AH register loaded with 42H. On return, you'll find the total number of EMS pages in the DX regis-

ter, and the number of unallocated pages (i.e., those not already claimed by someone) in the BX register. If there is enough EMS memory, your program should then load BX with the number of pages it wants and issue an INT 67H with AH loaded with 43H, the *allocate pages* function. (All EMS functions return an error code in the AH register. It's 0 if the function was successful. I'm assuming that your program is checking AH after each call to EMS to verify that things are running smoothly.)

The *allocate pages* function returns a *handle* in the DX register. Actually, the handle is in the low 8 bits of the DX register, but the EMS specification forbids your program to modify the upper 8 bits of a handle. This handle is a unique number between 1 and 255 that identifies the set of EMS pages you've just allocated. Of course, your program can simply grab all the pages it needs up front and use only one handle (this is what my memory manager does). Or, you might want to logically group portions of EMS memory so that pages used by one set of routines are referenced by one handle, while pages used by another group of routines are referenced by another handle.

To actually use your EMS pages, you "map" them into a region of memory below the 1-MB horizon referred to as the page frame. Here's where you get into a distinction between *logical* and *physical* pages.

A logical page is a member of that set of pages you have allocated. The EMS gave you a handle to that set. You reference a logical page by a sequence number; so if you allocated n pages, the sequence numbers range from 0 to $n-1$.

A physical page refers to the location in conventional memory where the logi-

cal page will "appear" when you map it in. Typically, the physical pages are located in the page frame, which shows up at the 768K-byte mark, just above the video memory region and adapter card memory. Physical pages are the same size as logical pages and are numbered from 0 up through the number of physical pages that the EMS driver supports. (The location of physical pages is not this restricted across all EMS implementations, and there are EMS functions that return the addresses of physical page locations.)

So, if you want access to logical page 4 through physical page 0, your program would execute the following:

```
MOV     AH,44H
MOV     AL,0
MOV     BX,4
MOV     DX,handle
INT     67H
```

where *handle* is the handle that EMS gave you when you allocated your logical pages. When this code fragment executes, logical page 4 is accessible at memory location C000:00 (768K).

Finally, when your program is finished with EMS memory, it's a good idea to return the memory to the system. You do this by issuing an INT 67H with the AH registers set to 45H and the DX register holding the handle. This is the *deallocate pages* function, and it releases pages your program had commandeered. Without it, successive execution of programs would claim more and more EMS memory until the well simply dried up.

Of course, there are many more EMS functions than those I've covered here. Your program can alter the page size—in which case you'll be dealing with what are referred to as "nonstandard pages." There are even powerful block move functions that allow you to blur the lines between the pages: Your program can copy chunks of memory larger than 16K bytes to and from EMS (or from one location in EMS to another), and the driver will handle the details of the data spilling over the top of one logical page and into the bottom of the next logical page, as well as deal with the headaches of overlapping source and destination.

To actually use your EMS pages, you "map" them into the page frame.

SOME ASSEMBLY REQUIRED

BBS Sysops

- Are you looking for ways to improve your board? Something that will set you apart from other boards in your area?
- Are your subscribers interested in Microcomputers? Listen to this!

Announcing the Bulletin Board EXchange

The Bulletin Board Exchange allows you to become a publisher of Micro-BYTES Daily, an on-line news service from BYTE. Bulletin Board Exchange/MicroBYTES is a custom package of news and features designed especially for local BBSes, and is available only to sysops.

Every Monday through Friday you get articles about developments in micro-computing, telecommunications and selected new product announcements. Get the latest news about MS DOS machines, Macintoshes, Unix workstations, Amigas, Atari STs, peripherals and software. All the stories are reported, written, and edited by the staff of BYTE Magazine, BYTEweek and BIX, and our world-wide network of reporters and editors.

Not only do you get a great resource for your subscribers, but you also get access to BIX which will cut your cost of exchanging information and conducting BBS network business.

All this is just \$49 a quarter.

Your one-year subscription to the Bulletin Board Exchange (billed quarterly) may be cancelled any time without further charge; just notify us. If you prefer, you may subscribe for three months only, at just \$69.

If you call BIX direct, you pay no hourly telecommunications charge. If you call using Tymnet, the rates are only \$3/hour on evenings and weekends and \$6/hour on weekdays. You may also purchase unlimited off-peak Tymnet for just \$20 a month.

Subscribe today.

BIX

One Phoenix Mill Lane
Peterborough, NH 03458
800-227-2983
In NH 603-924-7681

loads the associated page into the page frame and copies the first half of the 256-byte block into the 128-byte EMS block referenced by the MAT entry. It does the same with the second half of the 256-byte block: locating a free MAT entry, loading the page, and copying the data in.

Next, the memory manager sets the first MAT entry's contents to point to the second MAT entry, thus constructing a chain that links together the two halves of the original 256-byte block. The memory manager anchors this chain to the m-node that originally pointed to the 256-byte block by linking the first MAT entry into the m-node. This linking process is simply a matter of copying the MAT's page/offset word into the m-node's base address field. Finally, the memory manager detaches the m-node from the in-use list and makes its associated heap memory available for use.

Of course, the software has set the original m-node's status bits to indicate that the data referenced by that m-node is now off in EMS memory. So, the next time the application wants that data in memory, the memory manager looks in the m-node, sees that the data is in EMS memory, and follows the chain of MAT entries to pull the data back together.

Swap File

Once conventional memory has been consumed, the memory manager takes a whack at moving things out to EMS memory. If EMS memory is either not present or filled, the memory manager turns to the swap file on the disk. (The reason for the system's choice of EMS memory over the disk should be obvious: speed.)

Memory is kept in the swap file in 1026-byte records. The arrangement is illustrated in figure 4, and you can see

that the first 2 bytes of each record serve to hook the records together in yet another singly linked list. The list is anchored by an m-node in memory that points to the last record of the list—the base address field of the m-node holds the record number. When swapped out to disk, a memory block from the heap is spread through the swap file in a chain of 1K-byte records. As you can see, swapping to disk works conceptually just like swapping to EMS memory.

Perhaps you found it odd that the m-node points to the last record of the list (by "last" I mean that record holding the data that is loaded at higher addresses when the block is in the heap). I chose this scheme to minimize the disk's head movement as records are being written out. If the records were connected by forward links—with the m-node pointing to the first record of the list—imagine what would happen as a memory block was being written out. The memory manager would write out the first record, allocate the next record, go back to connect the first record to the second, return to the second record to load it with data, allocate the third, and so on. Before the memory manager could write a new record, it would have to go "back" to the previous record to build the forward link.

In my scheme, the memory manager simply remembers the record number just written and writes the backward link followed by the actual data in one swoop. The moral: It is easier to remember where you came from than to know where you're going.

Conceptually, swapping to disk works just like swapping to EMS. A block from the heap is carved into 1K-byte chunks that are moved out to the disk. On the disk, these chunks are connected by a

continued

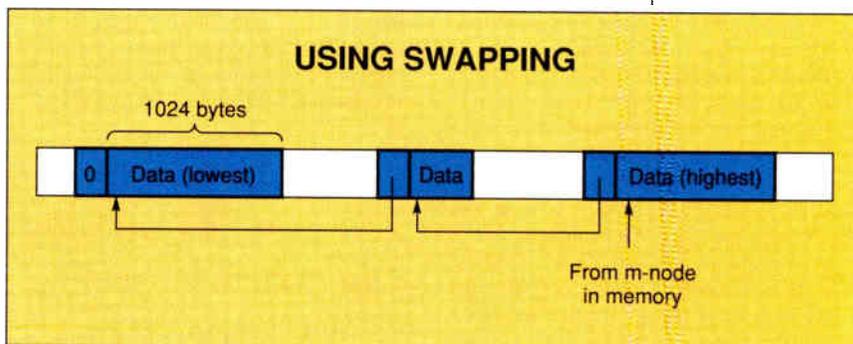


Figure 4: The swap file is divided into records of 1K + 2 bytes. The first 2 bytes serve as links in a backward-pointing chain. Data swapped out of the heap is chopped into 1K-byte pieces when written to the swap file. Note that the head of the chain actually begins with the record storing the data to be loaded highest in memory.

Power

Incredible Value!



Don't take our word for it, take theirs...



"Do you know what the underground bargain C compiler of this year is? It's the Mix Power C compiler. For under \$25 with shipping, it is one heck of a good compiler!"

Victor Schneider
Dr. Dobb's Journal, June 88 (Letter to the editor)

"Overall, Power C's performance is remarkable for the price. Quite compatible with the Microsoft C and Turbo C "standards", Power C is a heavyweight contender in the educational, hobbyist, and perhaps even the professional market — at a bantamweight price."

Stephen Davis
PC Magazine, September 13, 88 (Review)

"Power C is an unbelievable product for \$19.95, and is very competitive with Turbo C, Microsoft C, and Microsoft's new Quick C in both features and performance. It is excellent for the beginner who wants to learn C, or for the experienced programmer who wants to develop professional applications. The manual alone is worth the price of this package, and the generous library source code and assembler offer adds to the value of it. If you have any desire to program in C, or want a more powerful C compiler, get a copy of Power C!"

Michael Cortese
Computer Shopper, August 88 (Review)

"The Ctrace debugger is where Mix really shines. It is magnificent. It's not only better than the stripped down debugger Microsoft includes with Quick C, it's better than the full debugger Microsoft provides with its high-end compiler (Codeview)."

David Weinberger
Computer Shopper, November 88 (Review)



Circle 188 on Reader Service Card

Technical Specifications

Power C includes: Power C compiler with integrated Make, Power C Linker, Power C Libraries (450 functions), the Power C book (680 pages), and support for...

- ANSI standard
- IEEE floating point
- 8087/80287 coprocessor
- auto-sensing of 8087/80287
- automatic register variables
- unlimited program size
- mixed model (near & far pointers)
- graphics on CGA, EGA, VGA, & Hercules

Optional Products:

- Power Ctrace debugger
- Library source code
- BCD business math

Order now by calling our toll free number or mail the coupon to Mix Software, 1132 Commerce Drive, Richardson, TX 75081.

1-800-333-0330

For technical support call: 1-214-783-6001

Minimum System Requirements:
DOS 2.0 or later, 320K memory, 2 floppy drives or hard drive.
Runs on IBM PC, XT, AT, PS/2 and compatibles.

60 day money back guarantee

Name _____
Street _____
City _____
State _____ Zip _____
Telephone _____
Paying by: Money Order Check
 Visa MC AX Discover
Card # _____
Card Expiration Date _____
Computer Name _____ Disk Size 5 1/4" 3 1/2"
Product(s) (Not Copy Protected)
 Power C compiler (\$19.95) \$ _____
 Power Ctrace debugger (\$19.95) \$ _____
 Library Source Code (\$10.00) \$ _____
(includes assembler & library manager)
 BCD Business Math (\$10.00) \$ _____
Add Shipping (\$5 USA - \$20 Foreign) \$ _____
Texas Residents add 8% Sales Tax \$ _____
Total amount of your order \$ _____

IEEE-488

You can control any IEEE-488 (HP-IB, GP-IB) device with our cards, cables and software for the PC/AT/386, EISA, Micro Channel and Macintosh II. You get fast hardware and software support for all the popular languages, plus a software library of time saving utilities. Instrument control has never been easier.

FREE
Informative Catalog 800-234-4232
Applications help (617) 273-1818

cec Capital Equipment Corp.
Burlington, MA. 01803

Micro Channel is a trademark of IBM

The key is to identify local behavior in programs. Before a program enters a loop that accesses blocks that have already been allocated, lock those blocks.

chain of pointers ultimately linked to an m-node.

Lock Those Blocks

Anytime a system gets this complex, loopholes appear. In particular, suppose you've maxed out system memory, and you make a request for a 16K-byte block. Well, the memory manager will first try a compaction—which will fail—and then it will proceed from the high end of memory, swapping unlocked blocks out to the disk. Let's say it swaps out two 8K-byte blocks, freeing up enough space for your 16K-byte request. You store some data in your newly acquired 16K bytes, and then you turn around and request something out of one of the 8K-byte blocks that just got swapped out to disk. Well, the system has to go back, move the brand-new 16K-byte block out, and move that 8K-byte block back in. You could be in for some thrashing, as a small subset of memory blocks are swapped back and forth.

The solution is to lock the memory blocks that you expect to access frequently. This will keep them from getting swapped out. In the example I just gave, if you lock the 16K-byte block as well as the two 8K-byte blocks, some other blocks (that we will presume are not currently being accessed by the program) will be swapped out instead.

The key is to identify local behavior in your programs. Before your program enters a tight loop that accesses several blocks that have already been allocated, lock those blocks. In this way, they won't get swapped, and your program won't have to be continuously passing through the handle-to-address calculation routine.

continued

Introduction

C++ / ViewsTM
for Microsoft Windows

An application development framework with the most complete C++ object class library for MS Windows development.

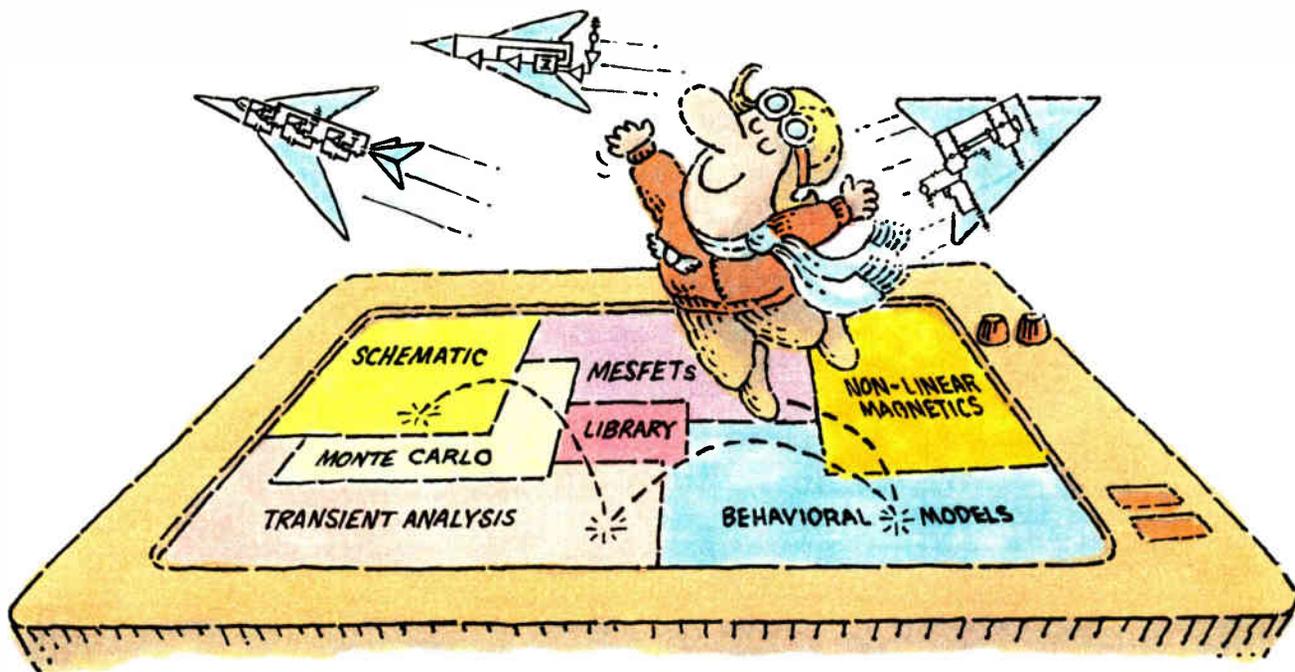
A powerful object oriented development environment with the first, fully functional object class Browser for C++.

A cost-effective and essential productivity tool for the next generation of software systems. Order today at the introductory price of \$495.00 (plus shipping). Comes with full source code for over 60 classes - NO Royalties.

CNS, Inc. - Software Products
7090 Shady Oak Rd., Minneapolis, MN 55344
612-944-0170, Fax 612-944-0923



... providing and advancing object-oriented methodology.



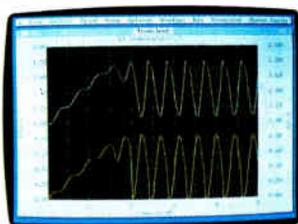
THE NEW MICRO-CAP III.TM SO YOU CAN TEST-FLY EVEN MORE MODELS.

It wasn't easy. But we did it. Made the long-time best-selling IBM® PC-based interactive CAE tool even better.

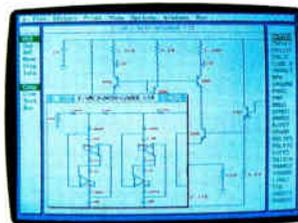
Take modeling power. We've significantly expanded math expression capabilities to permit comprehensive analog behavioral modeling. And, beyond Gummel Poon BJT and Level 3 MOS, you're now ready for nonlinear magnetics modeling. Even MESFET modeling.

Analysis and simulation is faster, too. Because the program's now in "C" and assembly language. That also means more capacity — for simulating even larger circuits.

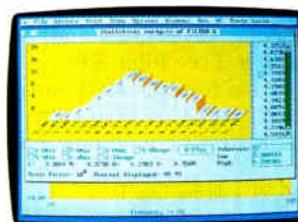
As always, count on fast circuit creation, thanks to window-based operation and a schematic editor. Rapid, right-from-schematics analysis — AC, DC, fourier and transient — via SPICE-like routines. The ability to combine digital/analog circuit simulations using integrated switch



Transient analysis



Schematic editor



Monte Carlo analysis

models and parameterized macros. And stepped component values that streamline multiple-plot generation.

And don't forget MICRO-CAP III's extended routine list — from impedance, Nyquist diagrams and BH plots to Monte Carlo for statistical analysis of production yield. The algebraic formula parsers for plotting virtually any function. The support for Hercules, CGA, MCGA, EGA and VGA displays. Output for plotters and laser printers.

Cost? Still only \$1495. Evaluation versions still only \$150. Brochure and demo disk still free for the asking. Call or write for yours today. And see how easily you can get ideas up and flying.

SPECTRUM

1021 S. Wolfe Road
Sunnyvale, CA 94086
(408) 738-4387

Circle 272 on Reader Service Card

Finale

You might be tempted to try your hand at more complex swapping algorithms; I'm sure plenty abound. But beware: You'll be treading into the domain of the classic knapsack problem (see my June "Cloak and Data" column).

Imagine that you are given a box (dimensions specified) for which you have to select blocks from a pile of random sizes. The selection must fit the box with the least wasted space. You are into a problem that—in the general case—is computationally intractable. But this is precisely the sort of situation you face when trying to determine what combination of blocks in the heap would satisfy a given memory request. Unfortunately, an algorithm to solve such a problem in a reasonable amount of time doesn't exist. If it did, you could immediately rewrite the memory manager to be vastly more efficient than what I've provided.

Another approach at improving the swapping routine would be to add some sort of usage information to the m-node. This would enable you to put together a least-recently-used (LRU) swapping algorithm, so that freshly allocated blocks

would tend not to be immediately swapped out (this would ease the thrashing headache I mentioned in the preceding section).

There would be an added complication: Currently, since the swapping routine swaps out blocks from the high end of the heap, it does not have to pass through another compaction to consolidate freed memory. In the general case, an LRU swapping algorithm would require a second compaction after the swap took place, since newly created (and therefore unswappable) blocks would have the effect of partitioning freed memory.

You may also want to modify the program's swap size. I chose a small size for EMS memory to reduce fragmentation; on average, there will be fewer unused bytes at the end of the last 128-byte EMS block in a chain than, say, a 1K-byte block. I chose a larger size for the disk to reduce access time (I was much less concerned about EMS access time). Had I chosen a small swap size for the disk, swapping out a large block would have required multiple disk accesses.

Of course, this means that there are

more unused bytes at the end of the last disk block in a chain. Your application may allocate most of the memory it needs in chunks that are—on average—only 500 bytes. You may therefore want to set the disk swap size to, say, 512 bytes. Better yet, you could modify the memory manager so that, at initialization time, the application tells the memory manager what swap size to use for both disk and EMS. ■

Editor's note: *The routines described in this column are written in 8088 assembly. The complete source includes an interface to Turbo C (for MS-DOS). It is available in a variety of formats. See page 5 for details.*

Rick Grehan is the director of the BYTE Lab. He has a B.S. in physics and applied mathematics and an M.S. in computer science/mathematics from Memphis State University. He can be reached on BIX as "rick_g."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Save "Man-Years of Effort" with Turbo 5.5

Don't Start from Scratch with Object-Oriented Pascal

Object Professional is a huge library of over 200 object types and 2000 methods that will multiply your productivity. Window object types let you use overlapping and resizable windows. The windows include ■ scrolling data entry screens ■ pick lists ■ menus ■ file selection ■ printed forms ■ help capability and more.

Build your programs using proven data object types like stacks, linked lists, virtual arrays, and more. System-oriented routines provide swappable TSRs in only 6K of RAM, EMS management, and much more.



Object Professional includes clear, comprehensive documentation, on-line help, full source code, technical support, and hot demo programs. Pay NO royalties. You'll get up to speed fast with OOP!

"The range of objects is fantastic. Object Professional could literally save you man-years of effort."

Jeff Duntemann

Object Professional 1.0, only \$150.

A Multi-User B-Tree Toolkit

Write powerful network compatible databases faster and easier using B-Tree Filer 5.0. You'll have the fastest, safest, most flexible databases — no rigid structure, no TSR hassles, no running out

of files. And they're compatible with Novell, 3Com, MS-NET, and others.

You get ■ Fixed and variable length records ■ Two billion records per database ■ Up to 100 indexes per index file ■ Fail-safe mode with journaling ■ Units for sorting, browsing, reindexing, and network control.

B-Tree Filer includes full source code, documentation, technical support, and you pay NO royalties.

"B-Tree Filer... a well rounded, feature-rich approach to B-Tree databases."

Computer Language, 1/90

B-Tree Filer 5.0, only \$125. (single user)
With network support, \$175.

**Call toll-free to order.
1-800-333-4160**



Satisfaction guaranteed or your money back within 30 days. Add \$5 per order for shipping in U.S. and Canada. Inquire about other shipping charges. OPro requires Turbo 5.5. BTF requires Turbo 4.0, 5.0, 5.5, or QuickPascal.



RAM - 5PM PST Monday through Friday, USA & Canada. For more information call (408) 438-8608. Fax: (408) 438-8610. TurboPower Software PO Box 66747 Scotts Valley, CA 95067-0747

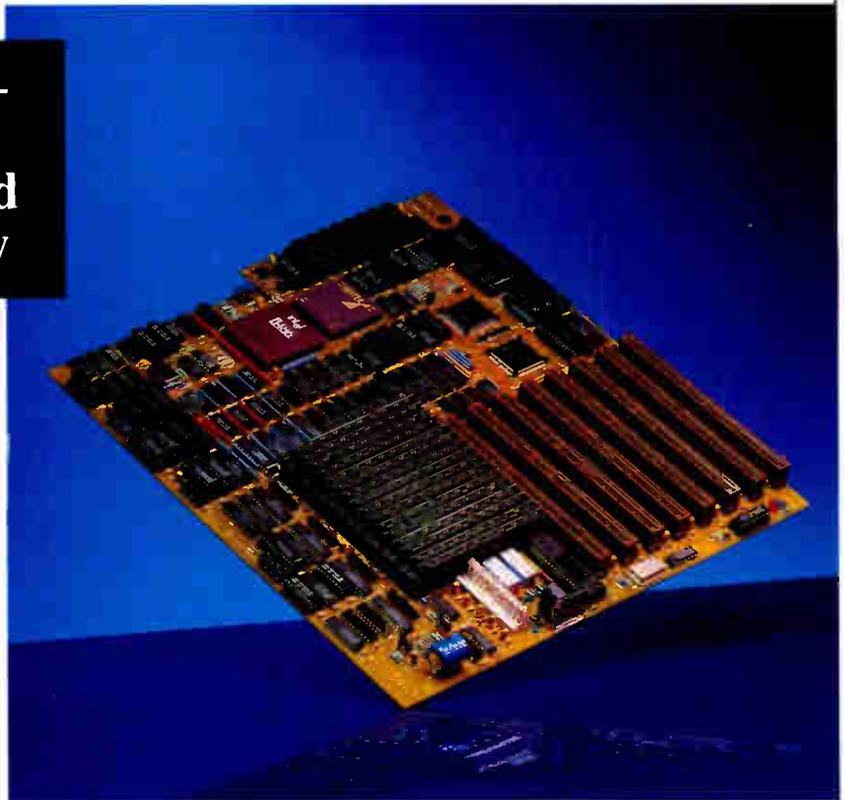
Unchartable Performance

Sun workstations...move over.
The Micronics 80486-33 EISA board is here.

- **Landmark 148+**
- **14 MIPS**
- **64MB On-board SIMM Capacity**

Fast. Micronics' 486 system board is designed for true 33MHz operation. The Micronics design also supports both the 80486 CPU burst mode and EISA burst mode for maximum CPU performance. It has write-through cache, which is essential for EISA bus architecture where DMA is frequently used. The write-through cache continually updates both cache memory and RAM memory so that after a DMA operation, the cache memory is always validated.

Powerful. Performing with 32-bit processing power, the Micronics 80486-33 EISA "machine" provides RISC-like performance in a CISC architecture. An ideal platform for UNIX/XENIX time sharing systems, high performance CAD/CAE and file servers. The 80486 EISA is also perfect for OS-2 Presentation Manager and X-Windows applications.



Solid. The 80486-33 EISA features 8 expansion slots with 6 EISA bus master slots, all of which allow for seamless integration of 16-bit and 8-bit AT/ISA I/O cards. Additionally, you'll have no more worries when your memory needs intensify. The 80486-33 EISA provides over ten various memory capacity choices from 1 to 64MB on-board! These memory configurations utilize 256K, 1MB or 4MB SIMM memory concurrently.

Micronics offers a complete line of advanced quality engineered 80386 and 80486 system boards.

*Watch us run
Landmark off the scale.*

MICRONICS
COMPUTERS INC.

232 E. Warren Avenue, Fremont, CA 94539
(415) 651-2300 Fax (415) 651-5666

Intelligent multiport, supports RS-422

SmartLynx AT™ intelligent 4-port serial adapter for PC-AT and compatibles supports RS-422 and most multi-user operating systems. On-board processor takes burden off CPU.

For order info, call:
1-800-553-1170



662 Wolf Ledges Parkway
Akron, OH 44311

PC-AT is a trademark of IBM Corporation.

Circle 237 on Reader Service Card

Eight Serial Ports One Board

Quatech's ES-100 provides eight RS/232 serial ports in a single AT slot. RJ-11 modular connectors. 16450 UARTS are standard. Optional buffered 16550 UARTS. PC-AT, ISA, or EISA compatible. Priced below \$500! Quantity Pricing Available!

Call for our PC Interface Handbook:
1-800-553-1170



662 Wolf Ledges Parkway
Akron, OH 44311

PC-AT is a trademark or registered trademark of IBM Corp.

Circle 238 on Reader Service Card

RS-422/RS-485 Boards for AT, Micro Channel

RS-422/RS-485 asynchronous serial communication boards from Quatech! available in 1 to 4 ports for PC-AT and compatibles and 1 to 4 ports for PS/2 Micro Channel.

Call for our free
PC Interface Handbook:
1-800-553-1170



662 Wolf Ledges Parkway
Akron, OH 44311

PC-AT, Micro Channel, and PS/2 are trademarks or registered trademarks of IBM Corp.

Circle 239 on Reader Service Card

Synchronous Communication Boards for AT

Quatech synchronous/asynchronous serial boards for PC-AT and compatibles support RS-232, RS-422, and RS-485 communication.

Call for our free
PC Interface Handbook:
1-800-553-1170



662 Wolf Ledges Parkway
Akron, OH 44311

PC-AT and PC are registered trademarks of IBM Corp.

Circle 240 on Reader Service Card

Communications Data Acquisition



"PC-AT (ISA) Interfaces"



"PS/2 Micro Channel Interfaces"



Phone: (216) 434-3154 • FAX: (216) 434-1409
TELEX: 510-101-2726

PC-AT, PS/2 and Micro Channel are registered trademarks of IBM Corporation.

Circle 241 on Reader Service Card

Digital I/O Board

Single-slot Quatech PXB-721 for PC-AT has 72 digital I/O lines. Connect three choices of data acquisition modules. Supports Labtech Notebook™

Call for our free
PC Interface Handbook:
1-800-553-1170



662 Wolf Ledges Parkway
Akron, OH 44311

Labtech Notebook is a trademark of Laboratories Technologies Corp.

Circle 242 on Reader Service Card

Joystick Adapter for PS/2

GPA-1000 works with IBM Micro Channel for PS/2 Models 50, 60, 70, and 80. Connect two joysticks or four paddles. Also compatible with IBM Game Control Adapter for PC-XT and AT.

Call our toll free order line:
1-800-553-1170



662 Wolf Ledges Parkway
Akron, OH 44311

IBM, Micro Channel, PS/2, PC-XT, AT, and Game Control Adapter are trademarks or registered trademarks of IBM Corp.

Circle 243 on Reader Service Card

2 parallel, 2 serial, 1 board

Quatech DSDP-402 for PC-AT has two parallel ports, and two serial ports for any combination of RS-232, 422, and 485 communication. DSDP-100, two parallel and two RS-232 ports, available at lower cost.

For order info, call:
1-800-553-1170



662 Wolf Ledges Parkway
Akron, OH 44311

Circle 244 on Reader Service Card

Wave Form 20MHz - 32K \$1290

The WSB-100 Wave Form Synthesizer Board from Quatech has the best set of numbers in the market. With speed to 20MHz and a 32K memory at \$1290, it's making waves in more ways than one. The WSB-100 is also a star performer as a digital pulse/word generator with the optional digital module.

Call for our free
PC Interface Handbook
1-800-553-1170



662 Wolf Ledges Parkway
Akron, OH 44311

Circle 245 on Reader Service Card

BYTE

PRODUCT SHOWCASE

- BUYER'S MART
- BYTE BITS
- PRODUCT SPOTS
- MICRO PRODUCT CENTER
- CATALOG SHOWCASE



Catalog Showcase

Order your copies of the most current catalogs from the market leaders

Order directly from the advertiser, or

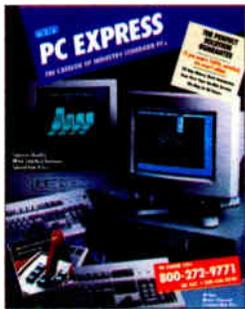
Circle the company's inquiry number on the Reader Service card in the back of the issue, or

Use the Fax response page for quicker delivery.

Advertisers: The Catalog Showcase is the most effective low-cost way to promote your product line to an influential audience.

Call Scott Gagnon for more details.
(603) 924-2651 Fax: (603) 924-2683

WLT PC EXPRESS



Standard with all of our PCs

- 3 years on-site service, free
- 3-year warranty, free
- Lifetime telephone support, free
- 30-day money-back guarantee

Call for our catalog of industry standard 286, 386, MCA PCs
1-800-272-9771

Circle 341 on Reader Service Card

Intel Development Tools



Choosing the right architecture and development support are two of the most important decisions you face today. For successful microcomputer development, Intel offers you the total solution with the most up-to-date and powerful tools available.

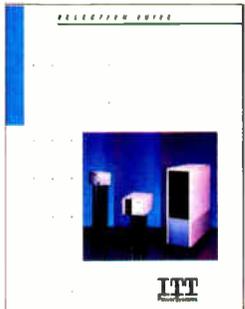
And we also offer you the easiest way to buy. Our Development Tools Catalog lists all our tools products in one guide. Call us at 1-800-874-6835, or FAX us at 503-696-4633 to get your free copy today.

Intel Corporation, Development Tools Operation, 5200 NE Elam Young Parkway, JF1-15, Hillsboro, OR 97124

1-800-874-6835 FAX 503-696-4633

Circle 149 on Reader Service Card

ITT POWERSYSTEMS CORP.



The ITT PowerSystems Selection Guide provides a brief description of ITT's full line of Uninterruptible Power Supplies (UPS), Standby Power Systems (SPS), and Power Line Conditioners (PLC). Complete technical specifications for each product line along with ordering information is also included in this four-color brochure. For your free copy, call (602)889-7600 or write ITT PowerSystems, 3400 E. Britannia Drive, Suite 122, Tucson, Arizona 85706.

1-602-889-7600

Circle 151 on Reader Service Card

Jensen Tools Inc.



Tools, Tool Kits, Cases and Test Equipment

Computer/electronic tools, tool kits, and test equipment are detailed in a new Catalog, free from Jensen Tools. Included are state-of-the-art field service systems and diagnostic software; tools and test equipment for servicing computers, telecommunication systems, LANs, and other electronic equipment; cases and shipping containers, soldering supplies, static control products, work holding devices and more.

For a free catalog, write or call Jensen Tools Inc., 7815 S. 46th Street, Phoenix AZ 85044.

1-602-968-6231

Circle 154 on Reader Service Card

Strawberry Tree



Data Acquisition and Control

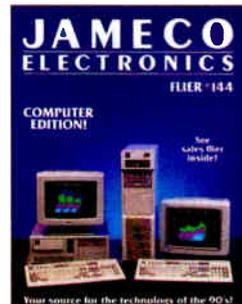
Catalog of data acquisition and control hardware and software for IBM and Macintosh computers for process control or laboratory measurement of thermocouple temperature, voltage, current, and chromatography analysis. The catalog includes WorkBenchMac™ and WorkBench PC™ software for data acquisition and control using a revolutionary new icon-based graphical interface.

Strawberry Tree, 160 South Wolfe Road, Sunnyvale, CA 94086

1-408-736-8800

Circle 345 on Reader Service Card

Jameco Electronics



**30-day Money-back Guarantee...
Large Selection, Competitive Prices...
High Quality Technical Assistance...**

Our staff of 30 technicians is on hand eight hours a day to answer your technical questions before and after your purchase.

99.99% of all Products are in stock...
Jameco stocks over 4,000 different products. 99.99% of these products are available for off-the-shelf shipment at any time.

Fast Shipment...
Most orders shipped within 24 hours. Guaranteed shipment within 48 hours for all in-stock items.

1-415-592-8097

Circle 342 on Reader Service Card

Catalog Showcase

Best Power Technology, Inc.

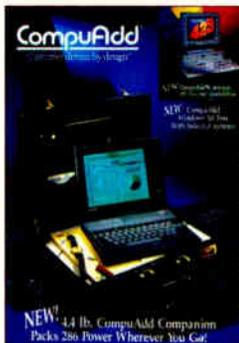


FREE, money-saving literature tells you how to protect your computer from power problems such as surges, sags, spikes, noise, brownouts, blackouts and lightning. These power problems can damage delicate equipment and cause loss of valuable data. Learn how Best Power Technology's uninterruptible power systems, ranging from 500 VA to 18 KVA, can protect your computer. Contact: Best Power Technology, Inc., P.O. Box 280, Necedah, WI 54646.

1-608-565-7200, ext. 1766
Toll-free 1-800-356-5794, ext. 1766

Circle 343 on Reader Service Card

CompuAdd

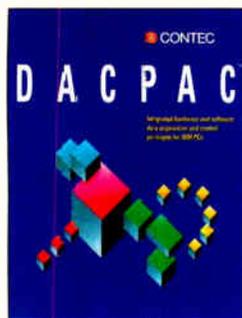


Get the news from CompuAdd! New 486 power with the CompuAdd 425, new computing convenience with the CompuAdd Companion notebook and 316SL laptop systems. From the industry leader in mail order sales and service, the CompuAdd catalog offers systems, kits, upgrades, software, accessories and hundreds more items. All with the unequalled CompuAdd value: the best price/performance ratio plus our famous guarantees and service.

1-800-477-9707

Circle 344 on Reader Service Card

Contec U.S.A. Inc.



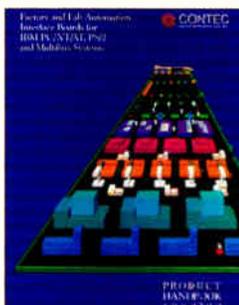
PC Data Acquisition Packages

Contec, the world's largest supplier of PC data acquisition interfaces, has available easy-to-install hardware and software data to allow IBM-compatible PCs to be used for acquiring data on temperature, pressure, flow, count, and from any RS232 instrument.

1-800-888-8884

Circle 72 on Reader Service Card

Contec U.S.A. Inc.



PC Data Acquisition Boards

Contec, the world's largest supplier of PC data acquisition interfaces, offers a free 150-page catalog on its range of IBM PC data acquisition and control boards, software, and accessories.

1-800-888-8884

Circle 73 on Reader Service Card

B&B Electronics Catalog



We help you solve RS-232 problems.

The free B & B Electronics Catalog is full of RS-232 Interfaces: RS-232 to RS-422 converters, RS-232 to Current Loop converters, Modem Security Devices, Splitters, Combiners, Four Port Switches, and many, many more RS-232 problem solvers.

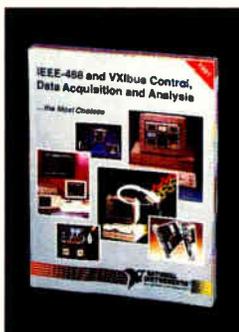
Pre- and post-sale technical support. Most items shipped within 24 hours. Direct from manufacturer to you. Money-back guarantee. One-year warranty.

Contact us for custom designs also. B & B Electronics Mfg. Co., 4050J Baker Road, PO Box 1040, Ottawa, IL 61350.

1-815-434-0846

Circle 34 on Reader Service Card

National Instruments



Free 488-page full-color catalog describing instrumentation hardware and software products for personal computers and workstations. Application software for data analysis and presentation and for collecting data using instruments and plug-in boards. Features GPIB interfaces, data acquisition and DSP boards, driver level software, signal conditioning and VXI controllers.

1-512-794-0100

Circle 198 on Reader Service Card

BYTE Catalog Showcase



The Catalog Showcase was created as a service to our readers, making it easy for them to locate and order the catalogs they need.

This new program offers an efficient way to promote your product line by sending catalogs only to those who request them. Make your catalog available to the 500,000 influential readers with enormous purchasing clout within their companies.

1-603-924-2651

Circle 346 on Reader Service Card

Specialized Products Co.



Electronic tools and test equipment

Color, illustrated 250-page catalog details comprehensive selection of toolkits, test equipment, telecom equipment and datacommunication products. Special emphasis on in-house and field service. Indexed catalog shows digital multimeters, breakout boxes, oscilloscopes, BERT testers, hand tools and extensive selection of instrument and shipping cases, plus over 50 standard tool kits. Complete specifications and prices are provided for all products.

Specialized Products Company, 3131 Premier Drive, Irving, TX 75063 USA.

1-214-550-1923 FAX: 214-550-1386

Circle 271 on Reader Service Card

THE BUYER'S MART

A Directory of Products and Services

THE BUYER'S MART is a monthly advertising section which enables readers to easily locate suppliers by product category. As a unique feature, each BUYER'S MART ad includes a Reader Service number to assist interested readers in requesting information from participating advertisers.

Effective January 1, 1990.

RATES: 1x—\$590 3x—\$550 6x—\$525 12x—\$475 24x—\$450

Prepayment must accompany each insertion. VISA/MC Accepted.

AD FORMAT: Each ad will be designed and typeset by BYTE. Advertisers must

furnish typewritten copy. Ads can include headline (23 characters maximum), descriptive text (250 characters is recommended, but up to 350 characters can be accommodated), plus company name, address and telephone number. Do not send logos or camera-ready artwork.

DEADLINE: Ad copy is due approximately 2 months prior to issue date. For example: November issue closes on September 8. Send your copy and payment to THE BUYER'S MART, BYTE Magazine, 1 Phoenix Mill Lane, Peterborough, NH 03458. For more information call Brian Higgins at 603-924-3754.

ACADEMIC COMPUTING

166 MHz PC

Proprietary technologies allow us to deliver our PC compatible workstation years ahead of the industry. Take advantage of inexpensive PC software (vs. UNIX), and the performance our platform offers, to execute applications previously run on minis and supers. We're offering the first 5000 of our 1993 production units at wholesale pricing. Educational and quantity discounts.

Eclectech, Inc.

Dept. 4142, P.O. Box 12887, Research Triangle Park, NC 27709

Inquiry 581.

ACCESSORIES

RADIOACTIVE?

Plot it on your PC with The RM-60 RADIATION MONITOR. Serial or printer port. Detects: ALPHA • BETA • GAMMA • X-RAY. MicroR, 1000 times the resolution of standard geiger counters.

Excellent for tracking RAON GAS. Find sources.

Plot: • Background • Cosmic Rays • Clouds • Foods
Call/Write for PC MAGAZINE review. • TSR • GM Tube
VISA/MASTER Phone orders. Not satisfied? Full refund.

Tel: (302) 655-3800

Aware Electronics Corp.

P.O. Box 4299, Wilmington, DE 19807 \$149.50

Inquiry 582.

BIG SAVINGS ON RIBBONS!

Get 50 better-than-new ribbons for each one you buy with our new Wet Ribbon Re-inker. Easy to use. Fits most cartridges. Printer safe. Satisfaction Guaranteed.

SPECIAL OFFER! CALL TODAY!

BLUE RIBBON INK, LTD.

3773 Cherry Creek Dr. North, #500
Denver, CO 80209

(800) 477-3465 (303) 377-4655

Inquiry 583.

CUT RIBBON COSTS!

Re-ink your printer ribbons quickly and easily. Do all cartridge ribbons with just one ink! For crisp, black professional print since 1982. You can choose from 3 models: Manual E-Zee Inker — \$39.50
Electric E-Zee Inker — \$94.50
Ink Master (Electric) — \$189.00

1000s of satisfied users. Money-back guarantee.

BORG INDUSTRIES

525 MAIN ST., JANESVILLE, IA 50647

1-800-553-2404 In IA: 319-987-2976

Inquiry 584.

COMPANION AND EXTENDER

Place a keyboard and monitor up to 600' from your CPU with EXTENDER and COMPANION products. Keep a second Keyboard/Monitor at the CPU with COMPANION. Supports MDA, CGA, EGA, VGA, PS2. Uses single 3/4" cable.

Prices start at \$149.00 for EXTENDER and \$219.00 for COMPANION 25 ft. unit complete.

CYBEX CORPORATION

2800-H Bob Wallace, Huntsville, AL 35805
205-534-0011 International Fax #205-534-0010

Inquiry 585.

472 B Y T E • SEPTEMBER 1990

ACCESSORIES

HEWLETT PACKARD

Buy — Sell — Trade

Laser Jet II/III	Color Pro (7440)
Genuine HP 2 Meg4 Meg	HP-7550A
Desk Jet	Draft Pro DXL/EXL
Rugged Writer	Draftmaster III
Electrostatic Plotters C1600 (D Size)/C 1601 (E Size)	
Science Accessories Corporation Sonic Digitizers	
36" x 48" (2750)	60" x 72" (3175)

T. E. Dasher & Associates

4117 Second Ave. S., Birmingham, AL 35222
Phone: (205) 591-4747 Fax: (205) 591-1108

Inquiry 586.

ARTIFICIAL INTELLIGENCE

NATURAL LANGUAGE C LIBRARY

Increase your market share! Use JAKE to add a natural language front end to your application. JAKE translates English queries and commands into C function calls and data structures. JAKE offers context-sensitive semantic processing; interfaces easily; <64K mem.

JAKE \$495. INTERACTIVE DEMO \$10

ENGLISH KNOWLEDGE SYSTEMS, INC.

5525 Scotts Valley Dr. #22, Scotts Valley, CA 95066

(408) 438-6922

Inquiry 587.

muLISP® 87 for MS-DOS

Fast, compact, efficient LISP programming environment. muLISP programs run 2 to 3 times faster & take 1/2 to 1/3 the space of other LISPs. 450 Common LISP functions, multi-window editing & debugging, flavors, graphics primitives, lessons & help, demo programs, comprehensive manual.

Soft Warehouse, Inc.

3615 Harding Ave., Suite 505, Honolulu, HI 96816

(808) 734-5801

Inquiry 588.

The Knowledge Engine:

Hypermedia for the rest of us!

The Knowledge Engine is an icon-driven, object-oriented hypermedia program for MS-DOS computers. Much more than a HyperCard™ clone. The Knowledge Engine allows even non-programmers to create breathtakingly powerful hypermedia applications simply by "pointing and clicking". Features include: full graphics support for CGA, EGA, VGA, Super VGA, and 8514A; PCX file support; memory-resident graphics snapshot program; graphics painter; animation editor; powerful programming language; and much more. A runtime library allows The Knowledge Engine to be embedded into Microsoft and Turbo C programs. Only \$495 for MS-DOS. Versions also available for UNIX and AS/400. Demo disk: \$25.

Software Artistry, Inc.

3500 DePauw Blvd., Suite 1100, Indianapolis, IN 46268
Phone: (317) 876-3042 Fax: (317) 876-3258

Inquiry 589.

BAR CODE

LABELING SOFTWARE

On EPSON, IBM, OKI dot matrix or LaserJet. Flexible design on one easy screen. Any format/size. Up to 120 fields/label. 18 text sizes to 3" readable at 100'. AIAG, MIL-STD, 2 of 5, 128, UPC/EAN, Code 39. File Input & Scanned logos/symbols (PCX)—\$279. Other programs from \$49. 30-day \$5 back.

Worthington Data Solutions

417-A Ingalls St., Santa Cruz, CA 95060

(408) 458-9938 (800) 345-4220

BAR CODE

BAR CODE READERS

For PC, XT, AT, & PS/2, Macintosh, and any RS-232 terminal. Acts like 2nd keyboard, bar codes read as keyed data. With steel wand—\$399. Top rated in independent reviews. Works with DOS, Xenix, Novell, Alloy, -ALL software. Lasers, magstripe, & slot badge readers. 30-day \$5 back.

Worthington Data Solutions

417-A Ingalls St., Santa Cruz, CA 95060

(408) 458-9938 (800) 345-4220

PORTABLE READER

Battery-operated, handheld reader with 64K static RAM, 2x16 LCD display, 32-key keyboard, Real-Time-Clock. Wand or laser scanner. Program prompts and data checking through its own keyboard. Easy data transfer by RS-232 port or PC, PS/2 keyboard. Doubles as On-Line Reader. 30-day \$5 back.

Worthington Data Solutions

417-A Ingalls St., Santa Cruz, CA 95060

(408) 458-9938 (800) 345-4220

PRINT BAR CODES/BIG TEXT FROM YOUR PROGRAM

Add bar codes and big graphics characters to your program. Print from ANY MS-DOS language. Bar codes: UPC, EAN, 2 of 5, MSI, Code 39. Epson, Oki, IBM dot matrix text up to 1/2". LaserJet up to 2". Font cartridges not required. \$179-\$239. 30-day \$5 back.

Worthington Data Solutions

417-A Ingalls St., Santa Cruz, CA 95060

(408) 458-9938 (800) 345-4220

BAR CODE READERS

Keyboard emulation for PC/XT/AT & PS/2's, all clones and any RS-232 Terminal. Transparent to your operating system. Available with Steel wands, Lasers, Slot & Magstripe Readers. Same day shipping. 30-day money-back guarantee. One-year warranty. Reseller discounts available.

AMERICAN MICROSYSTEMS

2190 A Regal Parkway, Eubess, TX 76040

(800) 648-4452 (817) 571-9015 FAX (817) 685-6232

BAR CODE PRINTING SOFTWARE

- MS/PC DOS SYSTEMS
- 9 & 24 PIN DOT MATRIX
- H-P LASER JET/PLUS/SERIES II
- MENU-DRIVEN or MEMORY RESIDENT
- CODE 39, 1 2/5, UPC A/E, EAN 8/13
- BIG TEXT & BAR CODE SOFTFONTS

AMERICAN MICROSYSTEMS

2190 A Regal Parkway, Eubess, TX 76040

(800) 648-4452 (817) 571-9015 FAX (817) 685-6232

THE BUYER'S MART

BAR CODE

BAR CODE PRINTING

Print bar codes from your custom program. ANSI C routines generate and print Code39, I25, Codabar, UPC A/E, EAN 8/13 and supplements. Supports LaserJet, OKI, and EPSON and custom printers. Works with UNIX/XENIX, MSDOS and others. All SOURCE CODE included. No royalties. Single pattern \$85.00. All patterns \$250.

Infinity Computer Services, Inc.
P.O. Box 269, Coopersburg, PA 18036
Voice: 215-965-7699 BBS: 215-965-8028

Inquiry 590.

PC-Wand Bar Code Solutions

Bar codes are easy with a FULL line of readers & printers. They plug & play with your existing systems, most all makes of CPU/printer/terminal/software in your office, store, truck, factory or warehouse. Our bar code DOS programs print on matrix or laser printers. 30 day refund, 1 year warranty.

International Technologies & Systems Corp.
655-K North Berry St., Brea, CA 92621
TEL: (714) 990-1880 FAX: (714) 990-2503

Inquiry 591.

BAR CODE READERS Only \$285

- Complete Bar Code Systems Available
- Acts like a 2nd Keyboard for IBM XT/AT, PS/2 and Clones, Macintoshes and any RS-232C Terminal
- Wand/Laser scanner/Six reader/Magnetic card reader connectivity
- POS Special Keyboard with Bar Code/Magnetic Card Readers
- No software or hardware modification needed
- 30-day Money-back Guarantee

KASCO TECHNOLOGY, INC.
486 Casita Way, Los Altos, CA 94022
Tel: (415) 949-0969 FAX: (415) 949-3814

Inquiry 592.

5-YR. WARRANTY AT PERCON

PERCON decoders are now covered by a five-year limited warranty. That means you won't spend one cent replacing your PERCON bar code decoder for five full years. That's reliability you can count on!

PERCON

2190 W. 11th Ave., Eugene, OR 97402
Phone: (800) 873-7266 FAX: (503) 344-1399
See our ad on page 484.

Inquiry 593.

PC BAR CODE SPECIALISTS

Bar code readers designed for fast, reliable, cost effective data entry. Looks just like keyboard data! Choose from stainless steel wand or laser interface. Also, powerful Bar Code and Text printing software. Great warranty. Dealer inquiries welcome.

Seagull Scientific Systems
15127 N.E. 24th, Suite 333, Redmond, WA 98052
206-451-8966

BAR CODE READERS

Among the best and most widely used bar code decoders. Reads all major codes (39, 1 2/5, S 2/5, UPC/EAN/JAN, CODABAR, MSI). Connects between keyboard and system. IBM, PS/2, MAC, DEC-VT compatible. OS & software independent. Same day ship. 2 Year Warranty (pen incl).

Large Reseller Discounts
Solutions Engineering
4705 Langdrum Lane, Bethesda, MD 20815
(800) 635-6533 (301) 652-2738

Inquiry 594.

BAR CODE

DATA INPUT DEVICES

Bar Code, Magnetic Stripe Readers & SmartCard Encoder/Reader for microcomputers & terminals, including IBM PS/2 & others, DEC, Macintosh, AT/AT, CT, Wyse, Wang. All readers connect on the keyboard cable & are transparent to all software. UPC & 39 print programs, magnetic encoders, & portable readers are also available.

TPS Electronics

4047 Transport, Palo Alto, CA 94303
415-856-6833 Telex 371-9097 TPS PLA
1-800-526-5920 FAX: 415-856-3843

Inquiry 595.

VARIANT MICROSYSTEMS BAR CODE READERS DELIVER

WAND/LASER/MAGNETIC CARD CONNECTIVITY
• Keyboard wedges (Internal/External) for IBM PC/XT/AT, PS/2 and portables.
• RS232C wedges for WYSE, Link, Kimtron terminals
• Bar code and label printing software
• Full two-year warranty
• 30-Day Money-Back Guarantee
• Extensive VAR/Dealer Discounts
3140 De La Cruz Blvd., Suite 200/Santa Clara, CA 95054/(408) 980-1880
800-666-4BAR FAX: (415) 623-1372

Inquiry 596.

BASIC CLIP MUSIC

300 Songs & Sounds + 180 Pg. Book

Besides being a fun jukebox, *The Enter-tainer* teaches DOS BASIC, bar file & display tricks. Many exciting musical projects! It's geared for beginners, yet teaches pros how to run music behind QB or C apps. Source code, no royalties. Money-back guarantee. 3.5" or two 5.25" disks. Needs BASIC 2.0 or later. \$29.95+\$3.50 s&h. (Europe, Canada & Mexico s/h=\$7, others=\$11, 1st class air) For fast VISA/MC orders - call:

(800) 727-4140 Price soon going up to \$45!
POI Music Software, 1511 48th St., Boulder, CO 80303 (303) 440-4140

Inquiry 597.

BRAILLE

BRAILLE PUBLISHING

Whether you have occasional word-processed memos or full-length textbooks, a Duxbury Translator enables conversion to properly contracted and formatted braille. The choice of professional publishers worldwide since 1975. Duxbury software for MSDOS, Macintosh, Unix and other systems supports: English Braille and Computer Braille (bidirectionally), Textbook Format, French, Spanish, Arabic, and others.

Duxbury Systems, Inc.

435 King St., P.O. Box 1504, Littleton, MA 01460 USA
508-486-9766

Inquiry 598.

CABLES AND ACCESSORIES

Parallel Printer Cables	\$3.59 and Up
Serial Cables	\$4.95 and Up
Switchboxes	\$11.95 and Up

We can supply ALL your cabling needs. Master-Card & Visa Accepted. Dealer pricing available. Corporate & Government accounts welcomed.

CONNECT-IT

P.O. Box 14337, Arlington, Texas 76094
(817) 461-9400 M-F 9-6 p.m. cst

Inquiry 599.

SPECIAL-PARALLEL-PRINTER CABLES for PC's and similar systems

10 FT	US \$ 69
100 FT	US \$249
300 FT	US \$649

All intermediate lengths available on request. Dealers are welcome. Delivery! FOB Munich, C.O.D.

E. HOLLER EDP-ACCESSOIRES
Boehmerwaldstr. 84, D-8192 Geretsried, W-Germany
Tel. 08171/31702 Fax. 08171/81275

Inquiry 600.

CAD

Electro-CAD \$99

Designed specifically for schematics and double-sided board layouts, Electro-CAD produces high quality board images on standard dot-matrix printers up to 11 by 15 inches. Virtually instantaneous screen replots, rubber-banding, user definable images, and many other features make Electro-CAD the best tool for the job or your money back.

Call us for more information and fast delivery.

AEROUX Engineering

32 West Anapamu Sulte 228, Santa Barbara, CA 93101
(805) 962-9695

Inquiry 601.

CAD-DRAWING VIEWSTATION

Allows non-CAD users to view drawings on PCs, print, plot, attach personal notes, and hyper-link between files. Change views and layers. Accurate entity representation. Easy to use.
• Sirlin VIEW/DWG for AutoCAD DWG files: \$295
• Sirlin VIEW/PLUS for DWG, DXF, HPGL and dBase: \$395
Developers: ask about linkable Sirlin VIEW/LIB. Dealers welcome.

Sirlin Computer Corporation

225 Lowell Road, Hudson, NH 03051
(603) 595-0420

Inquiry 602.

CD-ROM

ALDE CORPORATION

CD ROM players as low as \$499 plus selected disc. Choose from many titles. Alde does consulting, joint venture and/or royalty projects for qualified parties. Write, call or fax for complete information. New Ada release.

Box 1086, Glen Lake, MN 55346
1-800-727-9724 FAX: 1-612-934-2824

Inquiry 603.

Largest Selection and Best Price Microsoft Programmers Library & Drive \$949. Computer Library \$695 • Public Domain S/W \$49. NEC PC or Mac Drive Kit \$749 • Bookshelf-Best Price!

Drives from \$499. Hundreds of titles from \$29
MC/VISA/AMEX/COD, Money-back Guarantee.
Call or write for free 120-page catalog.

Bureau of Electronic Publishing

141 New Road, Parsippany, NJ 07054
800-828-4766
THE SOURCE FOR CD-ROM
See our ad on page 76.

CD ROM, Inc.

CD-ROM, WORM, MAGNETO-OPTICAL DRIVES, CD-ROM DISCS FOR IBM and MAC, OPTICAL CONSULTING SERVICES

* PUBLISHING * DISTRIBUTION * NETWORKING
QUALITY PRODUCTS AND SERVICES AT COMPETITIVE PRICES
FREE CATALOG

TEL. 303-231-9373

1667 COLE BLVD., SUITE 400, GOLDEN, CO 80401
FAX: 303-231-9581, CIS: 72007544
VISA/MC/AMEX/GOV. P.O.

Inquiry 604.

COMMUNICATIONS

PC SDLC SUPPORT

Use Sangoma hardware and software to provide a cost effective, robust and easy to use SDLC link from MS-DOS, XENIX, AIX, PICK, PC-MOS, etc.

All real time communication functions performed by Intelligent co-processor card.

X.25 support also available.

Sangoma Technologies Inc.

(416) 474-1990
7170 Warden Avenue -2, Markham, Ontario, Canada L3R 8B2

Inquiry 605.

SEPTEMBER 1990 • B Y T E 473

THE BUYER'S MART

COMPUTER INSURANCE

INSURES YOUR COMPUTER

SAFWARE provides full replacement of hardware, media and purchased software. As little as \$49 a year provides comprehensive coverage. Blanket coverage; no list of equipment needed. One call does it all. Call 8 am-10 pm ET. (Sat. 9 to 5)

TOLL FREE 1-800-848-3469

(Local 614-262-0559)

SAFWARE, The Insurance Agency Inc.

Inquiry 606.

COMPUTER UPGRADE

THE COMPLETE XT UPGRADE

The K-311 Upgrade Kit converts your XT to full 32-bit, 20MHz 80386 CPU and high speed disk performance. The K-311 Kit includes 20MHz 80386 w/1Mb RAM, 16-bit Adaptec i-1 controller, 63Mb 28Ms Mitsubishi disk drive, choice of 1.2 or 1.4Mb diskette drive, Key Tronic 101 Plus keyboard, 200 W PS, new drive cables. Matches or exceeds the performance of a new system but at far less cost. Top quality, easy installation, 1 year warranty. \$1,795

5G Corporation

4131 Spicewood Springs Road A-4, Austin TX 78759
800-333-4131 512-345-9843 Fax 512-345-9575

Inquiry 607.

CROSS ASSEMBLERS

CROSS ASSEMBLERS

Universal Linker, Librarian
Targets for 36 Microprocessors
Hosts: PC/MS-DOS, micro VAX, VAX 8000

ENERTEC, INC.

BOX 1312, 811 W. Fifth St.
Lansdale, PA 19446

Tel: 215-362-0966 Fax: 215-362-2404

Inquiry 608.

CROSS ASSEMBLERS/SIMULATORS

New unique full-function simulators for the 8096 and 80C196 controllers, featuring ALL MODES of interrupts, plus the HSI, HSO, and A/D functions.

We also support the 8048/49, 8080/85, 8051/52, and Z80 controllers with excellent, reasonably priced Cross Assemblers and Simulators.

Lear Com Company

2440 Kipling St., Ste. 206, Lakewood, CO 80215
(303) 232-2226 FAX: (303) 232-8721

Inquiry 609.

MACINTOSH CROSS ASSEMBLERS

„ASM“—New Version 3.0! Integrated text editor, assembler, and terminal package. 5 or Hex output downloads to most EPROM programmers. Macros, cond'l ass'y, local & auto labels, symbol table cross-ref. \$149.95 each plus S/H. MC/WAE. Tech. bulletin avail. Most 8-bit MPU's.
30 day money back guarantee.

MICRO DIALECTS, INC., Dept B

PO. Box 30014, Cincinnati, OH 45230
(513) 271-9100

Inquiry 610.

CROSS ASSEMBLERS

Relocatable
Macros
PC Compatible

**GUARANTEED,
SUPPORTED**

DEBUG SIMULATORS • DISASSEMBLERS
EPROM PROGRAMMERS

MICRO COMPUTER TOOLS CO.

Phone Toll Free (800) 443-0779

In CA (415) 825-4200

912 Hastings Dr., Concord, CA 94518

Inquiry 611.

474 B Y T E • SEPTEMBER 1990

CROSS ASSEMBLERS

Cross-Assemblers

Simulators

Disassemblers

PseudoCorp

See our ad on page 500.

Inquiry 612.

CROSS COMPILERS

Focus on Performance

Fast, 6000 lines per minute. C6805 Code Development System, first C compiler targeted to 6805 family. Built-in macro cross assembler, optimizing C compiler, integrated editor and development shell. MS-DOS with S1 or HEX output.

Free next business day shipping in N. America.

Call now! (519) 888-6911

Byte Craft Limited

421 King St. N., Waterloo, Ontario N2J 4E4 CAN

Inquiry 613.

CROSS DISASSEMBLERS

PROFESSIONAL PC SOFTWARE

• CROSS-DISASSEMBLERS

Analytic, Automatic Label Generation

• CROSS-ASSEMBLERS

Relocatable, Macro, Universal Linker + Librarian

• C CROSS COMPILERS

SOURCE TRANSLATION UTILITIES

Support for Intel, Motorola, Zilog, TI, RCA

Order Today: (408) 773-8465

LOGISOFT

PO Box 61929, Sunnyvale, CA 94086
FAX: (408) 773-8466

Inquiry 614.

DATA CONVERSION

MEDIA CONVERSION/DATA TRANSLATION

More than just a straight dump or ASCII transfer!
Word Processing, DBMS, and Spreadsheet data on Disks or Tapes transferred directly into applications running on Mainframes, Minis, Micros, Dedicated Word Processors, Typesetters, and Electronic Publishing systems.

IBM PS/2 & Macintosh supported
#1 in the translation industry!

CompuData Translators, Inc.

3345 Wilshire Blvd., Suite 407, Los Angeles, CA 90010
(213) 387-4477 1-800-825-8251

Inquiry 615.

DBMS/COPY

CONVERTS YOUR DATA INTO INFORMATION

Now your favorite stat package can access any database. DBMS/COPY can directly convert any database or spreadsheet file (ORACLE, PARADOX, dBASE, LOTUS etc) into any stat package file (SAS, SPSS, SYSTAT, etc.) and vice versa. The PLUS version allows sorts, selections, and recalculations. \$195. 30-day guarantee. VISA/MC/AMEX/PO/CCO. Call for free limited version.

CONCEPTUAL SOFTWARE INC.

P.O. Box 56627, Houston, TX 77256
(713) 667-4222 FAX: (713) 667-3FAX
1-800-STATWOW

Inquiry 616.

WE'LL DO IT BETTER... FOR LESS!

Conversion, Duplication, Any Format
FREE TEST • SATISFACTION GUARANTEED

Plus, the Personal Touch: Ask Questions and we'll explain it to you in simple English!!!

DATACOPI SERVICE

PO Box 820214, Dallas, TX 75382
1-800-969-DATA 214-272-7751

Inquiry 617.

DATA/DISK CONVERSION

DISK CONVERSIONS

Media transfer to or from: IBM, Xerox, DEC, Wang, Lanier, CPT, Micom, NBI, CT, Exxon, WRDPLEX also WP, WS, MS/WRD, DW4, MM, Samna, DEC DX, MAS 11, Xerox-Writer, ASCII.

FREE TEST CONVERSION

CONVERSION SPECIALISTS

531 Main St., Ste. 835, El Segundo, CA 90245
(213) 545-6551 (213) 322-6319

Inquiry 618.

THE #1 CHOICE

In disk & tape conversion

for many leading corporations, government agencies, law firms, and companies in every industry—world-wide.

Free test • Satisfaction guaranteed

Graphics Unlimited Inc.

3000 Second St. North, Minneapolis, MN 55411

(612) 588-7571 or (612) 520-2345

FAX: (612) 588-8783

Inquiry 619.

QUALITY CONVERSIONS

to or from virtually

ANY TAPE OR DISK FORMAT!

Horan Data Services converts over 2000 formats incl. 9-track tape, 3480 Cartridge and 8", 5 1/4" or 3 1/2" diskettes. All densities & most operating systems supported. Formats include EBCDIC, ASCII, databases, spreadsheets, and dedicated or PC word processors.

Call 1-800-677-8885

Hours 8:00 AM to 5:30 PM Eastern Time
817 Main Street, Third Floor, Cincinnati OH 45202

Inquiry 620.

IBM PC ↔ TO ↔ HP FILE COPY FASTER EASIER TO USE

Update version uses windows: Call for free demo! IBM PC <to> HP File Copy allows IBM PCs, PS/2, compatibles to interchange files with Hewlett-Packard Series 70, 80, 200, 300, 1000, 9000s.

Oswego Software

Box 310 708/554-3567
Oswego, IL 60543 FAX 708/554-3573

Inquiry 621.

CONVERSION SERVICES

Convert any 9-track magnetic tape to or from over 2000 formats including 3 1/2", 5 1/4", 8" disk formats & word processors. Disk-to-disk conversions also available. Call for more info. Introducing OCR Scanning Services.

Pivar Computing Services, Inc.

165 Arlington Hgts. Rd., Dept. #B
Buffalo Grove, IL 60089 (800) Convert

DATABASE

INFO-TRAK

INFO-TRAK is a new menu-driven database/cataloguer program for the professional and the beginner. Ideal for business, home inventory, collections (books, stamps, coins, artworks, etc.), investments etc. Features include SEARCH, add/delete lines, edit data, create custom formats, PRINT and more. (IBM XT, AT and compatibles, DOS 2.0 & up)

Only \$59. \$3 shipping/handling (check or money order only)

JA-DAL TECHNOLOGIES

PO. Box 611, Yaphank, NY 11980

(NY res. add 7.5% tax)

Inquiry 622.

THE BUYER'S MART

DATABASE MGMT SYSTEMS

SAVE TIME & MONEY!

OCELOT2—THE SQL! is a stand-alone database engine with a complete DB2 compatible SQL interface for developers who use BASIC, C, PASCAL, or COBOL.

- packs the full power of SQL into a 640KB PC;
- requires only 320KB RAM for program development;
- outperforms the rest!

For IBM and clones: \$195 & up. Free info.

OCELOT COMPUTER SERVICES INC.
#1502, 10025 - 106 Street, Edmonton, AB, Canada, T5J 1G7
(403) 421-4187

Inquiry 623.

dBASE file access from C

Code Base 4 is a library of C routines which gives complete dBASE or Clipper functionality and file compatibility. Use DOS, Unix, OS/2 or MS Windows.

\$295 with Source! FREE DEMO

Sequiter Software Inc.

Call (403) 448-0313 Fax (403) 448-0315
See our ad on page 439.

Inquiry 624.

DEMOS/TUTORIALS

INSTANT REPLAY III

Build Demos, Tutorials, Prototypes, Presentations, Music, Timed Keyboard Macros, and Menu Systems. Includes Screen Maker, Keystroke/Time Editor, Program Memorizer, and Animator. Rec'd Great Reviews! Simply the BEST. Not copy protected. No royalties. 60-day satisfaction money-back guar. IBM and Compat. \$199.00 U.S. Chk./Cr. Crd. Demo Diskette \$50.00.

NOSTRADAMUS, INC.

P.O. Box 9252
Salt Lake City, Utah 84109 (801) 272-0671

Inquiry 625.

DISASSEMBLERS

80x86 .EXE/.COM to .ASM

- Accurately reconstruct, study & modify [64K+] programs with a minimum of input or editing of output.
- Assembly language output is MASM 5.x-compatible.
- Exhaustive flow-trace distinguishes code from data.
- Best for macros for each. Commented BIOS calls/DOS functions. SEGMENT/PROC/other vital pseudo-ops.

PC-DISnDATA (5 1/4" disk & manual) \$165

PRO/AM SOFTWARE

220 Cardigan Road, Centerville, OH 45459
(513) 435-4480 (9 A.M. - 5 P.M. EST M-F)

Inquiry 626.

SOFT-X-PLORE

See "BYTE's May '88 issue pg. 78." Disassemble 500 kb (*) program at 10,000/min. (*) in any file, ROM/RAM memory up to 80386 instruction set (*). SOFT-X-plore:

- * is for MS/DOS 2.0+ systems
- * uses 20 algorithms and seven passes (*)
- * only \$99.95 plus S&H w/30-day guarantee.

To order call (800) 336-1961 or info (203) 953-0236

Or write: **RJSWANTEK INC.**
178 Brookside Rd., Newington, CT 06111
* best on the market MC/VISA accepted

Inquiry 627.

DISK DRIVES

PS/2 DRIVES FOR PCs ATs

CompatiKit/PC \$279
CompatiKit/AT \$219

Built-in floppy controllers—no problem. Supports multiple drives and formats. Lets your computer use IBM PS/2 1.4M diskettes *plus more!* Call for further information or to place an order.

VISA/MC/COD/CHECK

Micro Solutions Computer Products

132 W. Lincoln Hwy., DeKalb, IL 60115 815/756-3411
See our ad on page 440.

Inquiry 628.

DOCUMENT CONVERSIONS

Doc-to-Doc

Quickly and cleanly convert your documents to and from WordPerfect, WordStar, MultiMate, ASCII, Tandy, DeskMate Text, Lotus 1-2-3, Enable, Wang and DisplayWrite. Retain special attributes and formatting. Doc-to-Doc gives you professional quality conversions at a consumer price—\$99.

The MCS Group

2465 W. Chicago St., Rapid City, SD 57702
(605) 341-2166

Inquiry 629.

EDUCATION

B.Sc. & M.S. in COMPUTER SCIENCE

The American Institute for Computer Sciences offers an in-depth correspondence program to earn your Bachelor of Science and Master of Science degrees in Computer Science at home. BSC subjects covered are: MS/DOS, BASIC, PASCAL, C, Data File Processing, Data Structures & Operating systems. MS program includes subjects in Software Engineering and Artificial Intelligence.

AMERICAN INST. for COMPUTER SCIENCES

2101 Magnolia Ave., Ste. 200, Birmingham, AL 35205
205-933-0339

Inquiry 630.

ENTERTAINMENT

ADULT MODEM BBS FUN!

- West Coast's Hottest Adult BBS!
- 1000's of Shareware Programs!
- CB-Style Group and Private Chat!
- Exotic Adult Sections!
- Giant Message Bases!
- Matchmaker Database!
- Interactive Multiplayer Games!
- Access Numbers in 850 U.S. Cities!
- For "Over 18" Adults Only!

Information and Signup By Modem

(800) HOTTFUN [312/24 Baud, 8/N/1]

ACCESS LAI

Voice Information (818) 357-9570

Inquiry 631.

.386 SPYS

386 SPYS, the energy, excitement and superior graphics you've been looking for in an animated arcade game. Written specifically for PC's with a 386/386SX processor, Hi Res EGA graphics, 1 meg of memory and a hard disk. You will find incredible detail and action throughout. Try a demo disk now for \$6.95 or the full game for \$49.95. Include \$3 S&H.

GENKI SOFTWARE CORPORATION

"Imagination powered by the .386"

(800) 673-9038 Mastercard or Visa (301) 997-6333
P.O. Box 2563, Columbia, MD 21045

Inquiry 632.

NEMESIS™ Go Master®

Go, a game of strategic elegance, has been a way of life in the Orient for over four thousand years. Many consider Go to be the secret of the Japanese businessman's success. "While chess is a game of war, Go is a game of market share" [President of Nikko Hotels].

"If you are interested in Go, buy this program."
Game of the Month J. Pournelle BYTE '78

Toyogo, Inc. The Leader in Computer Go.

PO Box F, Dept. Y, Kaneohe, HI 96744
(808) 254-1166 or 1-800-TOYOGO-9

Inquiry 633.

☆ Zodialcal Advisor ☆

Daily advice based on planetary positions for your birthdate and current date. Includes accurate ephemeris (\$35). Also available: Stock Market Simulation (\$30), Klondike Solitaire (\$20); and more. (Tax & Shipping Inc.) Call or write for brochure.

1-800-342-0987 505-672-1028

Warnock Enterprises

30 Glenview Court, Los Alamos, New Mexico 87544

Inquiry 634.

FLOW CHARTS

WINDOWS FLOWCHARTER

RFFlow is a professional drawing tool for flowcharts & org charts (requires Microsoft® Windows). 75 shapes automatically adjust in size. Move, copy, delete groups of objects. 7 levels of zoom. Move flowcharts to other applications via the Clipboard. Supports Windows printers, plotters, and cartridge or soft fonts. Call for free trial disk.

RFF ELECTRONICS

1053 Banyan Court, Loveland, CO 80538
Phone: (303) 663-5767 FAX: (303) 669-4889

Inquiry 635.

FORECASTING

Solutions to Forecasting Problems

ForeProfit™, a comprehensive, easy-to-use package of analytic, forecasting and market analysis techniques. Moving averages, exponential smoothing, multiple regression, linear programming with tables and graphics output. \$250. The **SoothSaver™**, an artificial-intelligence-based, high speed analyzer to painlessly project piles of numbers. \$69. Both run on MS-DOS computers, 512K or larger, floppy or hard-drive. VISA or MC accepted.

Loon Valley Software

420 Summit Ave., Suite 38, St. Paul, MN 55102-2699
(800) 828-0136

Inquiry 636.

FRAME GRABBER

FRAME GRABBERS

TYPE	LIST PRICE	YOUR PRICE
PUBLISHERS' VGA	\$799.00	\$655.00
PUBLISHERS' GS	\$95.00	\$55.60
PUBLISHERS' COLOR	\$89.00	\$30.00

VGA TO VIDEO ADAPTERS

VGATV (256K)	\$499.00	\$443.00
VGATV (512K)	\$99.00	\$15.00
VGATV G/EO	\$95.00	\$30.00

MANUFACTURERS 3 YEAR WARRANTY

THE KRUEGER COMPANY

(800) 245-2235 (602) 820-5330
Call for large quantity pricing.

Inquiry 637.

FREE COMPUTER MAGAZINE

FREE SUBSCRIPTIONS

To More Than 200 Magazines
Don't spend a fortune on computer, communications or business magazines. The SeaBird Directory lists over 200 titles you can get free and runs on any IBM PC. For more info, and **FREE DEMO DISK**, call: **1-800-782-0194** or fax to: 617-863-8684

Inquiry 638.

GRAPHICS

YOU CAN BE IN PICTURES

- Send us a VHS tape with the counter location of the picture(s) you want.
- We'll convert the pictures to files & return them to you on a 5 1/4" floppy disk(s) in the format you request, with a file viewing utility for an IBM VGA or compatible video card with an analog monitor.
- Price: \$9.99 + \$9.99 per Picture + \$7.50 S&H

IEV, 3030 S. Main, Dept. 16, Salt Lake City, UT 84115

Phone 801-466-9841 Ext. 16 FAX: 801-466-5921

Inquiry 639.

EGAD Screen Print

Prints contents of VGA, EGA, CGA displays on variety of dot-matrix and laser printers. Prints in gray tones or color. Crop box lets you print any region of the screen. Enlarge graphics 1 to 4 times (reduction too). Setup program for picking printer colors, etc. \$35.00 Postpaid. Call or write for free catalog.

LINDLEY SYSTEMS

4257 Berwick Place, Woodbridge, VA 22192-5119
(703) 590-8890

Inquiry 640.

SEPTEMBER 1990 • B Y T E 475

THE BUYER'S MART

GRAPHICS

IMAGE CAPTURE BOARD

Capture images from any VCR or Camcorder. Resolution up to 512 x 480 pixels; 65,536 colors or 256 shades of grey. Images saved in GIF, PCX, TIFF formats and more. For XT/AT/PS2. Includes user friendly software and user's guide. One year warranty. VGA required. Can capture from live video (eliminates need for expensive digital video). Ideal for Desktop publishing, CAD, Animation, and Pictorial Databases.

\$749 VISA/MC/AMEX/C.O.D.

PEGA Micrographics

P.O. Box 713, Westerville, OH 43081, (614) 885-1007
1-800-477-PEGA

Inquiry 641.

HARD DRIVE REPAIR

HARD DRIVE REPAIR

WE WILL REPAIR YOUR HARD DRIVE AT A FRACTION OF THE COST OF REPLACING IT. FAST TURNAROUND!!! CALL FOR DETAILS.

H & W micro, inc.

528-C FOREST PARKWAY
FOREST PARK, GA 30050
(404) 366-1600

Inquiry 642.

DISK DRIVE REPAIR DATA RECOVERY

SALES of new, remanufactured and removable disk drives

FULL TECHNICAL SUPPORT ROTATING MEMORY SERVICE

1506 Dell Avenue, Campbell, CA 95008

(408) 370-3113

We buy used drives good or bad

Inquiry 643.

HARDWARE

CHIP CHECKER

- 74/54 TTL + CMOS
- 8000 Nat. + Signetics
- 14/4000 CMOS
- 9000 TTL
- 14-24 Pin Chips
- 3" + .6" IC widths

Tests/identifies over 650 digital chips with ANY type of output in seconds. Also tests popular RAM chips. IBM-compatible version \$259. C128 + C64 version \$159.

DUNE SYSTEMS

2603 Willa Dr., St. Joseph, MI 49085

(616) 983-2352

Inquiry 644.

INDUSTRIAL STRENGTH SINGLE BOARD COMPUTER

Has optimum features for monitor + control applications: 16 Chan A/D • 4 RS232/422 Ports • 48 Prog I/O Lines • 8 Opto I/Os • 8 HiDrive OUI's • 4 Timers • Watchdog • 104K Memory • 5.25 x 8.0 Options: Resident FORTH OS with Target Compiler, Editor, Assembler, + Auto Load/Start; 5 MHz 8085 • 4 Chan D/A • Battery Backed Clock/RAM • Networking • C-PAC 2000+

E-PAC 1000+ \$249.00 E-PAC 2000+ \$449.00

EMAC INC.

PO Box 2042, Carbondale IL 62902 (618) 529-4525

Inquiry 645.

FREE INTERFACE CATALOG

Interlaces for IBM compatibles. Digital I/O (8255) and Analog input 8 bit resolution (0-255). Control relays, motors, lights, measure temperature, voltage. Sample interconnect circuits, BASIC programs, and I/O map are included.

John Bell Engineering, Inc.

400 Oxford Way, Belmont, CA 94002
(415) 592-8411 9am to 4pm Pacific Time

Inquiry 646.

476 B Y T E • SEPTEMBER

HARDWARE

LATEST AWARD BIOS

User definable hard drives, 101/102 keyboard and 3.5" 1.44Mb floppy support are now available in Award BIOS Ver. 3.1 for the IBM AT, 286 and 386 compatibles.

KOMPUTERWERK, INC.

851 Parkview Blvd., Pittsburgh, PA 15215

Orders: 800-423-3400

Tech: (412) 782-0384

Inquiry 647.

APPLE® II & MACINTOSH®

• Systems • Parts • Exchange Repairs

HyperCard

(Sealed in box)

\$19

Call for a CATALOG

USA & Canada:

800-274-5343

International: 617-891-6851

Fax: 617-891-3556

Save

up to

50%

on Mac

CPU.

Pre-Owned Electronics, Inc.

30 Clematis Avenue • Waltham, MA 02154

Inquiry 648.

HARDWARE/COMPUTERS

EMBEDDED SYSTEMS COMPUTERS

SC/FOX[™]PCS (Parallel Coprocessor System) and PCS32 are PC/XT/AT plug-in boards, 16 and 32 bit, 15 MIPS average, 50 MIPS burst. PCS uses the Harris RTX 2000[™] 16-bit real-time CPU with 1-cycle multiplier, 14 prioritized interrupts, 3 timers/counters, 8-channel I/O bus. PCS32 uses the new SC32, 32-bit Forth CPU. SC/FOX SBC (Single Board Computer) is an 18 MIPS average, 60 MIPS burst, Eurocard-size RTX 2000 stand-alone computer. SC/FOX SCSI I/O Plug-on board for PCS or SBC with SCSI, floppy, 56K-baud serial, 16-bit parallel ports, and software drivers. Forth *n/w* included. C also available. Ideal for embedded real-time control, data acquisition, robotics, and signal processing.

SILICON COMPOSERS INC. (415) 322-8763
208 California Avenue, Palo Alto, CA 94306

Inquiry 649.

HARDWARE/CONTROLLERS

8051 SUPERMARKET

Complete family of 12 single board computers fully accommodates any 8051 variant. Power management, plenty of I/O, full memory map. Optional floating point, PC-compatible RS 232. PC versions reside on PC bus. Peewee's measure 3x5" 8051-optimized DIN52 bus allows stacking or backplane mounting, interprocessor communication. Boards run 8052AH BASIC. Starting at \$99. Quick custom modifications.

MODULAR MICRO CONTROLS

109 S. Water St., Northfield, MN 55057

call or fax (507) 645-8315

Inquiry 650.

HARDWARE/COPROCESSORS

DIGITAL SIGNAL PROCESSOR

DSP products for the IBM PC/XT/AT. Our TMS320C25 based Model 250, with extensive software, features 250 Khz multi-channel A/D and D/A, up to 192 Kwords RAM, very high throughput to PC RAM and disk, and is priced competitively with traditional Analog I/O boards. Call us about your applications.

DALANCO SPRY

89 Westland Ave., Rochester, NY 14618

(716) 473-3610

Inquiry 651.

DSP32C PC/AT COPROCESSOR BOARD

25 MFLOP 32 bit Floating point DSP:

- High speed NUMERICS and GRAPHICS
 - 640K DUAL PORTED on board memory
 - 32 bit parallel and serial I/O headers
 - 15 ms 1024 point FFT from high level C
 - Assembler, monitor, and math libraries
- Base board and ALL software \$950, 640K \$300

SYMMETRIC RESEARCH

15 Central Way #9, Kirkland, WA 98033

(206) 828-6560

Inquiry 652.

INVENTORY MANAGEMENT

STOCK-MASTER 4.0

Commercial grade inventory management software at micro prices.

- Supports all 12 transaction types
- Trend Analysis
- Quality Control
- Multiple Locations
- Purchase Order Tracking
- Open Order Reporting
- Serial/Lot # Tracking
- Stock Status Reporting
- Activity History Analysis
- Bill of Materials
- Purchase Order Writing
- Order Entry
- Material Requirements
- On Line Inquiry

Applied Micro Business Systems, Inc.

177-F Riverside Ave., Newport Beach, CA 92663 714-759-0582

Inquiry 653.

dFELLER Inventory

Business inventory programs written in modifiable dBASE source code

dFELLER Inventory \$150.00

Requires dBASE II or III, PC-DOS/CPM

dFELLER Plus \$200.00

with History and Purchase Orders

Requires dBASE III or dBASE III Plus (For Stockrooms)

Feller Associates

550 CR PPA, Route 3, Ishpeming, MI 49849

(906) 486-6024

Inquiry 654.

LANS

The \$25 Network

Try the 1st truly low-cost LAN

- Connect 2 or 3 PCs, XTs, ATs
- Uses serial ports and 5-wire cable
- Runs at 115K baud
- Runs in background, totally transparent
- Share any device, any file, any time
- Needs only 14K of RAM

Skeptical? We make believers!

Information Modes

P.O. Drawer F, Denton, TX 76202

817-387-3339

Orders 800-628-7992

Inquiry 655.

LAPTOP COMPUTERS

Laptop Savings

Laptops: Toshiba • Zenith • NEC • Sharp
• Epson • Mitsubishi • Compaq

Also Laptop Accessories: Modems, Fax Modems, External Drives, Portable Printers, Memory, Key Pads, Hard Drives, Batteries, and Auto Adapters.

Computer Options Unlimited

12 Maiden Lane, Bound Brook, NJ 08805

Phone: 201-469-7678 (Fax: 201-469-7544)

Hours: 9am/10pm 7 days Worldwide sales

Inquiry 656.

LAPTOP MEMORY

Rock-bottom prices for all memory-upgrade kits for Toshiba, Compaq, Sharp, and Texas Instruments!!

TOTE-A-LAP

550 Pilgrim Drive, Suite F, Foster City, CA 94404

(415) 578-1901

Inquiry 657.

Portable Computers and Accessories

- Many makes, sizes, and styles
- Unique add-ons for all brands
- Fast delivery
- Dealers and VARs welcome

Call for a free catalog 800-877-6044

or FAX 415-221-6044

TransPacific

San Francisco, CA

Inquiry 658.

THE BUYER'S MART

LAPTOP COMPUTERS

New Laptop Products for:

Palmtops: Atari Portfolio, Poquet
Notebooks: Compaq LTE, NEC-UL, Tandy 100/102, Tandy 1100, TI-M12, Toshiba SE/XE, Zenith-MS
PC-Laptops: All major brands and models
Accessories: Auto Adapters, Batteries, Carry Cases, Keypads
Peripherals: Portable Printers, Hard Disks, 360K/1.2M Drives,
Keyboard Covers, Modems, Barcode Wands, Laptop Software, etc.

For a free newsletter & catalogue, please call or write:

ULTRASOFT INNOVATIONS INC.

1 Transborder Drive, PO Box 247, Champlain, NY 12919
Tel: (514) 487-9293 Fax: (514) 487-9295 9-6 EST
Canadian Orders & Dealer Inquiries are Welcome

Inquiry 659.

LAPTOP PERIPHERALS

LAPTOP BACKLIGHTS

Factory Installed • 90-Day Warranty

Toshiba, Amstrad, Sanyo, DG,
Kaypro, IBM, HP, etc. **\$295**

The Portable Peripherals People

Axonix Corporation
(801) 466-9797

Inquiry 660.

TOSHIBA LAPTOP ENHANCEMENTS

FAX/MODEMS: 9600/2400 bps, software, acoustic port
MODEMS, INTERNAL: 2400 bps, acoustic or serial port
MODEM, DEDICATED: 2400 bps (TI200, T1600, T3200SX)
SERIAL IO CARDS: RS232, RS422, SCSI, HPIL, Barcode
BATTERY PACKS: 12V external battery + vehicle adapter

Contact us for more information:

PRODUCT R&D Corporation (Call)
805/546-9713, Fax: 805/546-9716

Inquiry 661.

MAILING LIST PROGRAMS

ELIMINATE DUPLICATES

Duplicates on your mailing list cost more than embarrassment. You're paying for all that extra postage and for the materials mailed. Invest \$149.00 in Dupe Eliminator and say goodbye to your dupes. Dupe Eliminator is easy to use—and it works with your dBase, ASCII, ArcList and other compatible files.

1-800-368-5806

Group 1 Software, Inc.

6404 Ivy Lane, Dept. BIT-80, Greenbelt, MD 20770-1400

Inquiry 662.

YOURS FREE!

"How to Manage Your Mailing List" ArcList* & AccuMail* are two powerful programs for your IBM or compatible PC:

- Duplicate Recognition
- Postal Discount Presorts
- Label Design & Printing
- Carrier Route and Zip+4 Insertion
- Address Correction
- dBase* Compatible

Call 800-368-5806 for a FREE GUIDE
Group 1 Software, Inc.

6404 Ivy Lane, Dept. BIT-80, Greenbelt, MD 20770-1400

Inquiry 663

ONLY A NICKEL A NAME

Now small business owners can reach their direct mail prospects easily and economically—with the PC Yellow Page listings: • On-line 900 database with millions of U.S. companies available for on-line loading. • Updated monthly with no minimum order. • Costs only \$1/minute—a nickel a name (charged to your phone bill). For a limited time only, get our startup kit, the PC Prospector, designed to make your direct mail marketing the most results-oriented possible. It's yours for just the \$6 phone charge for ordering the software. Order the PC Yellow Pages or the PC Prospector today by simply calling with either your modem or touch tone phone.

1-900-860-9210

For information call 404-455-8763

Inquiry 664.

MEMORY BOARDS

S.S.T. MEMORY UPGRADES

IBM PS/2

2MB module—Model 50, 70 \$243
2-8MB expan. bds—Model 55, 70 \$564

COMPAQ

4MB module—DESKPRO 386/20E, 25, S \$525
4MB expan. brd—DESKPRO 386/20E, 25, S \$580
8MB single slot module—SYSTEMPRO \$2400

H P LASER JET

2MB upgrades \$257

1-800-688-8993 5 YR. WARRANTY

Inquiry 665.

MULTILINGUAL APPLICATIONS

DTP/WPI/Forms and Sign Making

Apple MAC & IBM PC Available languages: Russian, E. European, Turkish, Greek & Indian. It's a DA on MAC, works with virtually any application program. It's a TSR on PC, for GEM based graphical WP, PerFORM & Ventura in WYSIWYG. Keybd remapping utility. Postscript, dot matrix, deskjet & laserjet fonts. Vinyl cutting sys. for sign making for any of the languages. Prices start at \$250, demo \$25. MC/Visa

Solustan, Inc.

378 Hillside Ave., Needham MA 02194

Ph: 617-449-7666 Fax: 617-449-7759

Inquiry 666.

NETWORK/WORKGROUP

CoordiNet

An unbelievably easy-to-use workgroup package for Novell local area networks. Features include: public and private calendars, electronic mail, telephone messages, project management, and document management. CoordiNet Plus adds a Btrieve database manager, report generator, and link to the Sharp Wizard. Can be used either as a 6K TSR or as a standalone program. Installs in 10 minutes and reads Network bindery to create user lists. Simple mouse (or keyboard) driven "point-and-click" user interface with full context-sensitive help. Manual included but not needed. Only \$249 per server! CoordiNet Plus only \$495 per server. Demo disk \$25.

Software Artistry, Inc.

3500 DePauw Blvd., Suite 1100, Indianapolis, IN 46268
Phone: (317) 876-3042 Fax: (317) 876-3258

Inquiry 667.

NETWORKS

PARTY LINE YOUR PC'S

If you have two to four PC's that need to be interconnected to:

- SHARE PRINTERS
- TRANSFER FILES
- SEND MESSAGES

and don't need the hassle or expense of a network, call us. We have a simple and inexpensive solution to your problem. Complete four-user kit retails for \$229.95

PC-InterLink from **SOFTWAREX**

801 E. Campbell Road #355, Richardson, TX 75081

Tel: 1-800-327-5013 Fax: 1-214-699-0330

IT SIMPLY WORKS!

Inquiry 668.

NEURAL NETWORKS

BrainMaker:

"The most fascinating computer software I've ever seen...learn about this stuff." *John Dvorak, PC Mag.* Predicts stocks, bonds, sales, inventories. Comprehensive documentation. Menus. Only \$195! Certified by Intel and Micro Devices

Free Brochure: 916/477-7481
California Scientific Software

Inquiry 669.

OPTICAL DISK

ERASABLE OPTICAL DISK DRIVE

SONY 5.25" 600 MB per disk, SONY 4mm 1.3GB per tape, Mac II, SE, SUN workstation, and other SCSI DEC Q-Bus, UNIBUS, and SCSI. 10 to 25 years warranty on Optical media. Highest quality in the industry Will supply complete Kit to build or Finished product. International and Domestic order or Inquiry within.

BENO SYSTEMS INC

718-921-1200

FAX: 718-748-1676

Inquiry 670.

PC ANALYZER

Repair PC's in Less Time
At Less Cost with the

LOGIMER

In-circuit PC Analyzer
for PC/XT/AT and Compatibles

TOTAL POWER INTERNATIONAL, INC. (TIG)

418 Bridge Street, Lowell, MA 01850

(508) 453-7272 FAX: (508) 453-7395

Inquiry 671.

PROGRAMMERS' TOOLS

HYPERINTERFACE™ II

Menu Creator™ — An interactive WYSIWYG editor to generate a menu-driven user interface for your software.
Screen Creator™ — An interactive WYSIWYG editor for quick and easy screen design and a screen database manager for your software. **Advanced Library** — Extended capability for data entry for your programs. FORTRAN, Pascal, C, BASIC supported.

Avanpro Corp.

P.O. Box 969, Pacific Palisades, CA 90272

(213) 454-3866

Inquiry 672.

TLIB™ 5.0 Version Control

"TLIB" is a great system! — *PC Tech Journal* 3/88. Full-featured configuration mgmt for software professionals. All versions of your code instantly available. Very compact, only changes are stored. Check-in/out locks, revision merge, branching, more. Mainframe deltas for Pansophic, ADR, IBM, Unisys. DOS \$139 (OS/2 \$195). 5-station LAN \$419 (OS/2 \$595)

BURTON SYSTEMS SOFTWARE

P.O. Box 4156, Cary, NC 27519 (919) 233-8128

Inquiry 673.

The EE-100 EPROM Emulator™

Powerful, Versatile, and Compact Prog. Tool Closed loop development capability from source code generation through in-circuit debugging.

STANDARD EQUIPMENT

1-EE-100 Command Unit • 2-24 pin 2716-32 Detachable

Header Cable • 2-28 pin 2764-256 Detachable Header Cable

• 1-28 pin 27512 Detachable Header Cable • 1-Desk-Top

Power Supply 110V AC to 5V DC • 1-User's Guide Manual

For more information call:

CompuLynk 1-800-969-9889

160-B Turpike Rd., Westboro, MA 01581

Tel (508) 898-3731 • Fax (508) 898-2548

Inquiry 674.

Bsupport for Btrieve®

The "Norton Utilities" for Btrieve users.
Bedit: DISPLAY, UPDATE, COPY, and DELETE.
EXPORT SDF to dBASE & LOTUS. RECOVER damaged files.
Edit/Insert using Data Dictionary.
Bbug: TSR Btrieve debugger. Displays info in pop-up window.
Brun: BUTIL replacement with Run-Time and C source.
Bedit/Bbug: \$120. Brun: \$150. VISA/MC/COD/PO

800/359-2721 FAX: 517/887-3866

Information Architects, Inc.

P.O. Box 4184, East Lansing, MI 48826-4184

Inquiry 675.

For QuickBasic programmers

SMART^{menu} plus **SMARTTOOLS** cuts your development time by more than 60% by giving you an integrated user interface that easily configures to your applications. Dialogue boxes, pop-up & pull-down menus, as well as "fill the form" type entries. For QB 4.0 or later. Libraries, tools & manual are \$99 + S&H.

KALTEK

P.O. Box 2166, Martinez, CA 94553 (415) 370-1920

Inquiry 676.

SEPTEMBER 1990 • B Y T E 477

THE BUYER'S MART

PROGRAMMERS' TOOLS

Functional Sizzle

Give your application a full-featured pop-up calculator with memory, a 100-line scrollable tape and more. Takes minutes and costs only \$395 with no royalties. Demo disk \$3.00. Specify language.

Liaison Systems, Inc.

P.O. Box 82720, Kenmore, WA 98028
(206) 486-4996 — 30-day money back guarantee. Visa/MC

Inquiry 677.

TURBO PLUS \$199.00

Programming tools for use with Turbo Pascal 5.0 & 5.5
Screen Painter, Code Generator, I/O Fields, Dynamic Menus, Programming Unit Libraries, OOP Support, and Sample Programs included. All routines work in both text and graphics modes! 60-day money-back guarantee! Demo Disk avail. For IBM and compatibles.

NOSTRADAMUS, INC.

P.O. Box 9252, Salt Lake City, UT 84109-0252
(801) 272-0671

Inquiry 678.

FREE BUYER'S GUIDE

Programmer's Connection is an independent dealer representing more than 440 manufacturers with over 1200 software products for IBM and Macintosh personal computers. We have serviced the professional programmer since 1984 by offering sound advice and low prices. Call or write today to receive your FREE comprehensive Buyer's Guide.

Programmer's Connection US 800-336-1166
7249 Whipple Ave. NW Canada 800-225-1166
North Canton, OH 44720 International 216-494-3781

Inquiry 679.

SPEED FORTRAN DEVELOPMENT AND CUT MAINTENANCE COSTS

FORWARN—Finds common programming errors such as mismatched parameter lists and common blocks, and uninitialized variables. Prints detailed cross-references and call-tree diagrams. \$329
FORTRAN DEVELOPMENT TOOLS—includes Pretty (indents, renames, changes GOTOs to IF-THEN-ELSEs, etc.) and 6 more tools. \$129.
For IBM PC. Also for UNIX—ask for details.

Qubus Enterprises, Inc.

4490 Burton Way #1223, Colorado Springs, CO 80918
(719) 531-6084

Inquiry 680.

- **MULTITASK Real Time**
 - **SERIAL COMMUNICATION by interrupt**
- MTASK**® Professional was designed for the specific requirements of Scientific Laboratories and Robotics Departments. **Gratis:** demonstration diskette. Available for the present, for Turbo Pascal, Turbo C, Quick Pascal, Turbo Basic. Evaluation software for only \$95. Price \$495 + Shipping \$20. Taxes not Included.

RAMSI® International

53 rue Bernard Iske, F-92350 Plessis Robinson, FRANCE
International FAX: 33 (1) 46.32.48.37

Inquiry 681.

Universal Report Generator

Generate reports from ANY file or database! The Universal Report Generator is a programming library that allows you to generate a report from any file or database from within your C or Pascal programs. Features include output to screen, printer, or text files, totals and subtotals, calculated fields, free-form report layout, automatic sorts and query selection; and much more. Also includes a "point-and-shoot" mouse-driven report painter that can be used to easily define reports. Microsoft C, Turbo C, and Turbo Pascal \$395. UNIX version \$499. Source code available. Demo disk \$25.

Software Artistry, Inc.

3500 DePaw Blvd., Suite 1100, Indianapolis, IN 46268
Phone: (317) 876-3042 Fax: (317) 876-3258

Inquiry 682.

478 B Y T E • SEPTEMBER 1990

PROGRAMMERS' TOOLS

C and C++ DOCUMENTATION TOOLS

- **C-CALL** (\$59) Graphic-trees of caller/called hierarchy.
- **C-CMT** (\$59) Create, Insert, update comment-blocks for each function, listing functions and identifiers used.
- **C-LIST** (\$39) List, action-diagram, reformat programs.
- **C-REF** (\$49) Local/global/parameter cross-reference.
- **SPECIAL** (\$149) All 4, plus integrated C-DOC program.

SOFTWARE BLACKSMITHS INC.

6064 St. Ives Way, Mississauga, ONT Canada L5N-4M1
(416) 858-4466

Inquiry 683.

PROTOTYPING

PROTOTYPES FROM CAD

Without the Wait

BoardMaker™ Systems produces single/double sided, "ready-to-stuff" circuit boards up to 22" x 22" in-house. No chemicals or photographic techniques. Line/channel width down to 4/8 mils. Accepts standard Gerber, HPGL, Quest, Emma formats. Pays for itself after 12 to 20 boards.

Instant Board Circuits Corp.

20A Pamaron Way, Novato, CA 94949
Tel: (415) 883-1717 Fax: (415) 883-2626

Inquiry 684.

PUBLIC DOMAIN

SHAREWARE

FOR IBM™ AND COMPATIBLES

FREE 112 PAGE CATALOG
OVER 3000 PROGRAMS

CALL 1-800-245-BYTE (2983)

BEST BITS & BYTES

P.O. Box 8225-B, Van Nuys, CA 91409
FOREIGN COUNTRIES SEND \$4.00 FOR SHIPPING

Inquiry 685.

FREE CATALOG 1500+ disks

Public Domain - Shareware
Software for IBM compatibles

\$1.44 per disk

Canadian Software Distributors

Box 199, Munster, Ontario, K0A 3P0 CANADA

Inquiry 686.

FREE CATALOG

IBM SHAREWARE/PUBLIC DOMAIN
LOW AS \$1.25/DISK

1-800-321-4270

CRANSTON SOFTWARE

PO Box 2679, Minneapolis, MN 55402-0679

Inquiry 687.

FREE SOFTWARE FOR IBM® PC's

TRY US! Get 15 disks full of our best selling software—FREE! Great graphics, programmers utilities, desktop publishing, finance, games, education, plus our 1600 disk catalog. Pay only \$5.00 for shipping/handling — VISA/MC/AMEX

INTERNATIONAL SOFTWARE LIBRARY

511-104 Encinitas Blvd. • Encinitas CA 92024
CALL TODAY (619) 942-9998

Inquiry 688.

PUBLIC DOMAIN

325 MEGABYTES Virus Free Share Ware

Dealers/Sysope/Educators. Instant IBM Shareware Library for your Customers, user group or Students. Distributed in 25 Megabyte increments on HD 1.2/1.4 diskettes. \$39.00 for first 25 Megabytes, then add \$40.00 for each 25 Megabyte increment.
Add \$3.00 postage for each 25 Megabyte increment
Add \$4.00/25 Meg increment for 1.44 diskettes

Orders Only: 1-800-876-8496

Info/Tech: 1-405-524-5233

SHARE-NET

POB 12388, Okla City, OK 73157

No S/C charge for Visa/MasterCard
We gladly accept PD's from Educational, Fed/State Agencies

Inquiry 689.

SOFTSHOPPE, INC.

Selected Programs, Latest Versions, As Low as \$1.50, Same Day Shipping, and No Minimum Order. For FREE CATALOG for IBM PD/Shareware, CALL 800-829-BEST (2378) or FAX 313-761-7639.

SOFTSHOPPE, INC.

P.O. BOX 3678, Ann Arbor, MI 48106-3678

Inquiry 690.

SDK85 (8 bit) and SDK86 (16 bit)

NOW AVAILABLE ONLY FROM URDA, INC. which has an exclusive, world-wide, manufacturing and marketing license from Intel, Inc. The UROA SDK85 and SDK86 educational trainers and microprocessor development systems are now furnished fully assembled and boxed with manuals. Call URDA, Inc. for new low prices and delivery schedules. Other 8, 16 and 32 bit systems are available.

Phone URDA, Inc.

1-800-338-0517 or 412-683-8732

Inquiry 691.

SECURITY

FIGHT PIRACY!

Since 1986, companies worldwide have been choosing Az-Tech security products. If you demand the strongest protection available, why not choose one of these "proven leaders":

- **EVERLOCK** Copy Protection
- **EVERTRAK** Software Security
- **EVERKEY** Hardware "Key" Software Security

For IBM and Compatibles: 30 day money back guarantee. Free info and demo disk available.

Az-Tech Software, Inc.

305 East Franklin, Richmond, MO 64085

(800) 227-0644 (816) 776-2700
Fax: (816) 776-8398

Inquiry 692.

THE ULTIMATE COPY PROTECTION

- Completely Menu Driven
 - Defeats all Hardware/Software Copiers
 - No Source Code Changes
 - Multiple Layering
 - No Damaged Media
 - Full Hard Disk Support
 - Unlimited Metering
 - FREE Demo Disk
- Quite Simply The Best Ways To Protect Your Valuable Software Investment
STOPCOPY PLUS™

BBI COMPUTER SYSTEMS® (301) 871-1094
14105 Heritage La., Silver Spring, MD 20906 FAX: (301) 460-7545

Inquiry 693.

COP's Copylock II

- Protects on standard diskettes
- Cannot be copied by any device incl. Option Board
- Fully hard disk installable
- Normal back-up of protected programs
- LAN-support
- Creates safe demo version of your software

Standard Version \$975, Automatic Version \$1950

DANCOTEC Computer

In US: 2835 Sierra Rd., San Jose, CA 95132 408-729-8162 or 1-800-344-2545
Int'l: 2880 Bagvard, Denmark Phone +45-44440322 Fax -44440772

Inquiry 694.

THE BUYER'S MART

SECURITY

BUGS! BUGS! BUGS! WE EXTERMINATE!

Every program has bugs. How do you find them? DIMENSIONAL REASONER™ is a new tool for finding and eliminating bugs in FORTRAN and BASIC programs. It uses the new AI technique of Symbolic Dimensional Algebra to evaluate all of your equations to see if they make sense. Just add comments defining variable units, we do the rest. 30-day \$5 back.

PC/DOS \$65, VAX \$250 Visa/MC. Bulk discounts available.

DIMENSIONAL REASONER™

205 Longleaf Ct., Aiken SC 29803 803-649-7887

Inquiry 695.

BIT-LOCK® SECURITY

Piracy SURVIVAL 5 YEARS proves effectiveness of powerful multilayered security. Rapid decryption algorithms. Reliable/small port-transparent security device. PARALLEL or SERIAL port. Complemented by economical KEY-LOCK™ and multifaceted COMPUTE-LOCK™ including countdown, timeout, data encryption, and multiproduct protection. (Dos/Unix/Mac)

MICROCOMPUTER APPLICATIONS

3167 E. Otero Circle, Littleton, CO 80122

(303) 770-1917

Inquiry 696.

1st Defense ANTI-VIRAL software

Protect your investment by removing that virus before it strikes.

\$59.95

1st Defense Anti-Viral Systems

ModalLogic Incorporated

10474 Broadview Rd., Broadview Hts. OH 44147

(216) 838-5238

MS-DOS 2.11+ • Ohio Residents Add \$4.20

Specify either 3 1/4" or 5 1/4" disk

Inquiry 697.

COPY PROTECTION

The world's leading software manufacturers depend on Softguard copy protection systems. Your FREE DISKETTE introduces you to SuperLock™—invisible copy protection for IBM-PC (and compatibles) and Macintosh.

- Hard disk support
- No source code changes
- Customized versions
- LAN support
- New upgrades available

(408) 773-9680

SOFTGUARD SYSTEMS, INC.

710 Lakeway, Suite 200, Sunnyvale, CA 94086

FAX (408) 773-1405

Inquiry 698.

HANDS OFF THE BOARD® 1/2 SIZE SECURITY BOARD

Stop floppy boot — Require password to boot PC. Real-time disk encrypt — prevent boot sector virus. Prevent DOS FORMAT/DISK and low-level formats. Set hard disk READ ONLY or turn ON/OFF.

Turn floppies, printers and COM ports ON/OFF

IBM XT, AT Bus — DOS V3.0+ — \$149.95 + \$5.00 S/H

SYSTEMS CONSULTING INC.

PO BOX 111209, Pittsburgh, PA 15238

(412) 781-5280

Inquiry 699.

SOFTWARE/ACCOUNTING

PC TIME CLOCK

AutoTime is an Employee Management System that allows you to turn any PC into an Electronic Time Clock. AutoTime provides Time & Attendance, Job Costing, Payroll Interface, and Labor Distribution reporting. Network compatible. Prices start at \$495. Other Business Products: Network FAX, Absence Call-In, db-EDI.

Chase Technologies

1617 Kingman Ave., San Jose, CA 95128

(408) 998-2917

Inquiry 700.

SOFTWARE/ACCOUNTING

dBASE BUSINESS TOOLS

- GENERAL LEDGER
- ORDER ENTRY
- JOB COSTING
- BILL OF MATLS
- PAYROLL
- PURCH ORDINVENTORY
- ACCOUNTS RECEIVABLE
- JOB ESTIMATING
- SALES ANALYSIS
- ACCOUNTS PAYABLE

\$99 ea. + S&H

DATAMAR SYSTEMS Cred. Card-Check-COD

4876-B Santa Monica Ave.

San Diego, CA 92107 (619) 223-3344

Inquiry 701.

SOFTWARE/BUSINESS

DATA ENTRY SOFTWARE

Full featured, heads-down data entry with two-pass verification, edit language, operator stats, much more! Designed for the PS/2®, PC, XT, AT or compatibles.

PC's from \$395 LAN version available

FREE 30 day trial

Computer Keys Tel: 206/776/6443

21929 Makah Rd., Fax: 206/776-7210

Woodway, WA 98020 USA: 800/356-0203

Inquiry 702.

LP88—LINEAR PROGRAMMING

A general-purpose system for solving linear programs with up to 3,000 constraints and 15,000 variables. Build LP88 into your own programs with compiled Turbo Pascal units. LP88 reads/writes Lotus worksheets. Use 1-2-3/Symphony as a matrix generator or post processor. Many other features including interactive and batch operation, spreadsheet LP display and editing, equation processor, problem/basis storage, primal/dual conversion, file I/O. Simplex restart, report generator, sensitivity analysis. \$29 for working demo. \$149 with manual and 8087 support. \$299 with Turbo Pascal units.

Eastern Software Products, Inc.

P.O. Box 15328, Alexandria, VA 22309

(703) 360-7600

Inquiry 702.

SOFTWARE/ENGINEERING

Boolean Logic Simulator

- LOGICSIM—a designer's assistant
- Make your logic equation waveforms visible
- Graphic waveform stimulus editor
- Single, multiple, simple & complex devices
- Multiple clocks for registered eqn's
- For IBM & clones. XT & up, CGA, EGA, VGA
- \$89.95 includes 1 yr upgrade support
- \$15.00 demo
- VISA, PO, MO, CHK

ARCTOS SYSTEMS CORP.

20 Sandwell Cr., Kanata, Ontario, Canada K2K 1V3

(613) 592-0947

Inquiry 703.

Affordable Engineering Software

FREE APPLICATION GUIDE & CATALOG

Circuit Analysis • Root Locus • Thermal Analysis • Plotter Drivers • Engineering Graphics • Signal Processing • Active/Passive Filter Design • Transfer Function/FFT Analysis • Logic Simulation • Microstrip Design • PC/MS-DOS • Macintosh • VISA/MC

BV Engineering Professional Software

2023 Chicago Ave., Suite B-13, Riverside, CA 92507

(714) 781-0252

Inquiry 704.

MATFOR

UNMATCHED VALUE FOR NUMERICAL COMPUTING

An interpreter with over 375 functions for Matrix Computations, Calculus, Differential/Nonlinear Equations, Optimization, Linear/Dynamic Programming, Graphics, Advanced Statistics, Signal Processing, Analysis/Design of Control Systems, and more. Extendible and Self-contained, \$150 IBM/compatibles. Editions using extended memory on 286/386 also available.

Computational Engineering Associates

3525 Del Mar Heights Rd., Suite 183, San Diego, CA 92130

(619) 259-8863

Inquiry 705.

SOFTWARE/ENGINEERING

Mass2—MASS & VOLUME CALCULATOR with MATERIALS DATABASE

Easily calculate the volume & weight of hundreds of shapes. Never need to look up material densities again! Differential and proportional comparisons made automatically. Menu driven with on-line context sensitive help. Flexible input system accepts Decimal, Fractional, and Exponential notation. For IBM PCs and Compatibles with 384K free.

DEMPEY'S FORGE, Software Division

Rt 2 Box 407, Gladys, VA 24554

Inquiry 706.

Control System Design & Simulation for PC's CODAS - II

Time & Freq. domain & s-plane design environment • Easy entry of transfer functions • Open or closed loop systems • Nyquist, Nichols or Bode plots • Root Loci • Discrete time/sampled data systems • Nonlinear domain • Non-unity feedback •

Also available: PCS Process Control Simulation

Produced by Gollen & Verwer Partners (UK)

Distributed exclusively in North America by

DYNAMICAL SYSTEMS, INC.

P.O. Box 35241, Tucson, AZ 85740 (602) 292-1962

Inquiry 706.

PC BASED DATA ACQUISITION

Snap-Series Software is the best solution for Integrated Data Acquisition, Analysis, and Display without programming. Works with I/O hardware by 12 manufacturers, and allows extensive time and frequency domain analysis. Ideal for monitoring, waveform generation, and DSP.

HEM Data Corporation

17336 12 Mile Road, Southfield, MI 48076

Voice: (313) 559-5607 Fax: (313) 559-8008

Inquiry 726.

Analog Circuit Simulation

- Macintosh and PC CAE
- Schematic Entry
- SPICE Simulator
- Model Libraries
- Monte Carlo Analysis
- Plotting/Graphics Output

Intusoft

The leader in low cost, full featured CAE software

PO Box 6607, San Pedro, CA 90734

(213) 833-0710 FAX (213) 833-9658

Inquiry 707.

4-BAR SYNTHESIS IN A PC

Lear...links is a powerful 4-bar design package with 3 and 4 design position options and many optimization and analysis tools including full animation. It runs on any IBM PC/XT, AT, PS/2, or compatibles with 256K and graphics display.

Full package: \$475.00, Interactive Demo: \$25.00

Lear Com Company

2440 Kipling St., Ste 206, Lakewood, CO 80215

(303) 232-2226 FAX (303) 232-8721

Inquiry 708.

MICROSTRESS CORP.

New MICROSTRESS 2D/3D Rel. 3.

Finite Element Analysis program for IBM PCs, MAC II Fam., and compatibles. Number of nodes, elements and conditions limited by disk space and model bandwidth (10000 d.o.f.). Color graphics support on various display cards (EGA, VGA, VEGA and Hercules) \$250. SAFECAD (bi-directional AUTOCAD interface) \$95. GRAFPLUS \$55. Plus S/H.

Accept VISA/MasterCard. Send for brochure.

P.O. Box 3194, Bellevue, WA 98009

Tel./Fax (206) 643-9941

Inquiry 709.

THE BUYER'S MART

SOFTWARE/ENGINEERING

SIMULATION WITH GPSS/PC™

GPSS/PC™ is an MS-DOS compatible version of the popular mainframe simulation language GPSS. Graphics, animation and an extremely interactive environment allow a totally new view of your models. If you are contemplating the creation or modification of a complex system you need GPSS/PC to help you predict its behavior. Call now.

MINUTEMAN Software

P.O. Box 1717Y, Stow, Massachusetts, U.S.A.
(508) 887-5662 ext. 540 (800) 223-1430 ext. 540

Inquiry 710.

Circuit Analysis — SPICE

Non-linear DC & Transient; Linear AC.

- Version 3B1 with BSIM, GaAs, JFET, MOSFET, BJT, diode, etc. models, screen graphics, improved speed and convergence.
- PC Version 2G6 available at \$95.

Call, write, or check inquiry # for more info.

Northern Valley Software

28327 Rothrock Dr., Rancho Palos Verdes, CA 90274
(213) 541-3677

Inquiry 711.

FREE ENGINEERING MAGAZINE

Personal Engineering is a monthly magazine sent free of charge (USA only) to scientists/engineers who use PCs for technical applications. Topics each month include **Instrumentation • Data Acq/Control • Design Automation**. To receive a free sample issue and qualification form either circle below or send request on letterhead to:

Personal Engineering Communications
Box 300, Brookline, MA 02146

Inquiry 712.

Worstcase Gets Even Better! Analog Circuit Simulation

ECA-2 Electronic Circuit Analysis offers the best Monte Carlo and Worst-Case analyses with all this and MORE included:

- AC, DC, Transient
- Full nonlinear simulator
- Sine, Pulse, PWL, SFFM
- On Line, Real Time and Exponential Generators
- Interactive/batch modes
- Multiple plots

Tatum Labs, Inc.

3917 Research Park Dr., B-1, Ann Arbor, MI 48108
(313) 663-8810

Inquiry 713.

SOFTWARE/FORTRAN

FORTRAN77-to-Structured C TRANSLATOR

FORTRAN PROGRAMMERS ASSISTANT II converts spaghetti FORTRAN into neat, maintainable C code. Runtime library source and C tool set included. It will make your conversion process easy and will significantly reduce your conversion and future maintenance costs. ASSISTANT II Plus also produces structured FORTRAN. Easy to use. At low prices. A must for conversion projects. Free sample translations available.

Please call, write, or check inquiry # for more information.

MICROTOOLS

P.O. BOX 2745, Santa Clara, CA 95055-2745, U.S.A.
phone/fax (408) 243-7688

Inquiry 714.

SOFTWARE/GEOLOGICAL

GEOLOGICAL CATALOG

Geological software for log plotting, gridding/contouring, hydrology, digitizing, 3-D solid modelling, synthetic seismogram, fracture analysis, image processing, scout ticket manager, over 50 programs in catalog. Macintosh too! Please call, or write, for Free Catalog!

RockWare, Inc.

4251 Kipling St., Suite 595, Wheat Ridge, CO 80033 USA
(303) 423-5645 Fax (303) 423-6171

480 BYTE • SEPTEMBER 1990

SOFTWARE/GRAPHICS

SEGS 2.1 Scientific Engineering Graphics System

- Logarithmic, Time/Date & Linear Axes.
- Easy Curve Fitting and Data Smoothing.
- 1-2-3 Interface & Numeric Spreadsheet.
- Supports all Video & Device Standards.
- 10 Curves with up to 16,000 points each.

Advanced Micro Solutions

3817 Windover Dr. 405-340-0697
Edmond, OK 73013 800-284-3381

QuickGeometry CAD/CAM Developer's Kit

Third party and custom developers: get your products to market sooner—eliminate 90% of development time and expense.

Just call functions for: reading and writing DXF files; vectorized geometry display for any graphics resolution; geometric operations (rotate, scale, move, copy, mirror, intersect, etc.) for lines, arcs, ellipses, NURB splines.

C source available for MS/DOS, Macintosh, UNIX, VAX, other.

Call (617) 628-5217 today for free info or to order.

Building Block Software, PO Box 1373, Somerville, MA 02144

Inquiry 715.

FRACTAL GRAFICS

is a radical new drawing program for your PC. Create breathtaking images and scientific models interactively with your mouse. Add dramatic effects to any PCX image. On-line tutorial, extensive Guidebook, and 200+ hands-on examples help you use and understand fractals and Chaos. Only \$79, FREE Brochure!

Cedar Software

R1 Box 5140, Morrisville, VT 05661
(802) 888-5275

Inquiry 716.

The Ultimate CAD/CAM Engine

TurboGeometry Library 3.0. The most complete tool box of 2D & 3D routines available today! Over 300 routines. Surfacing, Solids, Hidden line, Volumes, Areas, Transforms, Perspectives, Decom, Clipping, Tangents & more. 30 day guar., \$199.95 w/source S&H Incl. Foreign \$225.00 MS/PC DOS 2.0+. Turbo Pascal, Turbo C, MSC, MIX C, Zortec C++. VISA/MC, PO, Chk, USA funds only.

Disk Software, Inc.

2116 E. Arapaho Rd., #487, Richardson, TX 75081
(214) 423-7288, (800) 635-7760, FAX (214) 423-7288

Inquiry 717.

RAINDROP™

FAST, compact PrtScr Utility for end users AND developers. Hardcopy as fast as 10 secs. Average binary size - 6 kbyte. 12 video graphic standards. Scale, rotate, colorize and more. 'CALL' from user-written programs. Complete 9- & 24-pin dot-matrix, inkjet, and laserjet library \$39.95+\$3 s/h.

ECLECTIC SYSTEMS

8106 St. David Ct., Springfield, VA 22153
(703) 440-0064

Inquiry 718.

PEN PLOTTER EMULATOR

FPLLOT turns your dot matrix or laser printer into an HP pen plotter. Fast hi-res output. No jagged lines. Vary line width, color. Works with Autocad, Drafrix, etc. Supports NEC P5/P6, IBM Proprietary, Epson LQ/FX, Toshiba, HP Laserjet, Okidata 29x/39x, Hercules/CGA/EGA/VGA. \$64 check/m.o./VISA/MC

Fplot Corporation

24-16 Steinway St., Suite 605, Astoria, NY 11103
718-545-3505

Inquiry 719.

SOFTWARE/GRAPHICS

POPULAR HGRAPH

SCIENTIFIC 2D & 3D graphic routines for IBM PC, VAX, SUN and Macintosh. Powerful, easy to use. Multiple fonts, device and machine independent. Uses max resolution. Links with FORTRAN, Pascal, C, Modula-2 and QuickBasic. \$119.00

Custom software development.
UGraph—the graphics editor available now!

HeartLand Software, Inc.

234 S. Franklin, Ames, IA 50010
(515) 292-8216

Inquiry 720.

GRAPHICS PRINTER SUPPORT

AT LAST! Use the PrtSc key to make quality scaled B&W or color reproductions of your display on any dot matrix, inkjet, or laser printer (incl. Postscript) in up to 64 shades of gray or 256 colors. GRAFFPLUS supports all versions of DOS with IBM (incl. EGA, VGA, Super VGA), Hercules, or compatible graphics boards. Linkable/OEM versions available. \$59.95

Jewell Technologies, Inc.

4740 - 44th Ave. SW, Seattle, WA 98116
(800) 359-9000 x527 (206) 937-1081

Inquiry 721.

FORTRAN PROGRAMMER?

Now you can call 2-D and 3-D graphics routines within your FORTRAN program

GRAFOMATIC: screen routines \$135.
PLOTOMATIC: plotter driver 135
PRINTOMATIC: printer driver 135.

For the IBM PC, XT, AT & compatibles. We support a variety of compilers, graphics bds., plotters and printers.

MICROCOMPATIBLES

301 Prelude Dr., Dept. B, Silver Spring, MD 20901 USA
(301) 593-0883

Inquiry 722.

GRAPHIC TOOLS LIBRARY

PHONTM—THE FONTMAKER: Interactively create scalable, expandable and flexible outline, stroke and bitmap fonts, figures and logos. Create hand-writing fonts. Scale a type style to various size fonts. Laser font Loader. Fast print your creation at 60 to 600 dpi. Use same font for display and print. Free hand drawing. Use fonts with PC_VDI, SCANLIB, IBM 8514A & others. \$395.

NOVA INC.

2500 W. Higgins Road, #1144 CALL 708-882-4111
Hoffman Estates, IL 60195 FAX 708-882-4173

Inquiry 723.

IMAGE TOOLS LIBRARY

SCANLIB: Image Capture. Animation. Scale image up, down. Rotate, Mirror, Manage scanned images. Includes Text functions. 149 fonts. Modes from here. to 800X600X256. Faster and better package for PCX file handling. \$195. "C", PASCAL, FORTRAN, MS BASIC 4.0-7.0, PCKIO: Source Library avail. in "C" or Assembler for fast read/write & display of PCX files at any point on screen or memory. Color Mapping. \$295.

NOVA INC.

2500 W. Higgins Road, #1144 CALL 708-882-4111
Hoffman Estates, IL 60195 FAX 708-882-4173

Inquiry 724.

VGA ColorWorks™ V2.2

The most advanced image creation and manipulation package available for the VGA. Import/export TIF, PCX, TARGA images. Edit with over 250,000 colors in multiple hardware resolutions (switchable on-the-fly). Complete set of geometrics and patterns. Special effects include tint, shade, blend, mask, fountains, cutpaste, hardware zoom emulation, ... much more (over 150 drawing controls). Incl. 44 fonts, drivers for PostScript, HP-LaserJet, HP-PaintJet, Epson LQ/FPX. Producing up to 64 grey levels or 4096 colors. \$59. Call for our free fully operational demo.

SPG Inc.

1515 NW 167th Street, Suite 110-L, Miami, FL 33169
(305) 362-6602

Inquiry 725.

THE BUYER'S MART

SOFTWARE/GRAPHICS

GRAPHICS LIBRARIES for C, FORTRAN, PASCAL & QuicKBASIC

- Supports VIDEO, PRINTERS & PLOTTERS.
- Linear, log, polar, smith, bar & pie charts.
- Scalable fonts, line types, markers.
- Multiple plots on a page.
- Over 100 routines with full source code.
- 240 page manual. No royalties.

\$295.00 (713) 491-2088
Sutrasoft

10506 Permian Dr. • Sugar Land, TX 77478

Inquiry 727.

SOFTWARE/LANGUAGES

DRUMA FORTH-83

Break the 64K barrier without speed/space penalty. Powerful, attractively priced. '83 Standard.

- 1Mb+ automated memory management
- Full OS interface, extensive utilities
- On-line documentation, ASCII/block files
- Other products: windows, modules, profiler
- IBM PC/XT/AT including 386 compatibles

FREE learn/utility disks with purchase

DRUMA INC.

6448 Hwy. 290 East E103, Austin, TX 78723

Orders: 512-323-5411 Fax: 512-323-0403

Inquiry 728.

FINAL LIQUIDATION!!

IBM * Compilers, SAVE UP TO 80%!

Title	Retail	Sale
COBOL V2.0 (3 1/2" & 5 1/4")	\$900	\$100
Prof. FORTRAN V1.3 (3 1/2" & 5 1/4")	\$795	\$ 90
C Compiler (3 1/2" or 5 1/4")	\$395	\$ 50
BASIC Compiler V2.0 (3 1/2")	\$495	\$ 50
Macro Assembler V2.0 (3 1/2" or 5 1/4")	\$195	\$ 40

VISA, MC, Check accepted, S and H fee \$10 per order

THE COMPUTER PLACE, INC.

12105 Darnestown Rd. #9A Tel: (301) 330-6016
Gaithersburg, MD 20878 Fax: (301) 926-3415

Inquiry 729.

EASY TO C

The C Workshop interactive software teaches you C. Do real C program exercises with built-in editor and compiler. Feedback guides you to solution. All you need to learn C, including our 384-page book. \$69.95 + \$5 Ship. PC compatibles.

MC/VISA/AE/check.

Wordcraft

3827 Penniman Ave., Oakland, CA 94619

(800) 762-8003 (PST)

Inquiry 730.

SOFTWARE/MATHEMATICS

Fast WYSIWYG Editor

Leo — the best math editor available. See equations as you type. Menu and control key operation. Reads and writes TeX files.

Leo for PCs — \$199

ABK Software

4495 Ottawa Pl., Boulder CO 80303

(303) 494-4872

Inquiry 731.

MATH EDITING FOR THE PC

$$x_i^2 = \sum_{k=0}^{\alpha} [x_i^{2\alpha} (\frac{\alpha}{k}) + (\frac{1}{\alpha} \int F ds)]$$

- MathEdit constructs math equations to be inserted into WordPerfect, Word, WordStar, and others.
- WYSIWYG interface—no codes need to be learned.
- MathEdit—\$199

K-TALK COMMUNICATIONS

30 West First Avenue, Suite 100
Columbus, Ohio 43201
(614) 294-3535

Inquiry 732.

SOFTWARE/MATHEMATICS

MATHEMATICIANS—ENGINEERS

Have you ever seen functions of a complex variable? Would you like to really understand differential operators like div, grad and curl? How about a peek into the fourth dimension? Call or write for information on our latest PC and Macintosh software.

Lascaux Graphics

3220 Steuben Ave., Bronx, NY 10467
(212) 654-7429

Inquiry 733.

DERIVE®

A Mathematical Assistant

Makes math more inspiration and less perspiration! Combines the power of computer algebra with 2D & 3D plotting and a friendly menu-driven user interface. Does equation solving, calculus, trigonometry, vector & matrix algebra, and more. Derive requires a PC compatible computer & 512K memory.

Soft Warehouse, Inc.

3615 Harding Ave., Suite 505, Honolulu, HI 96816
(808) 734-5801

Inquiry 734.

SOFTWARE MEDICAL

Medical Systems with ECS

PPM offers a complete line of medical software ranging from simple insurance claims processing to comprehensive A/R management. PC CLAIM PLUS—claims processing with ECS to over 100 major insurance carriers—30-day money-back guarantee. THRESHOLD—complete A/R, patient billing, comprehensive practice management statistics. CLAIM NET—Nationwide electronic claims clearinghouse transmits claims to over 100 insurance carriers. Software prices start at \$45900. Dealer inquiries welcome.

Physicians Practice Management

350 E. New York, Indianapolis, IN 46204
800-428-3515 317-634-8080

Inquiry 735.

SOFTWARE/SCANNERS

Optical Character Recognition

Stop retyping! PC-OCR™ software will convert typed or printed pages into editable text files for your word processor. Works with HP ScanJet, Panasonic and most other scanners. Supplied with 18 popular fonts. User trainable: you can teach PC-OCR™ to read virtually any typestyle, incl. foreign fonts. Proportional text, matrix printer output. Xerox copies OK. \$385. Check/VISA/MC/AmExp/COD

Essex Publishing Co.

P.O. Box 391, Cedar Grove, NJ 07009
(201) 783-6940

Inquiry 736.

INCREDIBLE OCR

A total solution to all your OCR needs. Recognizes many common text typefaces, and can quickly learn most others. Supports all the major word processors. Faster and more accurate than systems costing twice as much. Amazingly it works with virtually every brand of hand-held scanner, most full-page scanners, and all PC/flex boards. More than 15,000 satisfied users.

All for only \$184.00 including shipping*

*International include \$25 for airmail shipping

Check, money order, VISA, MC, and COD accepted.

PAI OCR

611 Tucker Street, Raleigh, NC 27603
800-762-5542 FAX: 919-828-5196

Inquiry 737.

SOFTWARE/SCIENTIFIC

C Scientific Library

Create customized scientific and engineering tools with this comprehensive library of 600 functions including linear algebra, eigen-systems, matrix computations, time series, smoothing and filtering, statistics, regression, linear and integer programming, nonlinear systems, optimization, differential equations, curve-fitting and graphics. Superior documentation. Usable, encapsulated, modular, reliable, mature, and affordable. Several licensing and system options are available starting at \$295. Request on company letterhead or send \$5 (refundable on purchase) for 50-page CSL Buyer's Guide.

Eigenware Technologies

13090 La Vista Drive, Saratoga, CA 95070
(408) 867-1184 Fax: (408) 867-6575

Inquiry 738.

SOFTWARE/SCIENTIFIC

FREE CATALOG 800-942-MATH

MicroMath Scientific Software
Salt Lake City, UT 84121-0550

Inquiry 739.

Scientific/Engineering/Graphics Libraries Turbo Pascal, Turbo+MS C, MS Fortran, Basic Send for FREE catalogue of software tools for Scientists and Engineers. Includes: Scientific subroutine libraries, device Independent graphics libraries (including EGA, HP plotter and Laserjet support), scientific charting libraries, 3-D plotting library, data acquisition libraries, menu-driven process control software. Versions available for a variety of popular languages.

Quinn-Curtis

1191 Chestnut St., Unit 2-5, Newton, MA 02164
(617) 965-5660

Inquiry 740.

SOFTWARE/SORT

OPT-TECH SORT/MERGE

Extremely fast Sort/Merge/Select utility. Run as an MS-DOS command or CALL as a subroutine. Supports most languages and file types including Btrieve and dBASE. Unlimited file sizes, multiple keys and much more! MS-DOS \$149. OS/2, XENIX, UNIX \$249.

(702) 588-3737

Opt-Tech Data Processing

P.O. Box 678 — Zephyr Cove, NV 89448

Inquiry 741.

SOFTWARE/UTILITIES

Duplicate Disks Fast!

DiskDupe duplicates, formats and compares disks amazingly fast—up to 200 disks an hour! Its unique RELAY feature lets you quickly duplicate lots of master disks effortlessly. And you can protect your masters by storing disk images on your hard disk. Also supports high-density formats—plus a whole lot more! \$79+S/H, Money Back Guarantee.

Micro Systema Designs, Inc.

1309 El Curtola Blvd., Lafayette, CA 94549
(415) 944-9994 Order today!

Inquiry 742.

SOFTWARE/VOICE

MULTI-VOICE® TOOLS

Multi-Voice Tools is a complete development Toolkit for Pascal or "C" to access all the features of the WATSON or DIALOGIC Speech Boards. It is also a high level library of procedures to build MULTI-LINE VOICE RESPONSE systems in minutes. A powerful TELEPHONE ANSWERING program is given as an example with source code.

DIALOGIC, RHETOREX, VBX \$599, WATSON \$99, Visa/MC

ITI Logiciel

1705 St. Joseph E., Suite 4, Montreal, P.Q. Can. H2J 1N1
(514) 861-5988

We can also write your Voice Response application programs.

Inquiry 743.

STATISTICS

JUST RELEASED STATISTIX 3.1

PC Magazine Editor's Choice!

You can rely on STATISTIX to get your work done EASILY and QUICKLY. Menu-driven. Powerful yet compact. STATISTIX offers basic and advanced statistics with an easy-to-follow manual full of examples.

"Technical support was excellent..."

PC Magazine

Get the quality you want at a price you can afford. U.S. & overseas price: \$199. Money-back-guarantee.

Tel: 612-631-2852 Fax: 612-636-3070

Analytical Software, PO Box 130204, St Paul, MN 55113

Inquiry 744.

THE BUYER'S MART

STATISTICS

Cover all the bases of design . . . with Methodologist's Toolchest™, a comprehensive package of five programs to aid in research design and analysis. Specifically, these programs offer assistance in sampling, data collection procedures, statistical analyses, experimental design, and measurement and scaling. \$499.95 + s/h. VISA, MC, AMEX, PO, Checks accepted.

The Idea Works, Inc.

100 West Briarwood, Columbia, MO 65203
1-800-537-4866 FAX 314-445-4589
Outside USA 314-445-4554

Inquiry 745.

NCSS 5.x Series — \$125

Easy-to-use menus & spread sheet. Multiple regression. Tests: ANOVA (up to 10 factors, rep. measures, covariance). Forecasting. Factor, cluster, & discriminant analysis. Nonparametrics. Cross Tabulation. Graphics: histograms, box, scatter, etc. Reads ASCII/Lotus. Many new add-on modules.

NCSS

865 East 400 North, Kaysville, UT 84037
Phone: 801-546-0445 Fax: 801-546-3907

Inquiry 746.

SCA STATISTICAL SYSTEM

The only statistical software encompassing Forecasting & Time Series Analysis Quality and Productivity Improvement General Statistical Analysis

Available on DOS, OS/2 and Mac operating systems. Call today for more information

Scientific Computing Associates

4513 Lincoln Ave., Suite 106, Lisle, IL 60532, USA
Phone: (708) 960-1698 FAX: (708) 960-1815

Inquiry 747.

SURVEYS

Spreadsheet Statistics

Comprehensive statistics and forecasting modules for analyzing LOTUS worksheets. Low cost \$25 each. Convenient. Easy to use. Includes tutorial. Ideal for vertical markets. Basic and advanced statistics with graphics. Guaranteed best buy. Compare. Nothing else comes close. Free brochure.

StatPac Inc.

6500 Nicollet Ave. S., Minneapolis, MN 55423
(612) 866-9022

TERMINAL EMULATION

TEK 4207/4105/4014 Emulation

PC-PLOT-V is a complete communications program which includes file transfer, script files, VT-100/200 emulation plus Tektronix graphics terminal emulation. Supports COM1-4 plus support for DECnet, NETBIOS, U-B Net1. Graphics screenprint. \$225. Free Catalog.

MicroPlot Systems Co.

1897 Red Fern Dr., Columbus, Ohio 43229
614-882-4786 614-882-3399 (BBS/FAX)

Inquiry 748.

TONER CARTRIDGES

TONERS

LASER PRINTERS \$42.00 SHARP Z-50/70 \$40.00
PC COPIERS \$38.00 XEROX 1012 \$140.00
NEW LONG LIFE EPS DURA-DRUM \$87.00
YOUR CARTRIDGES TESTED, REMANUFACTURED,
& FULLY GUARANTEED BY EXPERIENCED TECHS.
COLORS 24 HR. TURNAROUND MC/VISA

SOUTHERN CARTRIDGE SERVICE
33 MATHEWS DR.
HILTON HEAD ISLAND, SC 29926

800-442-6288

Inquiry 749.

482 B Y T E • SEPTEMBER 1990

TRANSLATORS

100% PASCAL → C

P2C translates Turbo Pascal 3/4/5 into C code (Turbo, Microsoft, TopSpeed, ANSI) and supports all TP features: sets, nested functions, with, variant records, strings, files, interrupts, const expressions, graphics, units, dynamic memory management, mem & port arrays, absolute variables; in short—everything except inline and object-oriented features. Comes with full TP runtime library emulation and automatically generates project, make, header, and C files. English manual (130+ pages) included. Professional Edition includes complete source code for emulation library.
Standard Ed. \$395 Professional Ed. \$595 (MC, VISA, AMEX)
LAUER & WALLWITZ GmbH, Erikoenigweg 9,
D-6200 WIESBADEN, West Germany, Phone +49 (611) 42771

Inquiry 750.

UNINTERRUPTIBLE POWER

HOW TO PROTECT YOUR COMPUTER And Make It Last Longer

FREE money-saving literature tells you how to protect your computer and make it last longer with an uninterruptible power supply. 500VA through 18KVA models from the world's largest manufacturer of single-phase UPS.

Best Power Technology, Inc.

P.O. Box 280, Necedah, WI 54646
Toll-Free (800) 356-5794, Ext. 3858
Telephone: (608) 565-7200, Ext. 3858
See our Ad on page 503.

Inquiry 751.

DATASAVER AC POWER BACKUP

Provides reliable, affordable power protection for LAN Systems, Fileservers, CAD/CAM Systems, and all Desktop Microcomputers. Low profile, convection cooled and auto shutdown capabilities are some of the many user benefits. Highest quality. Made in the U. S. A. (Dealer, VAR, OEM inquiries welcome)

For Free Information Call or Write:

CUESTA SYSTEM CORPORATION

3440 Roberto Court, San Luis Obispo, CA 93401
(800) 332-3440 (805) 541-4160

Inquiry 752.

UTILITIES

DEAL - STEAL - DEAL Cardfile / Autodialer

- DBaseIII+ compatible
- More than 1,000,000 Records
- Not Copy protected
- Direct search and content search
- Any Mouse or none
- Not Memory Resident
- Cards can be sorted
- Any Phone and Modem

This is a MUST HAVE Utility. It's fast, easy, and you can afford it.
\$19.95

Engineering Concepts

314 N. Newell Pl., Fullerton, CA 92632
(714) 525-3519

Inquiry 753.

EZ-COPY PLUS™

FLAWLESS DISKETTES FAST! on the PC you already own! THIS IS SOFTWARE ONLY! Bypasses DOS for the utmost speed. Great for publishers, developers, MIS directors, etc. 2X+ faster than DOS. Read diskette once, then, quickly & accurately mass duplicate 5.25" & 3.5" disks on your own PC/XT/AT/etc. Formats, copies, verifies, optionally SERIALIZES & PRINTS LABELS. In 1 smooth operation. Save images to HD, more. . . Replaces dedicated hardware worth \$1000s. Only \$495 +s&h. Not Copy Protected for use on up to 10 machines ©

EZX, 917 Dakrove Dr. #101-8890, Houston, TX 77058
INFO: 713/280-9900, BBS: 713/280-8180, FAX: 713/280-0525
Orders (V/MC/AX/D) & Brochures Toll Free: 1 • 800 • 359 • 9539

Inquiry 754.

COPY AT TO PC—BRIDGE-IT 3.5

"CPAT2PC" RELIABLY writes 360KB floppies on 1.2 MB drives, saving a slot for a second hard disk or tape backup. Only \$79.00 + SH
"BRIDGE-IT 3.5" is a DEVICE DRIVER supporting 3 1/2" 720KB/1.44MB drives for PC/XT/AT without upgrading DOS/BIOS. Only \$39.00 + SH
BRIDGE-IT 3.5 BUNDLED WITH INTERNAL 1.44MB DRIVE AT \$129.00 + SH VISA/MC/COD UPS BR

MICROBRIDGE COMPUTERS

655 Sky Way Suite 220, San Carlos, CA 94070
1-415-593-8777(CA) 1-415-593-7675 (FAX)
1-416-855-1993 (CANADA) 1-800-523-8777
0909-260-188 (UK) 4711 4020 (FRG)

Inquiry 755.

UTILITIES

UNIX under DOS!!! Get the Feel & Power of UNIX

Include awk, cb, cp, diff, ed, find, grep, ls, make, more, mv, rm, sed, sort & 17 others. All V.3 and BSD 4.3 options included. Thorough documentation.

THE BERKELEY UTILITIES \$125 order now 800-542-0938
price EFFECTIVE JULY 15 \$200

OPENetwork

POWER TOOLS FOR POWER USERS
215 Berkeley Pl. (B-2), Brooklyn, NY 11217

Inquiry 756.

Recover deleted files fast!

Disk Explorer now includes automatic file recovery. You type in the deleted file's name, Disk Explorer finds and restores it. Disk Explorer also shows what's really on disk; view, change or create formats, change a file's status, change data in any sector. MS-DOS \$75 U.S. Check/ Credit card welcome

QUAD SOFTWARE LIMITED

45 Charles St. E. 3rd Fl.
Toronto, Ontario, Canada M4Y 1S2
(416) 961-8243

Inquiry 757.

COPYWRITE

CopyWrite
Removes
Copy Protection
No more diskettes, manuals or codewheels.
1000's of products copied.

US \$75

QUAD SOFTWARE LIMITED

45 Charles St. E. 3rd Fl, Dept B.
Toronto, Ontario, Canada M4Y 1S2
(416) 961-8243 Fax (416) 961-6448

Inquiry 758.

REMOVE HARDWARE LOCKS

Software utility allows for the removal of hardware locks. Don't wait for your lock or key device to fail or be stolen. Guaranteed to work! The following packages are available:
PCAD \$199.00 CADKEY \$ 99.00
MICROSTATION \$89.00 PERSONAL DESIGNER \$199.00
MasterCAM \$250.00 SmartCAM \$250.00
TANGO PCB \$ 99.00 CADVANCE \$99.00

PLUS SHIPPING AND HANDLING
PHONE (204) 658-4839 FAX (204) 658-3586
VISA AND MASTERCARD Welcome

SafeSoft Systems Inc.

191 Kirlystone Way, Winnipeg, MB, Canada, R2G 3B6

Inquiry 757.

Why You Want BATCOM!

BATCOM is a batch file compiler that transforms your .bat files to .exe files to make them faster. BATCOM extends DOS with many new commands so you can read keyboard input, use subroutines, and much more. In addition, BATCOM protects your source code. No royalties! Only \$59.95. Order today!

Wenham Software Company

5 Burley St., Wenham, MA 01984
(508) 774-7036

Inquiry 758.

WORD PROCESSING

DuangJan

Bilingual word processor for English and: Armenian, Bengali, Burmese, Euro/Latin/African, Greek, Gujarati, Hindi, Khmer, Lao, Punjabi, Russian, Sinhalese, Tamil, Telugu, Thai, Ukrainian, Viet. . . . Only \$109+\$5 s/h (foreign + \$12 s/h). Font editor included. For any IBM compatibles with dot-matrix & LaserJet printer. Demo \$9+\$1 s/h. Visa/MC

MegaChomp Company

3438 Cottman Ave., Philadelphia, PA 19149-1606
(215) 331-2748 FAX: (215) 331-4188

Inquiry 759.



PS/2 model 30/286	1895
PS/2 model 50/30 meg	2395
PS/2 model 70/60 meg	3695
PS/2 model 80/40 meg	4395
PS/2 model 70/120 meg	5595
PS/2 model 80/115 meg	Call
Call for other models	



386 S 40 meg	Call Call
386 20E - 40 meg	4015
286E 40 meg	2150
386 110 meg/25 MHz	7295
386 60 meg/25 MHz	5895
Portable III 40 meg/12 MHz	3995
CARD & MONITOR EXTRA	
Call for other models	

Macintosh

Mac IICX/80 Meg, 40 Meg RAM	5095
Mac-III/40 Meg	4095
Mac-SE 30/40 Meg	3595
Call for 60 and 100 Meg	
Lazer NT	3495
Lazer NTX	4795

LOW PRICE LEADER

SINCE 1983 LAP-TOP

Compaq SLT 286-20/40	3795/Call
Toshiba T1000	659
T1000SE	Toshiba Call
T1200HB	Sale! Call
T1600-40 Meg	Call
T1000 XE/10 MB	Call
T3200-40 Meg/SX40	Call
T5100-40/100	Call
T5200-40/100	Call
T3100SX	Call
T1200 XE/20 MB	Call
Zenith 286-20/40 Meg	Call
Mitsubishi 286-20/40	1795/2195

DISKS

DYSAN 5 1/4 HD / 3 1/2 HD	13/26
MAXELL 5 1/4 HD / 3 1/2 HD	12/25
Min. 10 Boxes Order	

Everex

Step 286 - 12 & 16 MHz & 20 MHz
1 Meg RAM
Set up utility in ROM
S/P, C/C
Enhanced keyboard
1.2 MB floppy
DOS/BASIC

Call! for your configuration

Everex

Step 386-20 MHz & 16 MHz & 25 MHz & 33 MHz
Up to 256K cache of very high speed RAM
2 Meg RAM, expandable to 16 Meg
S/P, C/C
Enhanced keyboard
1.2 MB floppy
DOS/BASIC

Call!

Everex 386-33 Special of the Month



AST 486	Call
AST 286 model 70	1190
AST 386 model 300c	2695
AST 386 40 Meg	3095
AST 386SX	Call

CARD & MONITOR EXTRA
CALL FOR OTHER MODELS

WE STOCK

CITIZEN
OKIDATA
EVEREX
GOLD STAR

TOSHIBA
NEC
WYSE
HITACHI

PRINCETON GRAPHICS
SONY
ACER
HOUSTON INSTRUMENTS

AMDEK
HAYES
SAMSUNG
CALCOMP

PC MOUSE
MICROSOFT MICE
LOGITECH
MITSUBISHI

IRWIN & ARCHIVE
TAPE BACK
TAXAN
MAGNOVOX

BOARDS

Paradise VGA +	219
Vega VRAM	409
ATI VGA Wonder	259
Everex EGA	149
Tatung 16 bit	239

SOFTWARE SPECIALS

dBase IV	455
Wordperfect 5.1	260
Aldus Pagemaker	495
Ventura Publisher	525
Clipper	435
WordStar 5.5	150
EasyExtra	40


NOVELL
Authorized Dealer

SPECIALS

HP Scan Jet	1425
HP Paint Jet	965
Lotus Ver. 3.0	355
Kodak 150P	370
Complete Fax Board	499
Okidata 391	625
Epson LQ1050	660
Panasonic 1124	319
HP-7475 Plotter	1595
SummaGraphic	365

LASER PRINTERS

HP Laser IID	2750
HP Laser 2P	995
HP Laser III	1695
Panasonic 4450	1395
Brother HL-8-E	1895
Nec LC 890	3195
Toshiba Laser 6	1095

MONITORS

Nec Multisync IIA	499
Nec Multisync 3D	599
Magnavox EGA	339
Nec Multisync 5D	2350
Samsung EGA	359
Sony 1302	619

PACIFIC DATA PRODUCTS

P. Page II	459
P. Page IIP	365
P. 1-2-4 Mem II	159
P. One Meg IIP	180
P. 25 in One III	325
P. Headlines	245

LAN BOARDS

8 bit Arcnet	110
16 bit Arcnet	220
8 bit Ethernet	190
16 bit Ethernet	275
8 port Active Hub	325
Token Ring Card	399
Tokenhub 4-port	355
Call for other LAN Accessories	

MODEMS

Everex 2400 Int/Mnp	179
Hayes 2400B	315
Hayes 9600B	875
USRbotics Hst/Dual	1150
More in Stock	Call

ALL QUOTED PRICES ARE CASH PRICES ONLY.
Visa and MasterCard 3% higher, American Express 5% higher

EXPORTS Available

COMPUTERLANE

HOURS:
M-F 9-6
S 10-6

1-800-526-3482 (Outside CA)
(818) 884-8644 (In CA)
(818) 884-8253 (FAX)

22107 ROSCOE BLVD.
CANOGA PARK
1/2 BLOCK W. OF TOPANGA
CA 91304

CORPORATE ACCOUNTS WELCOME
CALL FOR VOLUME DISCOUNTS
CONSULTANTS CALL FOR PRICING

Prices subject to change without notice
* Quantities are limited

Compaq is a Registered Trademark of Compaq
IBM is a Registered Trademark of International Business Machines



AutoCAD® Users



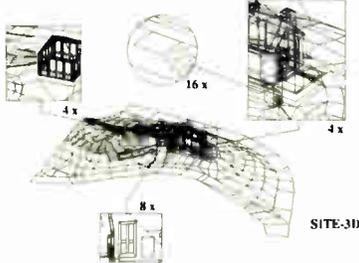
YOU NEED THIS UTILITY!!! FastBreak™

FastBreak™ - Cookie-cut, hatch, 'break' and/or 'trim' thousands of AutoCAD® entities: 3DFACES, 3DPOLYLINES, 3DLINES, SOLIDS, TRACES, ARCS, CIRCLES, LINES, POLYLINES, exploded SURFACES, MESHES, and 3D-CONSTRUCTION... and ALL within seconds in a single 'window' or 'crossing' point and pick.

YES! YES! YES! - 3DFACES, SOLIDS, TRACES, surfaces, splines, 3D-meshes, and any 2D or 3D-construction can be broken and/or trimmed using FastBreak™!!!

AutoCAD® will not break or trim 3DFACES and other 3D-construction.

FastBreak™ can do the job - quickly, accurately, and reliably in any UCS. The drawing shown is SITE.3D.DWG with four enlarged insert clips added. All four inserts were made on a 386-PC using FastBreak in less than two minutes!!!



ClipView™ - is integrated into FastBreak and performs Automatic clipping or trimming of the above entities to create inserts. Options include: Box or Bubble boundaries, Inside or Outside (makes a hole) trim, and borders.

FastBreak™ and **ClipView™** are integrated into DOS executable code, run interactively in AutoCAD shells from 256K, use fast block binary database, virtual memory paging, user friendly AutoLISP® interface, and perform FAST, FAST!, FAST in any AutoCAD Rel. 9 through Rel 10-386.

FastBreak™ and **ClipView™** are licensed in a single user package. Contact your dealer or buy direct (credit or money order, for UPS Next Day add \$6. shpg. fee) from:

BZ Technical
P.O.Box 10, Bothell, WA 98041
Phone: 206/258-1568 or FAX: 206/487-1357
Retail price: \$399.⁹⁵ Demo: \$25.⁰⁰

NOT Copy protected, NOT AutoLISP® encrypted, FULL documentation, technical support, 3.5" and 5.25" media.

"Quality software development located near the home of MICROSOFT® in Bothell's High Technology Corridor."

AutoCAD and AutoLISP are registered trademarks of Autodesk, Inc. FastBreak and ClipView are trademarks of BZ Technical.

dBASE Data Entry



The TransTerm 5 is a work station data entry/display terminal for on-line shop floor data collection into PC/AT based systems. The unit is one of a family of such terminals which feature LC displays for operator prompting and data entry via a membrane keyboard or an optional barcode wand (Code 39). A multi-terminal polling controller (up to 250 stations) and a dBASE III+ compatible software package are also available. System costs below \$300.00 per station. Call for info.

Options—backlighting for display, RS-422 I/O, 20 Ma current loop I/O, dBASE is a registered trademark of Ashton Tate, Inc.

COMPUTERWISE, INC.

302 N. Winchester • Olathe, KS 66062 • 913-829-0600 • Fax 913-829-0810

Only your imagination limits how you benefit from PERCON® keyless data collection.



Checking out books or checking in employees—input data quickly and accurately using bar codes or magnetic stripes. PERCON has proven bar code solutions for IBM®, DEC™, and Apple Macintosh®. Call 1-800-8-PERCON.

PERCON

2190 W. 11th Avenue, Eugene, Oregon 97402-3503
(503)344-1189 FAX(503)344-1399

©1989 Percon, Inc. PERCON, IHM, DEC and Apple Macintosh are trademarks.

9-Track? Just call us.

It doesn't get any easier than this. A wide variety of PC-9-Track tape subsystems are available to you by phone, including tape drives, cards, and software:

- DOS, UNIX, XENIX, PICK, NOVELL Support
- 486, 386, 286 & PS/2 Compatible
- Menu-Driven Software
- 2 Year Warranty on Controller Cards
- 800, 1600, 3200, 6250 bpi
- 24 Hour Delivery
- Excellent for Hard Disk Backup

We invented the first PC-9-Track controller ten years ago, and have been on top ever since with the world's best selling cards. It's easy to find out why: just call us.

1-800-PC-9TRAK*

OVERLAND DATA

5600 Kearny Mesa Rd. San Diego, CA 92111

* 1-800-729-8725 US & Can. • 1-619-571-5555 • FAX 1-619-571-0982



A COMPLETE 386 SYSTEM

WITH VGA COLOR AND 40 MB HARD DRIVE

\$1,449



- Intel 80386SX-16 MHz CPU
- 1 MB RAM Expandable to 8 MB
- 40 MB Hard Drive
- VGA Color Monitor (.31) and 16-bit Card
- 1.2 MB Floppy
- 2 serial, 1 parallel
- 101 Keyboard
- Case with power supply
- 2 Year Warranty

Other systems with the same configuration:
286-12: \$1,199 / 386-20SX: \$1,599 / 386-25: \$1,899 / 386-33: \$2,349
All upgrade options are available.

SPECIAL SALE

LAPTOP SPECIAL



286 LAPTOP \$1499

- 1 MB RAM
- 20 MB Hard Drive
- 1.44 MB Floppy
- LCD, CGA Display
- Serial, Parallel Ports
- Battery Pack
- AC adapter

386SX LAPTOP \$2599

- 1 MB RAM
- 40 MB Hard Drive 25 ms.
- 1.44 MB Floppy
- Paper White VGA Display
- Serial, Parallel Ports
- Battery Pack
- AC adapter

Prices subject to change without notice. Quantities are limited.

Both Laptops include: FREE MS-DOS, 1 year warranty

Call for special sale on 286, 386 & 486 Mother Board and other components.

First Computer Systems, Inc.

3951 Pleasantdale Road, Suite 224, Atlanta, GA 30340
Tel. (404) 441-1911 Toll Free (800) 325-1911 Fax (404) 441-1856

COMPUCOM

14,400 bps SpeedModem™ \$299

Cut Back on Your Contribution to Ma Bell.

SpeedModem's throughput - up to 57.6Kbps - is nearly unbelievable. Fully Hayes-compatible, MNP-5, DIS™, fax option and more.

High-Speed Isn't Our Only Speciality.

Our 2400 bps product-family includes Hayes compatibility, MNP5, and our DIS technology improves the phone line. Try send fax.

SpeedModem 300 - 14,400 bps	\$299
SpeedModem + F.F.Fax!	\$399
F.F.Fax! 9600 bps send/receive	\$299
MNP-5 Modem 2400-4800 bps	\$169
DISMNP-5 Modem 2400-4800 bps	\$193
DISModemPlus send-only fax	\$139
DISModem 2400bps	\$119
2400 bps Modem	\$ 95

FREE \$69 EasyCom™ Communications Software

Find out why Byte Magazine says, "...a real deal..." (3/89 p.102).



Call 1-800-ACT-ON-IT
(1-800-228-6648)

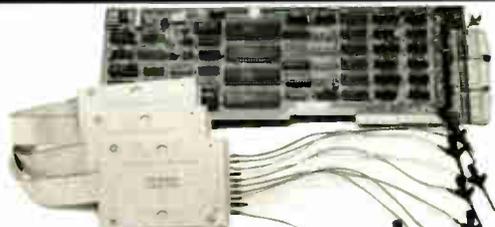


5-Year Warranty. 30-Day Money Back Guarantee.

Setting New Standards in Modem
Value and Performance

POWERFUL-AFFORDABLE INSTRUMENTS

200 MHz Logic Analyzer



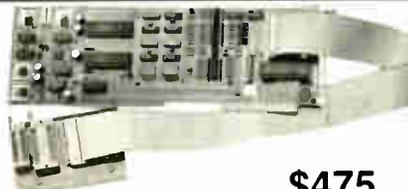
- 200 or 100MHz sampling rate
- 24 Channels, Timing and state
- Optional expansion to 72 channels
- 16 Levels of triggering
- 16K samples/channel
- Variable threshold levels
- 3 External Clocks
- 11 Quality lines

\$ 799-LA12100 (100 MHz)
\$1299-LA27100 (100 MHz)
\$1899-LA27200 (200 MHz)

Price is complete
Pods and Software
included

UNIVERSAL PROGRAMMER

PAL
GAL
EPROM
EEPROM
PROM
87xxx...



\$475

- 20 and 24 pin PALS, EPLDs
- 26V12, 18V10, 22V10 GALs
- 2716x-27020 EPROMs
- 87xxx MICROS
- EEPROMs (incl. 8 pin serial)
- Byte Split/Merge (16 & 32 bit)
- JEDEC, INTEL HEX, Motorola 'S' files
- Dallas NVS RAM programming
- PC/XT/AT COMPATIBLE
- FREE software updates on BBS

Call - (201) 994-6669



Link Computer Graphics, Inc.
4 Sparrow Dr., Livingston, NJ 07039 FAX:994-0730

VOICE MASTER KEY® SYSTEM II

VOICE RECOGNITION & SPEECH RESPONSE
FOR IBM PC/XT/AT/386, PS/2, LAPTOPS, COMPATIBLES



FOR PRODUCTIVITY, PRESENTATIONS, SOFTWARE DESIGN,
ENTERTAINMENT, LANGUAGE TRAINING, EDUCATION, MORE...

SPEECH/SOUND RECORDING AND PLAYBACK. Desktop Audio sound editing allows you to create custom sound applications. Variable sample rate (to 20 KHz) and compression levels. A four-voice music synthesizer is included also!

VOICE RECOGNITION TSR utility allows you to add voice command keyboard macros to your CAD, desktop publishing, word processing, spread sheet, or entertainment programs. Up to 64 voice commands in RAM at once--more from disk.

HARDWARE SYSTEM contains built-in speaker with separate volume and tone controls, external speaker and headphone jacks. Enclosure made of sturdy vinyl-clad steel. Attaches to parallel printer port without affecting normal printer operation (U.S. Patent 4,812,847). Headset microphone, printer cable, 9 volt AC adapter (110 volt UL/CSA listed), and comprehensive user manual included.

QUALITY THROUGHOUT. MADE IN USA. ONLY \$219.95

ORDER HOTLINE: (503) 342-1271 Mon-Fri, 8 AM to 5 PM PST

Visa/MasterCard, company checks, money orders, CODs (with prior approval) accepted. Personal checks subject to 3 week shipping delay. Specify computer type when ordering. Add \$5 shipping charge for delivery in USA and Canada. Foreign inquiries contact Covox for C&F/CI/F quotes. OEM configurations available.

30 DAY MONEY BACK GUARANTEE IF NOT COMPLETELY SATISFIED.

CALL OR WRITE FOR FREE PRODUCT CATALOG



COVOX INC.
675 Conger Street
Eugene, Oregon 97402

TEL (503) 342-1271
FAX (503) 342-1283
BBS (503) 342-4135

MEMORY UPGRADES

5 YEAR WARRANTY! - FREE DELIVERY!

<u>IBM PS/2 & LaserPrinter</u>	<u>COMPAQ Memory</u>
2MB Module Model 80's \$CALL	1MB Add-On Module \$162
2MB Module Mod. 70-E61;-121 \$190	DeskPro 386/20,25,20e,25e
Mod. 70-A21;B21;A61;B61 \$309	4MB Add-On Module \$411
2-8MB Exp Boards \$CALL	DeskPro 386/20,25,20e,25e
Models 50, 60, 70 & 80	2MB Module \$355
1, 2, 3.5MB Memory Boards \$CALL	DeskPro 486/25, 386/33, SystemPro
LaserPrinter 4019 & 4019e	8MB Module \$2718
<u>Toshiba Laptops</u>	DeskPro 486/25, SystemPro
2MB Upgrades \$CALL	1MB Module - LTE/286 \$245
Models 1000SE, 1600, 3100e, 3100SX, 3200SX, 5100, 5200	2MB Module - LTE/286 \$391
<u>Apple Mac & NTX</u>	1MB Module - SLT \$327
4MB Memory Kit \$591	<u>HP LaserJet Memory</u>
MacIntosh IIfx	1MB Upgrade - II; IID; IIP; III \$200
Laser Writer II/NTX	2MB Upgrade - II; IID \$318
1MB Memory Kit \$264	4MB Upgrade - II; IID \$493
Laser Writer II/NTX	2MB Upgrade - IIP; III \$287

Apple, AST, AT&T, DEC, Dell, Epson, NEC, SUN, Zenith, Others

SIGMA DATA

Scytheville Row • P.O. Box 1790 • New London, NH 03257

Call for latest pricing

TOLL FREE: (800) 446-4525

NH (603) 526-6909 FAX (603) 526-6915

Established - 1980

NEW!
RS-232 DATA MONITOR
LETS YOU SEE WHAT'S
ON THE LINE
\$595!



- Diagnose comm problems
- Install new equipment
- Determine baud rates
- Reduce development time
- Troubleshoot faster

- SDLC, HDLC, X.25, BISYNC
- Parity & CRC check
- 40 hours on 9v battery
- 2K buffer with printer dump

BitView shows you bidirectional data in ASCII, EBCDIC, or Hex for async and sync data lines at baud rates from 300 to 38400 baud. Now find your comm problems in minutes instead of hours!

Call (212)662-6012 or Fax (212)678-6143

MEASUREMENT & CONTROL PRODUCTS, INC.

415 Madison Avenue, 22 Fl., New York, NY 10017



Data Storage without Moving Parts



Flash-EPROM-Disk

Flash-EPROM and SRAM
1 MB

Silicon-Disk ES25

1 MB EPROM
544 KB CMOS-RAM

EPROM-Disk E8

2 MB EPROM
Short Card

Memory-Card-Drive

SCSI/V24 Drive for
SRAM/ROM/(OTP)-Cards

Programming with "copy *.*"
Booting capability

altec

altec electronic GmbH • Vahrenwalder Str. 205/7
D-3000Hannover 1 • Tel. (49) 511-63088-36 • Fax 49

Circle 340 on Reader Service Card

EZ-ROUTE VERSION II



SCHEMATIC TO PCLAYOUT \$500 INCLUDES AUTO ROUTER

EZ-ROUTE Version II from AMS for IBM PC, PS/2 and Compatibles is an integrated CAE System which supports 256 layers, trace width from 0.001 inch to 0.255 inch, flexible grid, SMD components and outputs in Penplotters as well as Photo plotters and printers

Schematic Capture \$100, PCB Layout \$250, Auto Router \$250

FREE EVALUATION PACKAGE

30 DAYS MONEY BACK GUARANTEE

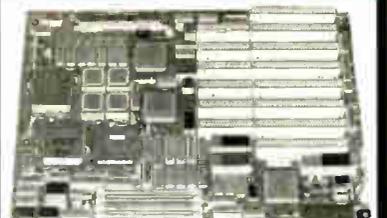
1-800-972-3733 or (305) 975-9515

ADVANCED MICROCOMPUTER SYSTEMS, INC.

1321 N.W. 65 Place • Ft. Lauderdale, FL 33309

Circle 32 on Reader Service Card

486/25MHz GIANT MEMORY Series



GM Series Expands to 32Mb On-Board
64K External Cache/Expand to 128K
TEXAS INSTRUMENT 486 Chip-Set

SX,386/33,486/33Cache GM SERIES..Call

(800)627-6998/SALES

(713)589-7100/INFO

HOMESMART COMPUTING

VISA • MCARD • AMX • COD

Circle 138 on Reader Service Card

Scottsdale Systems — Since 1980 — 1-800-777-2369

COMPUTERS SCOTTSDALE SYSTEMS

386-SX w/K.B. Monitor, 1 Meg of RAM \$1655
 386-33 MHz w/K.B. Monitor, 4 Meg of RAM \$3925
 Choice of Full Size Desktop Case or Full Size Tower Case
 Each Scottsdale Machine Has a 1 Year Warranty on Parts
 & Labor via Overnight Service on Warranted Products

Altos W/Xenix **SAVE**
 WYSE 386 25 MHz WYSE 286
 1 Year Warranty \$3920 Model 2112 \$1284
 WYSE 386 16 MHz 2214 Model 2116 1351
MATH CO-PROCESSORS **SAVE**

TERMINALS/MONITORS

WYSE TERMINALS **NEC 2A/3D MONITORS** \$499/849
 WY-30 G/A-w/Keyboard \$290 NEC 4D/5D 1160/2385
 WY-50 G/A-w/Keyboard 377 Mitsubishi Diamond Scan 528
 WY-60 G/W/A-w/Keyboard 405 Seiko 1440 815
 WY-99 G/A-w/Keyboard 468 Sony 1303/1302/1304 \$77/849/845
 WY-150 G/W/A-w/Keyboard 367 Hitachi Super Scan 1999
 WY-212 G/W-w/Keyboard 1489 Philips 20" Hi-Res 2059
 WY Height Adjustable Arm 95

QUIME

QVT 101 Plus G/A/W \$316 WY 530 G/A 14" Mono \$169
 QVT 119 Plus G/A/W 395 WY 550 AW 14" Mono 179
 QVT 203 Plus G/A/W 443 WY 650 12" VGR Color 459
 QVT PCT G/A/W 385 WY 700 W 15" Mono 695

IBM TERMINALS

IBM 3151 3 Year Warranty \$485 ImTec 1270/1470 \$90/121
 Link MC 5 405 ImTec 1430/1441V \$48/293
 Altos 7 457 ImTec 1432M 425

KIMTRON

KT-70PC \$349 4" Multiscan 438
 14" VGA 640x480 349
 14" Amber nonglare 129

Authorized Service for WYSE
 LEASING AVAILABLE

INTERNATIONAL ORDERS WELCOME

PLOTTERS

IQLINE Roland DESKTOP PLOTTERS
 A&D/LP 3500 \$2339 1 Year Warranty \$895
 A&D/LP 3700 2889 DXY-1100
 LP-3700-8 3129 DXY-1200 Electrostatic 1295
 LP-4000-1 w/Roll Feed 3579 Paper Hold
 LP-4000-8 w/Roll Feed 3935 DXY-1300 Electrostatic 1625
 Vinyl Cutting Machines Paper Hold
 Blades & Hot Tips Roland DRAFTING PLOTTERS
 1 Year Warranty \$3495

HOUSTON INSTRUMENTS

Img Mk \$982 GRX-300 AR 3559
 DMP 52/52 MP 2425/2866 Roland FLATBED PLOTTERS
 DMP 61/62 2941/3895 1 Year Warranty
 DMP 61 DL 3743 DPX-2500 Pen or Pencil \$4275
 DMP 62 DL 4737 DPX-3500 Pen or Pencil 4628

ENTER

SP600 \$599 DPX-5100 Pen or Pencil w/Stand 4628

CALCOMP

1023/1025 \$3715/4519 Roland THERMAL PLOTTERS
 1043DM/1044 5869/8739 LTX-420 \$9259
 5902/5902A 3819/4275 LTX-320 7125
 DM 5222A 11,919 LTX-120 2135

HEWLETT PACKARD OPTICAL SCANNER & SOFTWARE

Data Copy \$AVE Roland CANN MACHINES
 Panasonic RS-505/506 1037/1315 \$AVE Software & Accessories \$AVE
 Microtek \$AVE
 Authorized Service for
 Roland Plotters and CANN Machines
UNITED INNOVATIONS
 Model 7000A-C \$1899
 Model 8000A-D 2059
 Model 9000A-E 2829

AMT ACCEL 500 Intel-PLOT

..... \$1699

DIGITIZERS

KURTA Lifetime Warranty On Kurta IS-1
 IS-1 12x12 Cordless 4-button \$355
 cursor, pen stylus and 620
 interface kit \$439
 IS-1 12x17 Cordless 4-button \$AVE
 cursor, pen stylus and
 interface kit 629

CALCOMP

Cal Comp 23120 12x12 \$365
 Cal Comp 9100 Series \$AVE
 Cal Comp 9500 Series \$AVE
 Cal Comp Wiz 165

SUMMAGRAPHICS

..... Lifetime Limited Warranty
 12x12 Summasketch II \$355
 12x18 Professional 620

HITACHI

..... \$AVE

GENIUS TABLET

..... \$299
 12x12 w/Cursor, Stylus & Software
 3 Year Warranty on Tablet

Call For Pricing On
 Larger Digitizers

PRINTERS

ALPS Allegro \$345 QUAME Apple & IBM \$3190
 ALPS 324E 735 H.P. Laser III 1799
 AMT ACCEL 1299 Panasonic 4420 1199
 Canon BJ 130E 727 Panasonic 4450 1395
 Panasonic 1191 237 LPB 8111 1795
 Panasonic 1180 185 LPB 4 959

Dkidata all models \$ Samsung 286 \$2190
 DTC all models A Texas Instruments \$AVE
 Gencom all models V Texas Instruments \$AVE
 Toshiba all models E IOMEGA \$AVE

Citizen all models 339 Bernoulli Box
 Diconix 150P/300P \$315 B-120 1.214 MB Internal \$895
 NEC P-2200 505 144-1.44 MB Internal 1095
 NEC P-5200 659 Prices do not include interface
 NEC P-5300 3159 ALLOY \$AVE
 NEC LC-890 Alloy IMP 2 & IMP 8 Ca:ds \$AVE
 Multitware 386 & 286 Versions \$AVE
 Retriever 60 or 200 \$AVE

Authorized Service for

TriMatrix

BOARDS Datashield \$AVE
 Genoa/Intel A Sale Power Systems \$AVE
 Vericom All Models V TrippLite \$AVE
 BOCA E TAPS BACKUPS \$AVE
 VMI/Cobra All Models E Emerald Systems all models \$AVE
 Paradise VGA Plus \$289 Genoa all models \$AVE
 Paradise Prof 495 Irwin all models \$AVE
 Control Systems/NEC \$AVE
 Number Nine/Laicom \$AVE
MODEM \$AVE
 U.S. Robotics all models \$AVE
MULTITECH SYSTEMS \$AVE
 All Models \$AVE

NOVELL

ARCNET \$112
 Coax StarTopology \$360
 16 Bit Coax \$360
 TIARA ETHERNET \$278
 Lancard/E PC 8-Bit \$91
 TIARA ARCHNET \$91
 Lancard/A PC \$91

SYNOPTICS

2500/2510 Workgroup \$AVE
HARD DRIVES \$AVE
 CDC IMPRIMIS \$AVE
 1 Year Warranty \$AVE
 72 MB thru 600 MB \$AVE
 Maxtor \$AVE

SOFTWARE

MULTI USER \$510
 SCO Xenix 386 \$310
 Concurrent DOS 386 10 User \$310
 Compuone 4 to 16 Port Boards

All software sales are final
 CALL SERVICE FOR REPAIRS
 ON PRINTERS, TERMINALS,
 MONITORS, COMPUTERS.

1555 W. University Dr. #101, Tempe, AZ 85281

Prices listed are for cash. Discovery, MasterCard and Visa add 1.67%. AZ residents add 6.1% tax, add 3% for C.O.D. add 5% for P.O. International orders welcome. All items are new with manufacturer's warranty. Returned products subject to 20% restocking fee and in new condition in original packaging, with all warranty cards, manuals and cables. No credit issued after 30 days from date of shipment. We do not guarantee compatibility. Personal and company checks take up to 5 days to clear. Prices and specifications subject to change. Product subject to availability, all applicable trademarks recognized and on file.

602-966-8609

SERVICES (Mon.-Fri.) 602-731-4742

FAX 602-966-8634

IBM PS 2 70 & 80 4MB (6450160) \$675

MEMORY UPGRADES

APPLE IIFX 4MB KIT \$369

FIRST SOURCE INTERNATIONAL, INC.

WE ACCEPT INTERNATIONAL ORDERS
 3 day International delivery available via Federal Express or DHL!
 CALL (714) 588-9866 OR FAX (714) 588-9872
 24-HOURS A-OAY

We will beat any advertised price!!



TOLL FREE ANYWHERE IN THE US & CANADA **ORDERS: 1-800-535-5892**

IBM PS/2 MEMORY

Models 30-286, Exp. Board 1497259
 512K Kit 30F5348 \$54.00
 2MB Kit 30F5360 \$180.00
 Models 70-E61/121,55SX,65SX
 1MB 6450603 \$99.00
 Models 70-E61/121,50Z,55SX,65SX
 2MB 6450604 \$189.00
 Models 55SX, 65SX, 34F3077 & 34F3011
 4MB 34F2933 \$675.00
 Model 70-A21
 2MB 6450608 \$199.00
 Model 80-141
 1MB 6450375 \$145.00
 Models 80-111/311
 2MB 6450379 \$269.00
 All Models 70 and 80
 2-8MB w/2M 6450605 \$499.00
 2-14MB w/2M 34F3077 \$599.00
 4-16MB w/4M 34F3011 \$999.00
 Models 50,50Z,55SX & 60
 2-8MB 1497259 \$599.00

LASER PRINTER MEMORY

Hewlett-Packard LaserJet IIP & IIL
 1MB 334748 \$130.00
 2MB 334758 \$180.00
 4MB 334778 \$340.00
 Hewlett-Packard LaserJet II & IID
 1MB 33443B \$135.00
 2MB 33444B \$189.00
 4MB 33445B \$345.00
 IBM Laser 4019
 1MB 1039136 \$269.00
 2MB 1039137 \$369.00
 Canon LBP-8II Laser Printer
 1MB S63-1300 \$150.00
 2MB S63-1880 \$225.00
 Apple Laserwriter, Epson, Olivetti, and Facit memory also available now!

COMPAQ MEMORY

Deskpro 286-E,386-20,20E 25
 1MB 113131-001 \$139.00
 4MB 113132-001 \$369.00
 Deskpro 386-16
 1MB Kit 108071-001 \$255.00
 4MB Kit 108072-001 \$765.00
 Deskpro 386S
 1MB 113646-001 \$139.00
 4MB 112534-001 \$369.00
 Deskpro 386-33, 486-33 & SystemPro
 2MB 115144-001 \$225.00
 ALL Compaq boards also available!

AST MEMORY

Bravo-286, Workstation
 512K Kit 500510-010 \$59.00
 2MB Kit 500510-002 \$172.00
 Premium 386-16 20C
 1MB Kit 500510-007 \$95.00
 4MB Kit 500510-008 \$369.00
 Premium 386-20
 1MB Kit 500510-003 \$150.00
 4MB Kit 500510-004 \$369.00
 Bravo 386-SX
 2MB Kit 500510-002 \$172.00
 4MB Kit 500510-008 \$369.00
 Premium 386-SX/25/33 & 486-25
 1MB 500718-002 \$95.00

HEWLETT-PACKARD MEMORY

Vectra OS/16S
 1MB D1540A \$112.00
 4MB D1542A \$349.00
 Vectra OS/20PC, RS/25PC and 20C
 1MB D1640A \$126.00
 4MB D1642A \$365.00
 Vectra 486 PC
 1MB D2150A \$115.00
 4MB D2151A \$390.00

LAPTOP AND PORTABLE MEMORY SPECIALS

TOSHIBA MEMORY

1MB Model 1000SE/XE \$329.00
 2MB Model 1000SE XE \$469.00
 2MB Model T1200XE \$289.00
 2MB Model T1600 \$289.00
 2MB Model T3100E \$289.00
 2MB Model T3100SX \$289.00
 4MB Model T3100SX \$689.00
 2MB Model T3200SX \$289.00
 4MB Model T3200SX \$689.00
 2MB Model T5100 \$289.00
 2MB Model T5200 T8500 \$289.00
 8MB Model T5200 T8500 \$1300.00

ZENITH MEMORY

1MB SuperSport 286 & 286E \$199.00
 2MB SuperSport 286 & 286E \$455.00
 2MB SuperSport SX Alpha \$455.00
 2MB SuperSport SX Beta \$455.00

COMPAQ MEMORY

1MB Portable LTE 286 \$195.00
 2MB Portable LTE 286 \$299.00
 1MB SLT 286 \$245.00
 4MB SLT 286 \$1395.00

NEC MEMORY

1MB ProSpeed 286 \$270.00
 2MB ProSpeed 386 \$450.00

ZENITH MEMORY

Zenith Z-386 20 25/33 & 33E
 1MB ZA36/3800ME \$99.00
 4MB ZA3800MK \$675.00
 Zenith Z-386 20 25 & 33
 2MB ZA3600MG \$199.00
 Zenith Z-386 SX
 1MB \$255.00
 2MB Z-605-1 \$255.00

EXPANSION BOARDS

BocaRam/AT Plus

Up to 8MB for any AT or 16 bit compatible machines running up to 33MHz. Offers conventional, expanded or extended memory, provides a maximum of 2MB LIM EMS 4.0. Uses 1x1-10 Dram
 Order Now: SIMAT80 \$149.00
 with 2MB SIMAT82 \$299.00

SIMM MODULES

IBM TYPE \$61.00
 ADD \$5.00 FOR SHIPPS
 4Mx9-80 \$410.00
 1Mx9-12 \$69.00
 1Mx9-10 \$73.50
 1Mx9-80 \$79.00
 1Mx9-70 \$89.00
 256x9-12 \$20.00
 256x9-10 \$23.50
 256x9-80 \$26.00
 256x9-60 \$35.00
APPLE-MAC \$61.00
 1Mx8-10 \$65.00
 1Mx8-80 \$71.50
 256x8-12 \$23.40
 256x8-10 \$24.00
 256x8-80 \$24.70
DRAM
 All types and packages available - CALL!

WE ACCEPT PURCHASE ORDERS FROM UNIVERSITIES, QUALIFIED FIRMS AND GOVERNMENT AGENCIES

SEND ALL P.O.'S AND MAIL ORDERS TO
 36 Argonaut, Suite 140
 Aliso Viejo, California 92656
 PH: (714) 588-9866 FAX: (714) 588-9872

TERMS AND CONDITIONS

- NO SURCHARGE ON MC OR VISA
- Terms: MC Visa AmEx (Add 4%) COD Cash Net 30 days on purchase orders from qualified firms
- 20% Restocking fee on all non-defective returns & refused orders. RMA required
- All products third party guaranteed 100% compatible
- PRICES AND AVAILABILITY SUBJECT TO CHANGE



SIMM/SIPP MODULES

4MG x 9 & 1MG x 9 \$415
1MG x 9 120ns \$70
1MG x 9 100ns \$75
1MG x 9 80ns \$80
1MG x 9 70ns \$90
256 x 9 FOR IBM TYPES

256 x 9 - 120ns \$21
256 x 9 - 100ns \$24
256 x 9 80ns \$27
256 x 9 60ns \$39

APPLE SIMM MODULES

1MG x 8 120ns \$62
1MG x 8 100ns \$67
1MG x 8 80ns \$72
256 x 8 - 120ns \$24
256 x 8 100ns \$39

ZENITH 386 MODULES

386 25 33 1MG \$110
Super 1MG \$299
Sport 286 (4MG) \$1179

AST 386 MODULES

PART NO.	1MG	4MG
386 25 33 5X	\$105	...
386 16	\$95	\$375
386 6C	\$95	\$375
PART NO.	1MG	4MG
Westgate 286	\$249	...
Westgate 386	\$249	...
Rampage 286	\$95	\$190

PS-2 PRODUCT

MODEL 70 & 80 SIMM

6451060 - For model 80 A21 A31 \$699

6450608-070 - For model 70A21 A61 B21 B61 \$295

34F2933 - 4MG Module \$699

6450372 - 2MG Module for 6450366 \$449

6450608 For 70A21 1MG x 8 80ns \$200

6450603 For 70e61 70 121 50Z & 50SX 1MG x 9 80ns \$105

6450375 1MG For 80 041 \$149

6450379 2MG for 80 111 & 131 \$275

6450604 For 70E61 121 50Z & 55SX *10 or more units \$190

256 x 9 (FOR PS-2)

256 x 9 - 120ns \$36
30F5348 (Kit-Zea) \$72

1MG x 9 - 100ns \$95
30F5360 (Kit-Zea) \$190

D-RAM

1 MG x 1

1MG x 1 - 120ns \$6.00
1MG x 1 - 100ns \$6.75
1MG x 1 80ns \$7.25
1MG x 1 70ns \$8.00

256 x 1

256 x 1 - 150ns \$1.80
256 x 1 - 120ns \$2.00
256 x 1 - 100ns \$2.25
356 x 1 - 80ns \$2.75
356 x 1 - 70ns \$3.25
256 x 1 - 60ns \$3.75

256 x 4

256 x 4 - 120ns \$ 5.50
256 x 4 - 100ns \$ 6.50
256 x 4 - 80ns \$7.00

64 x 1

64 x 1 150ns \$1.25
64 x 1 120ns \$1.85
64 x 1 100ns \$2.49

64 x 4

64 x 4 - 150ns \$2.25
64 x 4 - 120ns \$2.50
64 x 4 100ns \$2.75
64 x 4 80ns \$3.50

256 x 4 ST 1CCOL

514258 100ns \$15

256 x 1 STATIC COL

512528 100ns \$2.25
512528 80ns \$3.00
512528 70ns \$4.25

NEW CYRIX MATH-CO PRO

Faster than a Speeding Bullet!
Totally Compatible!
5 Year Warranty!

83D87 16 \$305
83D87 20 \$350
83D87-25 \$450
83D87 33 \$549

256 x 1

2087 8 \$185
2087 10 \$219
2087 12 5 \$280
2087 20 \$324

FOR 286 MACHINES

2087 8 \$185
2087 10 \$219
2087 12 5 \$280
2087 20 \$324

FOR 386 MACHINES

3087 16 \$305
3087 20 \$350
3087-25 \$450
3087-33 \$549

INTEL MATH CO-PRO

8087-3(5MHz) \$88
8087-2(8MHz) \$115
8087-1 \$165
80287 6 \$179
80287 8 \$183
80287 10 \$208
80C287-12 \$280
80387 16 \$305
80387-20 \$350
80387-25 \$450
80387-33 \$549
80387-3X \$320

MONTHLY SPECIALS

STAR MICRONICS DOT MATRIX PRINTER

180 cps
HX1000 2 \$159

6450604
Module for 70E61/121 50Z & 55SX
2MG x 9 - 80ns
1-9 UNITS
\$200
10 or more units \$190

IBM LASER PRINTER

Memory Upgrade for Model 4019 4019E
1MG \$299
2MG \$399
4MG \$529

EPSON LASER PRINTER

Memory Upgrade for Model LP6000
1MG \$299
2MG \$399
4MG \$529

CANON FACIT FUJITSU AND TOSHIBA ALSO AVAILABLE

MEMORY EXPANSION BOARDS

COMPAQ MEMORY

ADD-ON MODULES

MODEL	1MG	4MG
386 20 20E 25 25E DESK PRO 286E 386S	\$445	\$425
MODEL	2MG	8MG
386 33 486 25 & SYSTEM PRO	\$320	\$2495

MEMORY EXPANSION BOARDS

MODEL	512K	1MG	2MG	4MG	8MG
386 16	\$425	\$675	\$1375	\$2495	
386 16 E USE	\$250	\$725			
Portable 386		\$1250			
Portable 486	\$219	\$325	\$495		
SLT 286		\$325			

MEMORY UPGRADE KITS

MODEL	512K	1MG	4MG
Portable III	\$70	\$178	
DESKPRO 386 16		\$250	\$795

BOCA RESEARCH

TOPHAT - Does backfill conventional memory from 512 to 640K on AT with 0K \$69

TOPHAT II - Same as TophAT with 128K \$85

BOCARAM/XT Provides up to 2MG of expanded memory for 8 bit bus. Operates up to 12 MHz - Uses 256K D-RAM with 0K \$120
with 512K \$179

BOCARAM/AT Provides up to 2MG LIM EMS 4.0 and/or 4MG of extended, expanded or backfill memory. For 16 bit bus. Operates up to 16MHz. Uses 256K D-RAM with 0K \$140
with 512K \$199

BOCARAM/AT PLUS Provides up to 8MG of extended, expanded or backfill memory. Operates up to 33MHz and is set thru software. Uses 1MG D-RAM with 0K \$149
with 2MG \$349

BOCARAM/AT I/O PLUS Provides up to 4MG of extended, expanded or backfill memory. For 16 bit bus. Operates up to 33 MHz and is set thru software. Has serial and parallel port. Uses 1MG D-RAM with 0K \$165
with 2MG \$379

BOCARAM 30 Provides up to 2MG of expanded memory for IBM PS 2 model 25, 30 and 8-bit bus PC that utilize 3.5 in floppy disks. Uses 256K D-RAM with 0K \$149
with 2 MG \$329

BOCARAM 50Z Provides up to 2MG, 0 wait state, expanded or extended memory for IBM PS/2 model 50, 50Z, 60. Uses 1MG D-RAM with 0K \$160
with 2MG \$379

BOCARAM 50/60 Provides up to 4MG expanded, extended or backfill memory for PS 2 model 50, 60. Uses 1MG D-RAM with 0K \$160
with 2MG \$379

HEWLETT-PACKARD LASERJET MODULES

2 & 2D

2 & 2D (0K) \$ 89
2 & 2D (1 MG) \$135
2 & 2D (2 MG) \$189
2 & 2D (4 MG) \$345

2P & 3

2P & 3 (0K) \$ 109
2P & 3 (1 MG) \$150
2P & 3 (2 MG) \$225
2P & 3 (4 MG) \$375

5 YEAR WARRANTY

LAPTOP MEMORY

2MG Card-Toshiba Portable T1200P \$499
2MG Card-Toshiba Portable T1600 \$299
2MG Card-Toshiba Portable T3100SX \$299
4MG Card-Toshiba Portable T3100SX \$799
512K Card-Toshiba Portable T3100E \$149
2MG Card-Toshiba Portable T3100E \$299
2MG Card-Toshiba Portable T3200SX \$299
4MG Card-Toshiba Portable T3200SX \$699
3MG Card-Toshiba Portable T3200 \$499
2MG Card-Toshiba Portable T5100 \$299
2MG Module-Toshiba Portable T5200 \$299
2MG Module-Toshiba Desktop T8500 \$349

NO SLOT CLOCK

Plugs in empty ROM socket. Accurate to 1/100 sec. only \$25.00

MODEMS

EVEREX AND HAYES COMPATIBLE

EVEREX Evercom 12 Internal 1200 BAUD \$69
EVEREX Evercom 24 Internal 2400 BAUD \$129
EVEREX External 2400 \$175

UNITEX 1200I Internal 1200 BAUD \$59
UNITEX 1200E External 1200 BAUD \$99
UNITEX 2400I Internal 2400 BAUD \$79
UNITEX 2400E External 2400 BAUD \$129

AST PRODUCT

SIX PAK 286

Up to 4MB EMS 4.0 extended or expanded memory and does backfill to 640K. One serial port and one parallel port available. For AT and compatibles. Uses 256 or 1MG SIMMs. Headroom TSR Memory Management Software included.

with 9K \$119
with 512K \$179
with 4MG \$479

ACCELERATORS

TINY TURBO 286 Low cost, high speed, half slot PC XT. Accelerates your PC XT up to 4 times faster with a 12 MHz 80286 microprocessor. 80287 Math chip socket \$229

TINY TURBO XT High-speed half slot accelerator for PC XT. Accelerates your PC XT up to 4 times faster with a 12 MHz 80286 microprocessor. 80287 Math chip socket \$259

ORCHID

RAMQUEST 8-16 The only card expandable to 32MG. For IBM PCs, XT's, AT's, PS-2 Model 30-286 as well as compatibles. Supports both 8 and 16 bit bus. Uses 256K 1MG or 4MG Modules. w/0K \$269

RAMQUEST EXTRA The only Multifunction card that provides up to 8MG and two serial ports on one board for the IBM PS 2 Models 50, 60 & 80. Guaranteed EMS 4.0 and OS-2 compatible. Easy to install with only 4 key-strokes. Uses 256K and/or 1MG SIMMS \$229

RAMQUEST EXTRA 16/32 The only 8-8MG, 6 wait state card for PS 2 mod 50, 60, & 80 which fully supports both 16 and 32 bit memory access. Includes 1 SER and 1 PAR port plus free serial cable. EMS 4.0 and OS 2 compatible. Uses 256K and/or 1MG SIMMS \$299

WE WILL MEET OR BEAT ANY ADVERTISED PRICE !!!

VIDEO ADAPTERS

ATI TECHNOLOGIES

VGA WONDER 512™ (512K video memory) High performance VGA graphics. 100% register-level compatibility in VGA, EGA, CGA, MDA and Hercules Displays Super-VGA 800x600 in 256 colors and 1024x768 in 16 colors. Switchless installation. Includes Microsoft compatible mouse \$339

VGA WONDER 256™ (256K video memory, user upgradeable). Same as VGA wonder 512™ except with 800x600 in 16 colors and 1024x768 in 4 colors. Includes Microsoft compatible mouse \$259

BOCA RESEARCH

1024 VGA 1024 X 768 in 16 simultaneous colors. 640 480 in 256 colors. 132 col X 50 43.25. 1024 X 768 + 800/600 Drivers. 132 col CAD \$269

SUPER VGA 800 X 600 Resolution™ 256K RAM 8 or 16 bit. 132 col X 50, 43.25 LIM Drivers/ 800 X 600 drivers for Windows, Auto CAD \$169

VGA 640 X 480 Resolution™ 256K RAM, 8 or 16 bit \$139

Multi EGA 640 X 480 Resolution on multiple frequency monitors. 640 X 480 - 752 X 410 256K RAM. Drivers for Auto CAD, Windows & Lotus \$119

EGA 640 X 350 Resolution™ 256K RAM \$129

SCANNER

PRINCETON LS300

300dpi High resolution. Intelligent graphics scanner. Automatic sheet feeder. permits up to 5 sheets. provides up to 32 shades of gray. CAL 0028L INCLUDES CALCULUS EZ-FAX \$589

RAMPAGE PLUS 286

Up to 8MG Expanded Memory - Uses 256 x 9 or 1MG x 9 SIMM. Supports LIM4.0 and OS-2 - Up to 12.5MHz bus - (or AT 16 bit bus)

with 0K \$319
with 2/4G \$529

D-RAM TESTERS

UNI-001 RT \$119.00
Tests all parameters except speed
64 x 1 256 x 1 1M x 1

UNI-002 RT \$149.95
Tests speed plus parameters

UNI-003 RT \$199.95
Tests standard SIMM Modules
256 X 8, 256 X 9, 1MG X 9, 1MG X 8
1 YEAR WARRANTY

I/O XT 02 41 For 8-bit bus. Has clock, parallel port, serial port, and optional 2nd serial port \$49

I/O AT For 16-bit bus. Has parallel port, serial port, and optional 2nd serial port \$69

I/O SER 2 Add 2nd serial port. to I/O AT or I/O XT \$15.95

BOCA MCA PARALLEL CARD Adds 1 parallel port to PS-2 System \$89

BOCA MCA SERIAL/PARALLEL CARD Adds 2 serial and 1 parallel port to PS-2 System \$139

EVEREX

RAM 3000 DELUXE Up to 3MG. Selectable memory addresses. Expanded Memory Specifications (EMS) 4.0 OS/2. Can be used to backfill base memory up to 640K and the rest as expanded and/or extended memory. Uses 256K D-RAM with 0K \$99
With 512K \$139

RAM 8000 Up to 8MG capacity/support to base, extended or expanded memory in any combination. Fully compatible with Lotus, Intel, Microsoft, EMS 4.0, EEMS. Supports Multi-Tasking and DMA Multi-Tasking in hardware. Software configurable (no dip switches to set). Full 16MG window for future expansion. Zero wait states. Uses 1MG-D-RAM \$275

RAM 10000 Up to 10MG capacity/support to base, extended or expanded memory in any combination. Compatible with Lotus, Intel, Microsoft, EMS 4.0. Operates with no additional wait states. Uses 1MG D-RAM \$169

3 BUTTON MOUSE - Microsoft Compatible - software included \$49

384 Multifunction Card \$89
for PC XT expands to 384K SER PAR/CLK Game port. Uses 64K DRAM

DESKTOP

BEST PERSONAL SCAN Combines two of the best scanning platforms into one, compact unit. Full page hand held and ten page sheet feed scanning in one device. Perform "free hand" scanning with the full page hand held unit - books, maps, technical documents, oddly-shaped originals are easily scanned. Place the hand held unit into the feeder base and automatically scan up to ten pages at a time, within seconds.
The DEST Personal scanner comes bundled with Recognizer™. DEST's critically acclaimed omnifont optical character recognition (OCR) software. Together these innovative products offer the most cost effective, high accuracy OCR solution available for the PC.
300 dpi resolution. Half-tone scanning with 64 levels of gray. \$695

TERMS AND CONDITIONS

No surcharge for MC or VISA
Terms: MC - VISA - CASH - AMEX add 4%
Purchase Orders from qualified firms
20% restocking fee on non defective returns
Prices subject to change

MAIL ORDER DIVISION & RETAIL STORE

17222 Armstrong Ave. • Irvine, CA 92714
Phone: (714) 251-UNTX (251 8 6 8 9)
Fax: (714) 251-8943

Mon - Fri 7am - 5pm
Sat 8am - 2pm

SEND ALL MAIL ORDERS TO

P.O. Box 19772
Irvine, CA 92713



ESTABLISHED 1976

Unitex, Inc

MAIL ORDER DIVISION

We Accept Purchase Orders from Qualified Firms, Universities and Government Agencies

FROM ANY WHERE IN THE U.S. & CANADA

1-(800)-533-0055

CALL for pricing on additional FLOPPY DISK DRIVES, HARD DISK DRIVES, PRINTERS AND MONITORS



SAMSUNG 286 / 12 MHz

Special Price ! Comes with 40 Meg Mini-Scribe Hard Drive

SAMSUNG 286/12MHz

- 12mhz Motherboard with CPU Intel 80286/12(zero wait state)
80387 Math Co-processor Socket
Switchable Speed
8 Expansion Slots
1MB RAM (Expandable to 8)



- 40MG Mini-Scribe Hard Drive
With ATI VGA Card or Mono Card & Monitor

- 1.1 FD/HD Controller
1.2MB Floppy Drive
1 Parallel Printer Port
1 Serial Port (RS-232 Interface)
101-Key Enhanced Keyboard
DOS 3.3
200 Watt Power Supply
FCC Class B approved

Star Micronics Dot Matrix Printer 180 cps, 34cps/nlq NX1000 2

\$159

OUR PRICE

\$999

Samsung Headstart VGA Monitor-31 Dot Pitch

\$289

1 YEAR WARRANTY

DFI COMPUTER SYSTEMS

The New 386 Personal Computer Systems from DFI have some incredible features that outperform machines that cost hundreds of dollars more! We have the configuration with exactly the options you want.

DFI-386-20

- 20MHz
1 MG RAM
Floppy disk drive 1.2 or 1.44
Fast IDE 1.1 hard/floppy drive controller
Mono Card & Monitor
200 Watt Power Supply
FCC Class B approved
101 keyboard
1 Year On-Site warranty

OUR PRICE

\$ 1159

Add VGA card & Monitor...\$350
Add 40MG Hard Drive...\$275

DFI-386-25

- 25MHz
1 MG RAM
Floppy disk drive 1.2 or 1.44
Fast IDE 1.1 hard/floppy drive controller
Mono Card & Monitor
200 Watt Power Supply
FCC Class B approved
101 keyboard
1 Year On-Site warranty

OUR PRICE

\$1299

Add VGA card & Monitor...\$350
Add 40MG Hard Drive...\$275

DFI-386-33

- 33MHz
1 MG RAM
Floppy disk drive 1.2 or 1.44
Fast IDE 1.1 hard/floppy drive controller
Mono Card & Monitor
32K Cache Memory
200 Watt Power Supply
FCC Class B approved
101 keyboard
1 Year On-Site warranty

OUR PRICE

\$2199

Add VGA card & Monitor...\$350
Add 40MG Hard Drive...\$275

KAYPRO COMPUTER SYSTEMS

Choose the System that's perfect for your needs! From the affordable MC-10, the additional speed and power of the MC-20, to the advanced 32-bit processing with speeds of over 25MHz of the MC-30, Kaypro has your system.

MC-10

- 8088-10mhz
512K RAM
1 360K floppy disk drive
1 parallel port
1 serial port
1 game port
clock/ calendar with battery back-up
101 keyboard
150 watt power supply
FCC class B approved
Dow Jones 48 hour depot service

\$429

MC-20

- 80286-12mhz (zero wait state)
1 MB RAM
1:1 HD/FD controller
1 1.2MB floppy disk drive
1 parallel port
1 serial port
1 game port
101 keyboard
200 watt power supply
FCC class B approved
Dow Jones 48 hour depot service

\$649

MC-30 Series

- 1 MB RAM
1:1 HD/FD controller
1 1.2MB floppy disk drive
1 parallel port
1 serial port
1 game port
101 keyboard
200 watt power supply
FCC class B approved
Dow Jones 48 hour depot service

1 YEAR WARRANTY ON ALL KAYPRO PRODUCTS
*Prices do not include monitor

MC-30SX

80386-16MHz SX \$999

MC-30/20

80386-20MHz \$1299

MC-30/25

80386-25MHz \$1399



Retail Office
4025 S. Industrial Blvd.
Las Vegas, NV 89103
Phone: (702) 732-8689
FAX: (702) 732-0390
Mon - Fri 8am - 5pm
Sat 9am - 1pm

TERMS AND CONDITIONS

Terms: Cash, MC or VISA - no surcharge
AMEX only add 4% handling fee
COD Purchase Orders from qualified firms
20% restocking fee on non defective returns
Prices subject to change

SEND ALL MAIL ORDERS TO
P.O. Box 19772
Irvine, CA 92713

Mail Order Division & Retail Store

17222 Armstrong Ave. - Irvine, CA 92714
Phone: (714) 251-UNTIX(251-8 6 8 9)
Fax: (714) 251-8943
Mon - Fri 7am - 5pm
Sat 8am - 2pm

UNICORN YOUR I.C. SOURCE

COLLIMATOR PEN (INFRA-RED)

A low power collimator pen containing a MOVPE grown gain guided GaAlAs laser. This collimator pen delivers a maximum CW output power of 2.5 mW at 25°.

These collimated laser sources are designed for industrial applications such as data retrieval, telemetry, alignment, etc.

The non-hermetic stainless steel encapsulation of the pen is specifically designed for easy alignment in an optical read or write system, and consists of a lens and a laser device. The lens system collimates the diverging laser light. The wavefront quality is diffraction limited.

The housing is circular and precision manufactured with a diameter of 11.0 mm and an accuracy between + and - 11 μm.

LIST PRICE: \$180.00 OUR PRICE: **\$39.99**

• QUALITY COMPONENTS...LOW PRICES SINCE 1983 •



LASER DIODE (INFRA-RED)

Designed for general industrial low power applications such as reading optical discs, optical memories, barcode scanners, security systems, alignment, etc.

The gain guided laser is constructed on an n-type gallium arsenide substrate with a Metal Organic Vapor Phase Epitaxial process (MOVPE).

The device is mounted in a hermetic SOT148D encapsulation. (diameter 9.0 mm)

The SB1053 is standard equipped with a monitor diode, isolated from the case and optically coupled to the rear-emitting facet of the laser. This fast-responding monitor diode can be used as a sensor to control the laser optical output level.

LIST PRICE: \$38.00 OUR PRICE: **\$9.99**

• WE CARRY A FULL LINE OF COMPONENTS! •



EPROMS

STOCK#	PINS	DESCRIPTION	1-24	25-99	100+
1702	24	256 x 4 1us	3.99	3.79	3.41
2708	24	1024 x 8 450ns	6.49	6.17	5.55
2758	24	1024 x 8 450ns	3.99	3.79	3.41
2716	24	2048 x 8 450ns (25v)	3.29	3.13	2.82
2718-1	24	2048 x 8 350ns (25v)	3.79	3.60	3.24
TMS2716	24	2048 x 8 450ns (25v-CMOS)	6.29	5.98	5.38
27C16	24	2048 x 8 450ns (25v)	3.99	3.79	3.41
2732	24	4096 x 8 450ns (25v)	3.79	3.60	3.24
2732A-2	24	4096 x 8 200ns (21v)	3.79	3.60	3.24
2732A	24	4096 x 8 250ns (21v)	3.69	3.51	3.18
2732A-4	24	4096 x 8 450ns (21v)	3.19	3.03	2.73
TMS2532	24	4096 x 8 450ns (25v)	5.79	5.50	4.95
TMS2532	24	4096 x 8 450ns (25v)	1.99	1.89	1.70
27C32	24	4096 x 8 450ns (25v-CMOS)	4.19	3.98	3.58
2764-20	28	8192 x 8 200ns (21v)	3.99	3.79	3.41
2764	28	8192 x 8 250ns (21v)	3.79	3.60	3.24
2764A-20	28	8192 x 8 200ns (12.5v)	3.99	3.79	3.41
2764A	28	8192 x 8 250ns (12.5v)	3.29	3.13	2.82
TMS2564	28	8192 x 8 250ns (25v)	6.79	6.45	5.81
27C64	28	8192 x 8 250ns (21v-CMOS)	4.19	3.98	3.58
27128-20	28	16,384 x 8 200ns (21v)	5.79	5.50	4.95
27128	28	16,384 x 8 250ns (21v)	5.09	4.84	4.35
27128A	28	16,384 x 8 250ns (12.5v)	5.79	5.50	4.95
27C128	28	16,384 x 8 250ns (21v)	5.79	5.50	4.95
27256-20	28	32,768 x 8 200ns (12.5v)	5.29	5.03	4.53
27256	28	32,768 x 8 250ns (12.5v)	4.79	4.55	4.09
27C256	28	32,768 x 8 250ns (12.5v-CMOS)	6.29	6.03	5.53
27512-20	28	65,536 x 8 200ns (12.5v)	7.49	7.12	6.41
27512	28	65,536 x 8 250ns (12.5v)	6.99	6.64	5.98
27C512	28	65,536 x 8 250ns (12.5v-CMOS)	6.99	6.64	5.98
27C1024	32	131,072 x 8 200ns (12.5v-CMOS)	17.99	17.09	15.38
68754	24	8192 x 8 450ns	13.99	13.29	11.96
68756	24	8192 x 8 450ns	14.99	14.24	12.82

• CALL FOR A FREE CATALOG! •

UNICORN ELECTRONICS

10010 Canoga Ave., Unit B-8 • Chatsworth, CA 91311

ORDER BY PHONE! OUTSIDE CALIFORNIA: (800) 824-3432
IN CALIFORNIA: (818) 341-8833
ORDER BY FAX: (818) 998-7975

BLAST YOUR MESSAGE THRU!

VOICE MAIL • TELEMARKETING CALL PROCESSING

Let Powerline transform your PC/XT/AT/386 into a multi-line voice processing command center. Have your computer intelligently process your sales, inquiries and messages. Complete package.

Single Line (BigMouth) . . . \$295.00
Multi-Line \$895.00

(Developer/OEM packages available)
VISA • MC • AMEX • COO

Call: (415) 522-3800
FAX: (415) 522-5556

TALKING TECHNOLOGY, INC.

1125 ATLANTIC AVE., ALAMEDA, CA 94501

Circle 285 on Reader Service Card

JLaser 5 . . . \$399

Laser Printer Controller

Thinking of buying a

- LaserMaster
- Intel Visual Edge™
- Kofax board

Wasting \$\$\$

JLaser 5 gives you the functions of all three boards combined into one, plus EMS:

- Fast laser printing
- Halftones on a laser printer
- Group 4 file printing and display

TALL TREE SYSTEMS
2585 E. Bayshore Rd. ■ Palo Alto, CA 94303
(415) 493-1980 ■ FAX (415) 493-7639

Versions available for HP Series II/III and Canon LBP-4 laser printers
All products are trademarks of their respective companies
Artwork for this ad created with JLaser 5 and included software

Circle 286 on Reader Service Card

Intelligent Solutions NetWare, DOS, OS/2 & Xenix

SCSI CONTROLLERS FOR ISA & MCA

Novell tested under NetWare 286
Use with NetWare 286 or 386
Use any size SCSI disk drive
Handle large SCSI hard drives and erasable opticals

NOVELL LABS AUTHORIZED
TESTED AND APPROVED
NetWare Compatible

PROCOMP
Phone: (216) 234-6387
FAX: (216) 234-2233

The SCSI Professionals
6801 ENGLE ROAD, CLEVELAND, OH 44130

Circle 225 on Reader Service Card

There is a Difference. Lifetime Free Updates

EP-1140 \$895

A programmer is not just another programmer. That is why BP Microsystems is committed to bringing our customers the highest quality programmers at an affordable price. This commitment is evident in our EP-1140 E/EPROM programmer supporting thousands of 24-, 28-, 32- and 40 pin devices. A 32-pin model, EP-1132, is available also for \$695. And, all of our programmers include future chip support at no charge and an unconditional money back guarantee.

BP MICROSYSTEMS
1-800-225-2102
(713) 461-9430

Circle 47 on Reader Service Card

New

LPC Serial/2A HDLC/SDLC Data Communication Controller for IBM PC/AT Bus

- Dual Channel Synchronous Controller (Z85C30)
- Runs 800K BAUD
- Full Duplex DMA
- HDLC LapB software option

Computer Modules, Inc.
2348C Walsh Ave.
Santa Clara, CA 95051
Tel: (408) 496-1881
Fax: (408) 496-1886

IBM PC/AT is a trademark of IBM, Inc.

Circle 68 on Reader Service Card

Infra-Red Remote Control

OCTACOMM®/IR

Change TV channels from your PC. Control DOS programs from a hand-held remote. Use a PC to send and receive the infra-red signals used by hand-held remote controllers like those used with TVs, VCRs and other devices. Maintains a database of IR signals learned from your own hand-held remote controller. Hardware attaches to the serial port of the IBM-PC. Software for DOS 2.0 and greater.

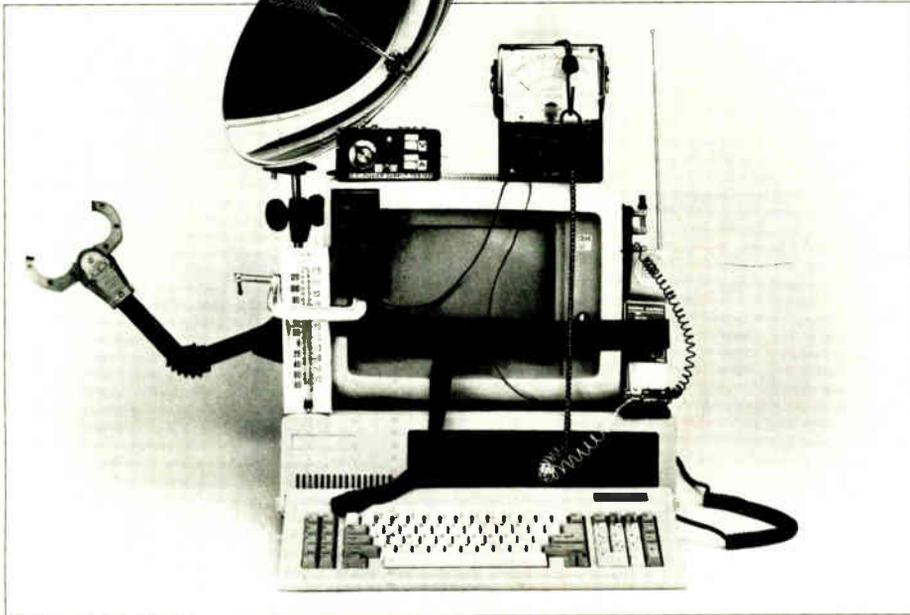
Price: \$395.00

Houston Computer Services, Inc.
11331 Richmond Avenue / Suite 101 / Houston, Texas 77082
(713) 493-9900
M/C - Visa - Discover - AmEx - COD

OCTACOMM is a registered trademark of Houston Computer Services, Inc.

Circle 139 on Reader Service Card

There's A Better Way To Add Data Acquisition and Control To Your Computer



What is the A-Bus?

The A-Bus is a system for connecting devices to your computer. All A-Bus devices work together: no matter what computer you have. With the A-Bus, you can perform a myriad of functions:

Sensing. Detecting or reading a switch closure or voltage presence.

Measuring. Determining a force, frequency, temperature, weight, or any other quantity. These are converted to voltages which are then measured by A-Bus cards.

Switching. Open or close a circuit. Switch any type of electrical device.

Governing. Control the level or position of a device. Move objects, drive motors.

In simple terms: A-Bus cards are data acquisition and control building blocks which can be assembled into any system.

Why should you choose the A-Bus?

It's affordable. From the \$65 Digital Input Card to the \$299 Smart Stepper Controller, you get much more than your money's worth.

It's simple. Easy connection to your computer and simple wiring with screw terminals. Designed to be easy to integrate in software.

It's reliable. Built to commercial standards using prime components.

It's versatile. You mix and match low cost boards to fit your project.

It's built in America. Local manufacture means quality on-time support.

It's proven. Thousands of applications installed around the world, on sea, in the air, and on land.

A Sampling of Products from Our Summer 1990 Catalog

Call 1-800-221-0916 for Yours

Relay Card: 8 individually controlled industrial relays. 3A at 120VAC, SPST. **RE-140: \$142**

High-Speed 12-bit A/D converter: 8 extremely fast (10µs) analog inputs. 0-5V, on board amp. **FA-154: \$179**

8 Bit A to D: 8 Analog inputs. 0-5.1V. 20mV steps. 7500 readings/sec. **AD-142: \$142**

12 Bit A to D: Range: ±4V. On-board amp. 1mV resolution. Conversion time 130ms. 1 channel; expand with RE-156 or MX-155 **AN-146: \$153**

Temperature Sensor: Range 0-200°F. 10mV/°. 2° Resolution with AD-142. **TS-111: \$12**

Digital Input: 8 opto-isolated inputs. Read voltage presence or switch closures. **IN-141: \$65**

Latched Digital Input: 8 optoisolated inputs. Each input individually latched to catch switch closures and alarm loops. **LI-157: \$85**

Smart Quad Stepper Controller: On board microprocessor controls four motors simultaneously. Uses simple commands like "MOVE ARM 10.2 (INCHES) LEFT". Set position, ramping, speed, units.... Many inputs for limit switches etc. Stepper motors available. **SC-149: \$299**

Odin Software: PC compatible. Control relays from analog inputs or time schedules. Logging. Runs in background. **OS-189: \$129**

Reed Relay Card: 8 reed relays (20mA at 60VDC, SPST). **RE-156: \$109**

Digital Output Driver: 8 outputs: 250mA at 12V. For relays, solenoids, stepper motors, lamps. **ST-143: \$78**

D/A converter: 4 Channel 8 Bit D/A converter with output amplifiers. **DA-147: \$149**

24 line TTL I/O: Connect 24 signals, TTL 0/5V levels or switches. (8255A) **DG-148: \$72**

32 Channel Multiplexer: Switches up to 32 channels to a single common. **MX-155: \$83**

Clock with Alarm: Powerful clock/calendar. Battery backup. **CL-144: \$98**

Touch Tone Decoder: Converts tones to unique values. **PH-145: \$87**

A-Bus Prototyping card: **PR-152: \$16**

Counter Timer: Three 16 bit counters/timers. Count pulses, measure frequency **CT-150: \$132**

Cobra Robot Arm: 5 axis robot. Connects to printer port. Excellent resolution and repeatability. **SX-190: \$549**

Motherboard: Holds up to 5 A-Bus cards. **MB-120: \$108**

A-Bus Adapters:
IBM PC/XT/AT & compatibles. **AR-133: \$69**

MicroChannel Adapter: **AR-170: \$93**
Parallel Adapters also available for Apple II, Commodore 64,128, TRS-80

Serial Adapter: Connect A-Bus systems to any RS-232 port. **SA-129: \$149**

Serial Processor: Built in BASIC for off-line monitoring, logging, decision making. **SP-127: \$189**

ALPHA Products

242-B West Avenue, Darien, CT 06820 USA Call (203) 656-1806 or Fax 203 656 0756

UK Distributor: Pinna Electronics, Scotland.....Tel: (0294) 605296

Fax: (0294) 68286

Asia: Batam Development Agency, Singapore.....Tel: 473-4518

Fax: 479-6496

Scandinavia: A/S Con-Trade, Norway.....Tel: (04) 41 83 51

Fax: (04) 41 94 72

CALL 800-654-7762 WITH YOUR BEST PRICE AND WE'LL BEAT IT*!!

"We guarantee lowest pricing on Seagate, Everex, Panasonic, DTK Systems, Samsung, all memory expansions, and many more name brand products. Also, NEVADA COMPUTER specializes in over stock, discontinued, excess, liquidation, bankrupt, etc. INVENTORIES, of which we purchase large quantities under dealer cost and offer to you at a fraction of everybody elses pricing. Savings up to 90% off! All new with at least 90 day warranties."

COMPAQ

Description	Equiv. Compaq Part #	For Model #	Your Low Price
1MB Add-on Module	113131-001	386/20/25/20e/286E	179 ⁰⁰
1MB Add-on Module	113646-001	Deskpro 386S	189 ⁰⁰
4MB Add-on Module	113132-001	386/20/25/20E/286E	359 ⁰⁰
4MB Add-on Module	112534-001	Deskpro 386S	499 ⁰⁰
1MB Memory Exp Bd	113644-001	Deskpro 386/20e	299 ⁰⁰
1MB Memory Exp Bd	113633-001	Deskpro 386S	309 ⁰⁰
4MB Memory Exp Bd	113645-001	Deskpro 386/20e	799 ⁰⁰
4MB Memory Exp Bd	113634-001	Deskpro 386S	799 ⁰⁰
1MB Memory Exp Bd	117428-001	286E	469 ⁰⁰
4MB Memory Exp Bd	117429-001	286E	1299 ⁰⁰
1MB Upgrade Bd	110235-001	SLT/286	399 ⁰⁰
4MB Upgrade Bd	108070-001	386/16	1299 ⁰⁰

HP LASER JET II, IID, IIP & III

1Meg	134 ⁰⁰	2Meg	189 ⁰⁰	4Meg	339 ⁰⁰
HP IIP	1049 ⁰⁰	HP LASER JET II	1499 ⁰⁰	HP III	1799 ⁰⁰

All memory boards expandable to 4 Meg. Specify Machine

ZENITH

386/25/33	1 Meg	109 ⁰⁰	Super	1 Meg	359 ⁰⁰
	2 Meg	299 ⁰⁰	Super 286	4 Meg	1159 ⁰⁰

EVEREX

RAM 3000 DELUXE Up to 3 Meg. (EMS) 4.0 DS/2. Back up base memory and expanded and/or extended memory Uses 256K D-RAM **9900**

RAM 8000 Up to 8MG capacity/support to base extended or expanded memory in any combination Fully compatible with Lotus, Intel, Microsoft, EMS 4.0, EFMS. Supports Multi-Tasking and DMA Multi-Tasking in hardware software configurable (no dip switches to set). Full 16MG window for future expansion. Zero wait state. uses 1MG D-RAM **19900**

RAM 10000 Up to 10 MB extended or expanded memory Compatible with Lotus, Intel, Microsoft, EMS 4.0 Uses 1 MB D-RAM **17900**

MEMORIES...

SIMM MODULES

Description	120NS	100NS	80NS	60NS
256 x 9 IBM	19 ⁰⁰	29 ⁰⁰	33 ⁰⁰	59 ⁰⁰
1Meg x 8 Apple	85 ⁰⁰	95 ⁰⁰	99 ⁰⁰	—
1Meg x 9 IBM	69 ⁰⁰	74 ⁰⁰	79 ⁰⁰	109 ⁰⁰
4Meg x 9 IBM	—	—	599 ⁰⁰	699 ⁰⁰

INTEL COPROCESSORS

	8 Bit	32 Bit	
8087	5MHz or less	88 ⁰⁰	80807-16 16MHz
8087-2	8MHz	118 ⁰⁰	80387-20 20MHz
8087-1	10MHz or less	149 ⁰⁰	80387-25 25MHz
			80387-33 33MHz
			80387-SX 33MHz
80287	6MHz	149 ⁰⁰	80387-SX 33MHz
80287-8	8MHz	189 ⁰⁰	80387-SX 33MHz
80287-10	10MHz	218 ⁰⁰	80287-XL
80C287-12	Laptop	278 ⁰⁰	80287-XL

AST

1 Meg	149 ⁰⁰
2 Meg Workstation 286/386	259 ⁰⁰
4 Meg 386/16 or 386 C	399 ⁰⁰

BOCA AT PLUS

16 BIT MEMORY BOARD FOR 286, 386 AT
DK-8Meg Board • 4.0 LIM Compatible • New 5 Year Warranty
• Conventional. Expanded and Extended Memory
• Supports DOS, DS/2, LIM/EMS & EEMS
• Operates with CPU Speeds to 33 MHz
DK — 129⁰⁰ 2 Meg — 269⁰⁰
4 Meg — 389⁰⁰ 8 Meg — 649⁰⁰

IBM PS2 (BOARDS & MODULES)

Description	Equiv. IBMP52 Part #	For Model #	Your Low Price
512K Upgrade	30F 5348	30/286	69 ⁰⁰
2MB Upgrade	30F 5360	30/286	189 ⁰⁰
1MB Module	6450603	70-E61 & 121	104 ⁰⁰
2MB Module	6450604	70-E61 & 121	199 ⁰⁰
2MB Module	6450608	70-A21	209 ⁰⁰
1MB Mem. Board	6450375	80-041	149 ⁰⁰
2MB Mem. Board	6450379	80-111 & 311	319 ⁰⁰
2MB Exp. 8MB	6450605	70/80	999 ⁰⁰
4MB Module	34F 2933	70/80	689 ⁰⁰

RAM CHIPS

Description	150NS	120NS	100NS	80NS	70NS
64 x 1	1 ⁰⁰	1 ⁰⁰	2 ⁰⁰	—	—
64 x 4	2 ⁰⁰	2 ⁰⁰	3 ⁰⁰	3 ⁰⁰	—
256 x 1	1 ⁰⁰	1 ⁰⁰	2 ⁰⁰	2 ⁰⁰	4 ⁰⁰
256 x 4	—	8 ⁰⁰	9 ⁰⁰	10 ⁰⁰	13 ⁰⁰
1 Meg x 1	—	5 ⁰⁰	6 ⁰⁰	6 ⁰⁰	7 ⁰⁰

Thousands In Stock Call For Qty Dis

TOSHIBA

2MG Card Toshiba Portable T1600	298 ⁰⁰
2MG Card Toshiba Portable T3100SX	298 ⁰⁰
4MG Card Toshiba Portable T3100SX	798 ⁰⁰
512K Card Toshiba Portable T3100e	148 ⁰⁰
2MG Card Toshiba Portable T3100e	298 ⁰⁰
2MG Card Toshiba Portable T3200SX	298 ⁰⁰
4MG Card Toshiba Portable T3200SX	698 ⁰⁰
3MG Card Toshiba Portable T3200	498 ⁰⁰
2MG Card Toshiba Portable T5100	298 ⁰⁰
2MG Module Toshiba Portable T5200	298 ⁰⁰
3MG Module Toshiba Desktop T8500	348 ⁰⁰

CANON FLATBED SCANNER IX-12F

• 300 DPI • 16 Secs per page • 32 Level Gray Scale
• 1 year warranty • Ready to go Interface card and cable included
List 1595 **Your Price 499⁰⁰**

OPTIONS: DCR 199⁰⁰ PC Paint By Z-Soft 165 79⁰⁰
Sheet Feeder (also works with HP) 299⁰⁰

LIQUIDATIONS

WHILE SUPPLIES LAST — WITH 1 YEAR WARRANTY



FAX-MODEM CARD by Xerox

• Automatic Group III Digital Fax • Background operation
• Send text, screen images, scan!e! pages
• Hayes compatible modem built on • Fax 9600/7200/4800/2400
• Software • telephone cord • New, factory sealed
List 695 **Your Price 149⁰⁰**

WANGTEK TAPE BACKUPS

• 65MB per minute • Wangtec 5099EN24 drive
• Wangtec 8 bit Cic60 controller • Software • Menu driven
• DC600 cartridge • Easy installation
List 999⁰⁰ **Your Price 399⁰⁰** 40MB backup no controller 189⁰⁰

LIQUIDATION ITEMS

QTY LEFT	SALE PRICE	QTY LEFT	SALE PRICE
14 Microsoft File for Mac 2.0	49 ⁰⁰	27 US Robotics 2400 Modem for PS2	99 ⁰⁰
9 80MB for Mac II & SE by Everex	499 ⁰⁰	14 Starwriter F-10 40CPS Letter Quality	399 ⁰⁰
19 Nec CutSheet Feed for 2000/3500 series	49 ⁰⁰	175 PFS Proof or Graph	19 ⁰⁰
14 Wordstar 5.0	129 ⁰⁰	9 Bernoulli Box 2-20Meg SCSI Interface	699 ⁰⁰

MODEMS

MANUFACTURED BY ZOOM PC 2400 HC INTERNAL MODEM
• Fully Hayes Compatible • Monitor Speaker with Volume Control
• 2400/300 Baud Transmission Rate • Addressable CDM 1,2,3,4
• Compatible with IBM PC XT, AT and Compatibles
• Full Duplex Operation • Complete with ProConim Software
• Two Year Manufacturer's Warranty • Auto Dial/Auto Answer
List 199⁰⁰ **Your Price 79⁰⁰ Each**

2400 BAUD EXTERNAL MODEM List 299⁰⁰ **Your Price 99⁰⁰**

EVEREX MODEMS

EV-923 EverCom 12 300/1200 bps Bitcom Software 69⁰⁰
EV-941 EverCom 24 2400 Baud Int. Bitcom Software 139⁰⁰
EV-945 External 2400 Baud 199⁰⁰
EV-942 2400 PS2 199⁰⁰ Level 5 MNP Add 39⁰⁰

FLOPPY DRIVES

360K 1/2 Ht. 5 1/4" MITSUMI 59⁰⁰
1.2 Meg 5 1/4" 79⁰⁰
720K 3 1/2" Drive w/5 1/4" mounting 69⁰⁰
1.44 Meg 3 1/2" Drive w/5 1/4" mounting 89⁰⁰
360K Tandon TM100-2 Full Ht. (The original IBM) 89⁰⁰
We also carry Sony, Teac & others. Please Call

SUPER SPECIALS...

POWER SUPPLIES

IBM DIRECT REPLACEMENT
150 WATT XT Comp. • UL Appr. • 110/220V input switch • 4 drives 49⁰⁰
200 WATT/286/386 AT comp. • UL Appr. • 110/220V input switch 69⁰⁰
• 4 drives

SAMSUNG MONITORS

12" Amber w/Tilt & Swivel Base 89⁰⁰
14" Color 640 x 200, 16 colors 109⁰⁰
14" EGA 640 x 350, 64 colors/31 369⁰⁰
VGA 800 x 600 Multisync Compatible 449⁰⁰
14" VGA Demo looks new, 31 Dot Pitch 284⁰⁰
For Nec Multisync with lowest price.

EVEREX VIDEO CARDS

EGA EV659, 640 x 350, Auto Switch 99⁰⁰
VGA EV659 16 Bit 256 Exp 512K 179⁰⁰

NCC VIDEO CARDS...
MonoGraphics (Hercules Compatible) with Par. Port 29⁰⁰
Color Graphics (Hercules Compatible) with Par. Port 39⁰⁰
Mono Card Text Only 9⁰⁰
VGA Card 1024 x 768 (256K Exp 512K) 109⁰⁰
STB mono/color card 29⁰⁰

SEAGATE HARDDRIVE

ST125-0	20Mb 40msec 3.5"	AT KIT	XT KIT
ST125-1	20Mb 28msec 3.5"	\$249	\$299
ST138-0	30Mb 40msec 3.5"	\$269	\$319
ST138-1	30Mb 28msec 3.5"	\$289	\$339
ST225	30Mb 28msec	\$309	\$359
ST238R (RLI)	20Mb 55msec	\$199	\$249
ST251-1	30Mb 65msec	\$219	\$279
ST227R-1 (RLI)	42Mb 28msec	\$339	\$389
ST4096	65Mb 28msec	\$379	\$429
ST4144 (RLI)	80Mb 26msec	\$579	\$629
	120Mb 28msec	\$649	\$699

XT kits include cables, software (over 32MB) controller
AT kits include cables, rails, software (over 32MB)

MORE HARDDRIVE SPECIALS

10 Meg 80 Mil. Sec.	89 ⁰⁰	20 Meg 60 Mil. Sec.	189 ⁰⁰
40 Meg 40 Mil. Sec.	299 ⁰⁰		

CONTROLLERS

8 Bit WD Controller FOR HARDDRIVES 59⁰⁰
16 Bit WD Controller 2-1 109⁰⁰ 16 Bit Everex HD/Floppy 1.1 99⁰⁰
FOR FLOPPYS
Super Floppy Controller 1.2, 360K, 720K & 1.44 Drives 69⁰⁰

ORDERS ONLY
800-654-7762

TECHNICAL / CUSTOMER SERVICE / ORDER STATUS:
702-294-0204
FAX 702-294-1168

Trademarks are Registered with their respective Co's. Prices Subject to Change
All Products 90 Day Warranty unless stated otherwise.

SE HABLA ESPANOL

• WE ACCEPT INTERNATIONAL ORDERS

• WE ALSO PURCHASE EXCESS INVENTORY—FAX OR CALL

• NO SOFTWARE RETURNS

*APPLIES TO ADVERTISED PRICES IN THIS MAGAZINE ONLY!

NO SURCHARGE FOR MC/VISA/AE

TERMS:

MC • VISA • CDD CASH • NET

Purchase Orders from Qualified Firms

Personal Checks • CDD add \$5.00

20% Restocking Fee on Returns Within 15 Days

No Refunds After 30 Days



1000 Nevada Hwy. • Unit 101
Boulder City, NV 89005

Formerly Mead Computer



SHIPPING: (min. 8%) UPS

486

\$2495

Made in U.S.A.

JC GOLD CARD

The JCS 486, the New Performance Leader in Personal 486 Systemboards

- Intel 80486/25(B6) CPU
- 8KB Cache integrated in CPU
- Math Coprocessor integrated in CPU
- Shadow RAM for Video & System BIOS
- Second Level Cache Memory expandable to 512KB
- Waitak 4167 numeric coprocessor socket
- 30 DAY MONEY BACK GUARANTEE

486 Complete System.....\$3985
 Include 4MB Memory, 150MB ESDI HDD, ESDI Cache Controller, 12 or 1.44MB FDD, MS DOS, AT IO, 101 Keyboard

80386/20 CPU Bd, C&T chipset \$ 590
 80386/25 CPU Bd, C&T chipset \$ 695
 80386/25 Cache Bd, C&T chipset \$1095

Dealer inquiries welcome
Jemini Electronics (408)727-9986
 3400 De La Cruz Blvd, Unit T
 Santa Clara Co, 95054 (408)727-7687

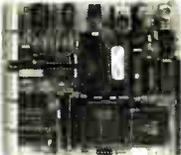
11.1 MIPS

Circle 153 on Reader Service Card

Little Giant™

C Programmable Controller

This shirt pocket sized computer interfaces directly to the outside world. Use it to control anything. Instantly C programmable with your PC and our Dynamic C. ROM and battery backed RAM to 1024k bytes. 8 Channel, 10/12 bit, A/D with conditioning. High voltage/current drivers. Battery backed time/date clock. Watchdog/power fail. 4 serial channels. 24 parallel ports. Timers. Integral power supply. Terminations for field wiring. Expansion connector. Plastic/metal packaging available. OEM versions from \$199.00.



Z-World Engineering
 1340 Covell Blvd., Davis, CA 95616
(916) 753-3722
 Fax: (916) 753-5141

Circle 325 on Reader Service Card

BLACKJACK COMPUTER



The ultimate card-counting weapon, operated under complete concealment within the casinos. CPU, "magic" shoes, I/O switches, sensors, power supplies, extensive training and support provided. Win consistently with the latest generation of the technology every casino fears the most.

Contact
(714) 865-1191

Circle 40 on Reader Service Card

Terminal Emulation

TEK 4105/4010

- Tektronix 4105
- Tektronix 4010/4014
- VT320, VT220, VT102
- Picture files
- VGA and EGA support
- High resolution hardcopy

VT320

- VT320, VT220, VT102 emulation
- File transfer
- 132 column modes
- Color support
- Hot key
- Extensive network support

Diversified Computer Systems, Inc.
 3775 Iris Avenue, Suite 1B
 Boulder, CO 80301 (303) 447-9251
 FAX 303-447-1406

Trademarks: VT102, VT220 — DEC, Tektronix — Tektronics Inc.

Circle 98 on Reader Service Card

PC Communications Coprocessors



Our communications coprocessors offload serial and parallel communications tasks from PC's used in dedicated applications. RS232 and RS485 style communications. Easily programmed using C. A memory mapped interface to the host PC allows high speed data transfer and simple buffer schemes. From 64k to 512k of memory local to the coprocessor but accessible from the host PC. Used in many industrial and business systems to dramatically improve performance compared to standard PC serial port implementations.

Z-World Engineering
 1340 Covell Blvd., Davis, CA 95616
(916) 753-3722
 Fax: (916) 753-5141

Circle 326 on Reader Service Card

SAVE on MEMORY!

IBM PS/2 Model 70 E61/061/121 1 MB "603" Call	APPLE, TOSHIBA, AST, OTHERS Call
Model 70 E61/121/502/55x 2MB "604" Call	SIMMS/SIPS 256K, 1MB Call
Others Call	4MB, X8, X9 Call

OTHERS PRODUCTS
 Modems, FAX Switches Call

COMPAQ
 286E/386-20/20E/25/PORT 3
 1MB Call
 4MB Call
 Others Call

HP LaserJet II, IID, IIP, III
 1MB Call
 2MB Call
 4MB Call

ADD ON AMERICA
 Div. ROHM Corp.
 8 Whatney, Irvine, CA 92718
 TEL (714)-855-9537
 FAX (714)-855-0727
 VISA/MC
 Prices subject to change

TEL 1-800-292-7771

Circle 12 on Reader Service Card



3M

DS-DD 519 PER BOX	Foreign Enquiries Welcome	DS-HD 969 PER BOX
795 PER BOX	5.25" 3M Brand Diskettes	1495 PER BOX
	3.50" 3M Brand Diskettes	

3M DATA CARTRIDGES

DC-2000	13.95	DC-600A	18.99
DC-300XLP	17.39	DC-6150XTD	19.99

3M COMPUTER TAPES

777-1/2"-2400'-C55	11.45	700-1/2"-2400'-C55	12.55
777-1/2"-1200'-C55	8.95	700-1/2"-2400'-C143	13.45
DEC-TK-50	25.95	DEC-TK-52	37.95
IBM-3480	4.95	Opt. Rewrite Disks	169.00

3M HIGHLAND DISKETTES

5.25" DS-DD		5.25" DS-HD	
389 PER BOX	3M Highland	649 PER BOX	
689 PER BOX	3.50" BRAND NAME	1439 PER BOX	



BASF

DS-DD 449 PER BOX	Quantity Discounts Available	DS-HD 749 PER BOX
729 PER BOX	5.25" BASF Brand Diskettes	1399 PER BOX
	3.50" BASF Brand Diskettes	

.32 BASF 5.25" DS-DD No-Logo Bulk with sleeves, labels & W/P tabs

2400' w/tape seal	10.95	600' w/tape seal	6.95
1200' w/tape seal	7.95	300' w/tape seal	5.45



Verbatim DataLifePlus

Tellon/Preformatted

DS-DD 539* PER BOX	Quantity Discounts Available	DS-HD 999* PER BOX
795 PER BOX	5.25" DataLife Plus Diskettes	1495 PER BOX
	3.50" DataLife Diskettes	

maxell.

5.25" DS/DD	5.25" DS/HD	3.50" DS/DD	3.50" DS/HD
5.39	9.69	7.99	15.49

KAO BULK

DS-DD .39	"No-Logo"	DS-HD .69
.69	5.25" Color-Bulk	1.09
	3.50" Color-Bulk	

BULK DISKETTES

5.25" DS/DD	5.25" DS/HD	3.50" DS/DD	3.50" DS/HD
.25*	.46*	.45	.99

*WITH SLEEVES, LABELS AND W/P TABS



HEWLETT PACKARD Original Toner Cartridges

Laserjet Series I P/N 92285A	75.95
Laserjet Series II P/N 92295A	75.95
Laserjet Series IIP P/N 902275A	63.95



Dysan

5.25" DS/DD	5.25" DS/HD	3.50" DS/DD	3.50" DS/HD
539 PER BOX	969 PER BOX	795 PER BOX	1495 PER BOX

WE BEAT ANY PRICE!!

TERMS: No surcharge on VISA, Mastercard or AMEX. Order packaging and processing = \$2.95 per order. COD orders add \$3.95 PO's accepted from recognized institutions on Net 30 days. L/C, T/T and Bank Draft acceptable. Price quoted for case (100 disks or 10 cartridges). For quantities less than 1 case add 10%. SHIPPING: UPS surface \$1.95/5 cartridges; \$0.95/50 diskettes. (Prices subject to change without notice. Errors and omissions not accepted. All warranties are from manufacturers.)

Toll Free Order Line: **1-800-523-9681**
 Information Line: **1-800-255-0080**
 TLX-9102404712 FAX-801-572-3327

DISKOTECH

213 Cottage Avenue
 P.O. Box 1339 Sandy, Utah 84091

KNAPCO

MASTER DISTRIBUTORS

EMERSON UPS

**YES !!!
KNAPCO
DELIVERS
EMERSON
POWER !!!**



EMERSON MODELS

- MODEL 10 150Va. **\$177.**
- MODEL 20 300Va. **\$244.**
- MODEL 30 500Va. **\$344.**
- MODEL 40 800Va. **\$569.**
- MODEL 50 1400Va. **\$798.**
- UPS 600 \$798. **\$499.**
- UPS 1250 \$1398. **\$769.**
- UPS 1500 \$1798. **\$995.**
- TRUE ON LINE MODELS**
- PC ET \$798. **\$479.**
- AP 15KVA \$3217. **\$1999.**
- AP 3KVA \$5550. **\$3799.**
- AP 5KVA \$9499. **\$5999.**

AccuCard NOW \$199.

EMERSON UPS

\$479
retail \$798

\$439
retail \$698

true SINEWAVE or ONLINE
KNAPCO DELIVERS THE BEST PRICES !!!!

SHAPE LINE TAMERS

FERRO POWER CONDITIONER



Surge Suppressor
REGULATION 3%
4 Outlets, 6 ft. Cord
IEEE Std. 587 for Noise

Model	Retail	Dealer
150 Va.	\$165.	\$110.
300 Va.	\$220.	\$165.
450 Va.	\$285.	\$214.
600 Va.	\$350.	\$247.
800 Va.	\$485.	\$309.
1000 Va.	\$540.	\$319.

ORDER HOT LINE
800-827-4718

A/B SERIAL BOX \$9.95
ALL UPS BATTERIES IN STOCK FOR QUICK SHIP

813 - 449 - 0019
FAX 813 - 449 - 0701 N-22

KNAPCO

QUALITY DISTRIBUTION FOR 45 YEARS
1201 HAMLET AVE.
CLEARWATER FL. 34616

8031/51 Single Board Computer \$99

A fast and inexpensive way to implement an embedded controller. 8031/32 processor, 8+ parallel I/O, up to 2 RS232 serial ports, +5 volt operation. The development board option allows simple debugging of 8031/51 family programs.



Circle 137 on Reader Service Card

PAL™/PLD SOFTWARE

Sets The Standard



CUPL™/PLD compiler, the most powerful language for the state machine logic design, now allows front end design entry with popular schematic capture packages such as OrCAD, P-CAD, Schema, Hi-Wire, PADs or RACAL. CUPL supports all PLDs and carries the most extensive update program. Available on MS-DOS™, Apollo™ SUN™ VAX™ and most UNIX™ based platforms.

LOGICAL DEVICES, INC.
1201 N.W. 65th Place
Ft. Lauderdale, FL 33309
Fax: (305) 974-8531
1-800-331-7766

Circle 162 on Reader Service Card
(RESELLERS: 163)

QUARTERHORSE

High Capacity
Tape Subsystems

for Disk Backup, Data Acquisition, and Archiving
on IBM PC/XT/AT & PS/2

Everything you need in a single high quality package: Drive, SCSI Host Adapter, Enclosure, and DSI's Backup Software.

- 150 Mb 1/4" CT.....\$1,395.
- 320 Mb 1/4" CT.....\$1,495.
- 1.2 Gb 4mm DAT.....\$3,195.
- 2.3 Gb 8mm HS.....\$3,695.

Optional Application Interface Library (in "C") available. Full Support.

DATA STRATEGIES INTERNATIONAL, INC.

9020 Capital of Tx. Hwy. Suite 570
Austin, Tx. 78759
(512) 338-4745 FAX (512) 345-1328

Circle 82 on Reader Service Card

OCR Software that works with your scanner... It is fast and accurate... It has all of the features you could ask for...

SX-OCR Reads Text

- SX-OCR will automatically "re-type" your documents, producing text files that work with your word processor
- SX-OCR handles English and foreign text, footnotes and headlines, typeset and typewritten material
- SX-OCR will automate the typing process - from simple business letters to illustrated product catalogs

SX-OCR Can Learn

- SX-OCR can be taught to read nearly everything through its trainable recognition process
- In addition, SX-OCR automatically avoids dirt, boxes, lines, logos and graphics while converting text images to ASCII files

SX-OCR Manages Graphics

- SX-OCR uniquely separates graphics from text in one scan... and remembers both.
- SX-OCR can import and export popular image formats such as PCX and TIFF

System Requirements

- PC AT with 640K RAM and 2mb available on hard disk - EMS memory can be used in place of the hard disk space to speed up the OCR process
- Compatible graphics monitor: CGA, EGA, VGA, Hercules, Wyse, Genius, and others
- Available on 5 1/4" Diskettes, 3 1/2" Diskettes available on request
- SX-OCR works directly with the following scanners: Canon, HP, Microtek, Panasonic, Ricoh, Umak, Chinon, Zsoft, Princeton, Abaton, AST, Mitsubishi and others; also will work with any scanner that will make a PCN file or a bitlevel TIF file

Dealer Inquiries Invited **SX/OCR...\$395.00...shipping & handling**

Call for information 1-800-759-4001
dte Desktop Technology Corporation
900 Michigan Ave. Suite 400 • 48206-400 • Tel: 408-732-1200

Circle 88 on Reader Service Card

UNIVERSAL/GANG PROGRAMMER

made in U.S.A.

\$695.00 includes One Year Update and Warranty



HUSKY programs EE/EPROMS, CMOS PLDS, and Micros. It's your best bet when low cost and quality are both important.

From the people who make CUPL and ALLPRO

LOGICAL DEVICES, INC.
1201 N.W. 65th Place
Ft. Lauderdale, FL 33309
FAX: (305) 974-8531
1-800-331-7766

Circle 164 on Reader Service Card
(RESELLERS: 165)

Laser Printers Memory Upgrades

Model	1MB	2MB	4MB
HP III/III	CALL	\$185	\$255
HP II/II	CALL	\$185	\$255
IBM 4019	\$225	\$295	\$395

Memory Modules - SIMM/SIP

Model	Price
PS/2 2MB X 36 - 80ns	\$195.00
PC/AT 4MB X 9 - 80 ns	\$425.00
1MB X 9 - 70/80/100 ns	Call/571/568
256K X 9 - 70/80/100 ns	Call/519/518

SUN Systems
1MB X 9 - 80ns\$425.00 1MB X 9 - 80ns\$71

Macrotron Systems, Inc.
Tel (415) 651 - 9115
4011 Clipper Ct. Fremont, CA 94538
Prices subject to change w/o notice. Fax (415) 651-6922

Circle 166 on Reader Service Card



“Parlez-vous Q-TEL™?”

Oui...Si...Ja...now the answer

is Yes *wherever* you go internationally—thanks to our *new* Q-TEL International Database.

Q-TEL speaks everyone's language when you're talking about *one single source* of tele-communications rate, tariff and regulatory information. Domestically, you've already seen how our Q-TEL Databases (Q-TEL 1000, Q-TEL 5000 Plus, Q-TEL 7000 and Q-TEL 9000) can define a better bottom line for you. Now watch how the newest Q-TEL database translates into maximum cost savings for you internationally.

All our Q-TEL products have superior performance packaging, adapting easily to your applications with the most current and accurate rate, tariff and regulatory information to keep you updated and on top of industry activity.

So why not parlay our advanced telecommunications capabilities into a unique profit opportunity for you. Remember, whatever your role in telecommunications—manufacturer, seller, user of equipment or services—you also get our 20 years of telecommunications experience, backed by the information network of McGraw-Hill. Parlez with us today... Call: 1-800-526-5307 ext.: 290



CCMI First-Rate Information



714 855-0411

FAX 714 855-8504

ALR • APPLE • AST • AT&T • COMPAQ • DELL •

EVEREX • HP • IBM • NEC • SUN • TOSH

ESTABLISHED 1985
VISA MASTERCARD SAME DAY SHIPPING

LOW, LOW PRICES
CORPORATE & SCHOOL P.O.S. WELCOME OAC

DYNAMIC ELECTRONICS

SIMM AND SIPP MODULES

256 x 9-10
1 MEG x 8-10 (MAC)
1 MEG x 9-10
1 MEG x 9-80

ORCHID BOARDS

(FOR ALL PS/2'S)
RAMQUEST EXTRA 16/32
2 MEG

NEW PRODESIGNERII W/1 MEG **NEW**

INTEL MATH COPROCESSORS

8087 -1,2
80287 -6, 8, 10 **NEW** 80287XL
80387 -16, 20, 25, 33 80287XL T
80387-SX

BOCA RESEARCH

BOCARAM/AT PLUS
2 MEG \$345.00
4 MEG \$425.00
BOCARAM/AT
512 \$189.00
2 MEG \$329.00
BOCARAM/AT 10 PLUS
2 MEG \$370.00
4 MEG \$470.00

\$19.50
\$55.00
\$60.00
\$63.00

\$519.00
\$345.00

NEW

\$345.00
\$425.00
\$189.00
\$329.00
\$370.00
\$470.00

IBM PS/2 MODEL 70 & 80

6450603 1 MEG-80NS \$99.00
6450604 2 MEG/70-E61, 121 \$199.00
6450608 2 MEG/70-A21 \$199.00
6450379 2 MEG/80-111, 311 \$279.00
30F2933 4 MEG \$875.00

COMPAQ MEMORY

1 MEG ADD-ON MODULE \$129.00
DESKPRO 386/20, 25
4 MEG ADD-ON MODULE \$349.00
DESKPRO 386/20, 20E, 25

H.P. LASER JET UPGRADES

II & IID
1 MEG \$104.00
2 MEG \$169.00
4 MEG \$309.00

IIP & III

1 MEG \$119.00
2 MEG \$189.00
4 MEG \$329.00

LAPTOP MEMORY

5 12K FOR TOSHIBA T3100E \$149.00
2 MG FOR TOSHIBA T1600 \$279.00
2 MG FOR TOSHIBA T3100E \$279.00
2 MG FOR TOSHIBA T3100SX \$279.00
2 MG FOR TOSHIBA T3200SX \$279.00
2 MG FOR TOSHIBA T5100 \$279.00
2 MG FOR TOSHIBA 15200 \$279.00
3 MG FOR TOSHIBA T3200 \$479.00

714 855-0411

DYNAMIC ELECTRONICS, INC.

FAX 714 855-8504

Distributing Computer Upgrades Worldwide
PRICES SUBJECT TO CHANGE

Up to date. Down to earth.

Changing the world. UNIX is changing the world of computers, the world of business—quite simply, changing the world. It's revolutionizing office automation. It's required for U.S. government computer contracts. It's the backbone of information strategies worldwide.

The information you need. That's why you need *UNIXWORLD*—the magazine that keeps you up to date on the rapidly changing world of opensystems computing. Each issue brings you the latest product trends and technical advances that can affect your business. The inside story on some of the world's

biggest high-tech companies. Easy-to-understand programming tips and tutorials that can help you and your company use UNIX to its fullest. And unbiased hardware and software reviews to help you invest wisely when you buy.

The whole UNIX-verse.

UNIXWORLD's in-depth features go beyond dry technical facts, to show how the pieces fit together—to tell you what's important about the advances and the strategies that are changing your world. And *UNIXWORLD* consistently offers the freshest, most down-to-earth writing you'll find in any computer publication.

Subscribe and Save. Subscribe today, and receive the next 12 issues of *UNIXWORLD* for just half the regular newsstand price. Save even more by ordering for two or three years. You can't lose—every subscription to *UNIXWORLD* comes with a no-risk guarantee.*

1 year \$18.00 (save 50%)
2 years \$32.00 (save 55%)
3 years \$42.00 (save 60%)

**Subscribe now! Call toll-free:
1-800-341-1522**

UNIXWORLD

If you're into UNIX, you need *UNIXWORLD* MAGAZINE.

UNIX® is a registered trademark of AT&T. UNIX WORLD is not affiliated with AT&T.
*UNIX WORLD's no-risk guarantee: If not satisfied, cancel and receive a full refund for the balance of your subscription.
A McGraw-Hill publication

World Radio History



TOSHIBA LAPTOPS

Call for low monthly payments

MONTHLY PAYMENTS		
TOSHIBA T1000	\$599	\$23/mo
T1000 SE Notebook		\$CALL
T1000 XE/1200 XE Notebook		\$CALL
T1200 HB 20MB	\$1599	\$58/mo
T1600 286 20MB	\$2399	\$64/mo
T1600 286 40MB	\$2585	\$69/mo
T1600 X 40MB		\$CALL
T3100 E 286 40MB	\$3585	\$96/mo
T3100 SX 40MB/80MB	\$3585	\$CALL
T3200 SX 40MB		\$CALL
T5100 386 100MB	\$4199	\$112/mo
T5200 386 40MB	\$4479	\$119/mo
T5200 386 100MB	\$4879	\$130/mo

LEADING EDGE LAPTOPS

386SX with 20MB	\$1995	\$52/mo
386SX with 40MB	\$2095	\$57/mo

LAPTOPS TEXAS INSTR.

TI 12 286 20MB Notebk	\$1895	\$51/mo
TI 25/45 286 Notebook	\$2249/2349	\$65/63/mo
Notebook 286 20MB VGA-4lbs		\$CALL

ZENITH LAPTOPS

Minisport NOTEBOOK	\$Call
Supersport 184-2	\$1695
Supersport 286 20MB	\$2499
Supersport 286 40MB	\$2699
Supersport 286E 20/40MB	\$Call
386SX 40MB	\$3899

NEC LAPTOPS

Ultralite 2MB NOTE BOOK	\$Call	
Prospeed 286 20MB	\$2379	\$64/mo
Prospeed 286 40MB	\$2595	\$70/mo
Prospeed 386SX	\$Call	
Prospeed 386 40MB	\$3499	\$92/mo

MITSUBISHI

MP 286-210 2 FD	\$1265	\$35/mo
MP 286-220 1 FD, 20MB	\$1639	\$45/mo
MP 286-240 1 FD, 40MB	\$2139	\$58/mo

COMPAQ LAPTOPS

LTE 20MB	\$2139	\$58/mo
LTE 286 20MB	\$2999	\$80/mo
LTE 286 40MB	\$3250	\$87/mo
COMPAQ SLT 20MB	\$Call	
COMPAQ SLT 40MB	\$LOW	
SLT 386SX VGA	\$Call	

EPSON LAPTOPS

286E 20MB removable	\$2495	\$66/mo
286E 40MB removable	\$2695	\$72/mo
386SX 20MB removable	\$3159	\$84/mo
386SX 40MB removable	\$3599	\$88/mo

GOLDSTAR

G5500 286 20MB	\$1495	\$40/mo
G5520 386SX VGA	\$Call	

MORE LAPTOPS

FORA 386SX with 40MB VGA	\$2395	
PACKARD BELL 286-VGA20	\$1995	
Aris NOTEBOOK	\$Call	
PSION	\$Call	
Bondwell B200 2 floppys	\$795	
Bondwell 310: 286 40MB	\$1695	
Panasonic CF 150 B Notebk	\$599	\$23/mo

AD 900BT

800-383-3199

orders only

714-898-8626

customer service/foreign orders

FAX: 714-891-1202

BACKLIT NOTEBOOK

* 9.5 Mhz-20MB \$1295

only 6lbs \$34/mo

POQET \$Call

ATARI Portfolio

\$379-\$15/mo

POCKET COMPUTERS

SHARP MZ-200 2 floppy \$

* MZ 250 1 floppy, 20MB \$\$

* MINI LAPTOP

SHARP 4741 MiniLaptop

* 8088-10Mhz

* 40MB hard drive

\$LOW\$

* 3.5" 1.44MB floppy drive

* 640x400 res backlit screen



FAX \$15 / mo



TOSHIBA	
T1000/286	\$249
T1000/1200 SE/XE	
1MB/2MB Call/\$299	
T1600/3100/3200/5200 2MB	\$295

ZENITH	
1MB/4MB \$199/Call	
2386-20/25/33	
1MB \$145	
2MB \$249	
4MB \$649	
Z386SX 2MB	\$159

COMPAQ	
LTE 286	\$199
1MB/2MB \$295/475	
DeskPro 286-20/20E/25/286-E	
1MB/4MB \$165/440	
DeskPro 386S	
1MB/4MB \$165/495	
DeskPro 386/33 2MB	\$295

IBM PS/2	
Model 30/50/70	
512K/2MB \$75/225	
Model 70-E61/121	
1MB \$125	
Model 70 A-21	\$245
2MB \$245	
Model 80 141	\$199
Model 80 111/211	
2MB \$299	
4019 Laser 1MB/\$299	

HP LaserJet	
HP II/III	
1MB/2MB \$145/209	
HP II/III	
1MB/2MB \$145/245	

MATH COs	
80287-8	\$125
80287-10	\$195
80287-12	\$204
80387-16	\$269
80387-20	\$295
80387-25	\$389
80387-33	\$455

EPSON FAX	
F2000	\$550
F3000	\$699
FAX phone 8	\$449
FAX phone 15	\$419
FAX phone 20	\$629
FAX phone 23	\$749
FAX phone 25	\$929
FAX phone 35	\$865
Fax 222	\$1149
Fax 270	\$1495
Fax 350	\$1595
Fax 450	\$1845
Fax 630	\$1995
Fax 705	\$2479
Fax 850	\$3089

PANASONIC	
KXF 100 Portable	\$539
KXF 100	\$585
KXF 120	\$749
KXF 220	\$1045
KXF 320	\$1335
KXF 50	\$CALL
KXF 90	\$CALL
KX 110	\$CALL

PANAFAX	
UF 150	\$645
UF 170	\$925
PDE 120E	\$495
PDE 160E	\$679
PDE 170E	\$979

MURATA	
M1900	\$395
M1400	\$528
M1800	\$568
M1850	\$698
F25	\$769
F37	\$849
F40	\$1110
F45	\$1299
Guls 110/220v	\$499
Samsung 1010	\$399

TOSHIBA	
T3600	\$659
T3750	\$748
RF810	\$359
RF860	\$625
RF910	\$725
RF920	\$845
Fax 15	\$715
Fax 25	\$1039
Fax 35	\$1099
Fax 80	\$1205
Fax 95	\$1795
Fax 105	\$1819
Fax 1010	\$2799
Fax 1000L	\$3095

SHARP	
FO 215	\$589
FO 230	\$599
FO 333	\$699
FO 510	\$859
FO 550	\$1299
FO 750	\$1599
FO 800	\$1995
FO 5200	\$2499
UX 110	\$479
UX 181	\$639
Audiovox 110/220v	
AF2000	\$499

FAX CARDS	
Quartz 21 9600	\$299
Hayes JT 9600	\$459
9600 FAX + 2400	
Modem card	\$299
Complete	
PC 9600	\$394
9600 Fax card	\$184

MODEMS	
2400 int	\$69
2400 ext	\$Call
9600 int	\$395
9600 ext	\$Call
IBM PS/2 9600	\$Call

T.P.C. TELEPHONE PRODUCT CENTER

100% FINANCING No money down OAC

SHARP LAPTOPS



CALL FOR NEW LOW PRICES !!!

SHARP NOTEBOOK

PC 6220: 286 with 20 MB & VGA

* 8.5"x11"x1.4" - 4lbs

\$Call

SHARP 386 Color VGA \$185/mo

* PC 8081 with 80MB

SHARP 5541 286 40MB VGA \$2295

\$95/mo

SHARP 5741

\$Call

* 386SX-40MB

Back lit VGA screen-Mini Laptop

FINANCE \$51/mo

DESKTOP

386-20 GOLDSTAR

\$1895

40MB drive, VGA

386SX-16Mhz

\$999

1MB RAM, 1 5/4" 1.2MB floppy drive,

1:1 interleave controller, 40MB HD

MAGNAVOX \$16/mo \$399

8 Mhz IBM XT compatible, 768K RAM,

1 5/4" 360KB FD, Color/mono card

386-33Mhz 40MB mono \$1895

486-25Mhz - Call for configuration

IBM PS/2

Model 25 Mono/color \$975/1229

IBM 8530-286 20MB/30MB \$1695/1895

IBM 8555 SX-30MB \$2695

IBM 8555 SX-60MB \$3025

IBM 8560 286 44MB \$3175

IBM 8571E61/O61 \$3495/3895

IBM 8570 A61 \$5845

Portable 70 60MB/120MB \$Call

IBM 8570-121 20Mhz 386 \$4450

IBM 8570-A21 25Mhz 386 \$6195

8580-041 16Mhz 386, 40MB \$4195

8580-111 20Mhz 386, 115MB \$5795

COMPAQ

Deskpro 286E 20MB/40MB \$2099/2399

Deskpro 386S \$Call

Deskpro 386/20E 40MB \$4275

Deskpro 386/20E110MB \$4799

Deskpro 386/25E 84MB \$5495

Deskpro 386/25E 110MB \$6195

Deskpro 386/25E 300MB \$8495

Deskpro 386/33 84MB \$7245

Model 486/25N

120MB/320MB/650MB \$CALL

Portable III 20MB/40MB \$3395/3998

Portable 386 40MB/100MB \$4799/5599

APPLE MACINTOSH

Portable \$3899

Mac SE 30/40MB \$2950

Mac IIX 40MB \$4150

T.P.C. 12603 Hoover St., Garden Grove, CA 92641

Circle 291 on Reader Service Card

Terms: These are pre-payment prices discounted 2.9% for cash. Discover, VISA/MC/COD are not considered pre-payment. Restocking 20%. We accept Cashiers Checks. We check for stolen credit cards. Prices and availability subject to change, all sales are final. Defective items repaired in warranty. A \$5.95 handling charge will be added to all orders. NO RETURNS. Monthly financing payments are approximations only.

World Radio History

CALL FOR LOW \$ \$ MONTHLY PAYMENTS

**Write COBOL Applications
for DOS, UNIX, VMS, Novell
and BOS with one compiler.**

- Multi-user
- DBMS Tools
- Screen Builder
- Report Writer
- Text Editor
- Debugger
- Multi-platform
- Transportable Object
- Subroutine Library
- Utility Toolkit
- Terminal-independent
- Many more features

Call or write for complete information.

BOS National, Inc.
2607 Walnut Hill Lane
Dallas, TX 75229
(214) 956-7722



Special Offer
Available
Now!

Money-Back
Guarantee

Circle 46 on Reader Service Card

IEEE 488

**Easiest to use,
GUARANTEED!**

- IBM PC, PS/2, Macintosh, HP, Sun, DEC
- IEEE device drivers for DOS, UNIX, Lotus 1-2-3, VMS, XENIX & Macintosh
- Menu or icon driven acquisition software
- IEEE analyzers, expanders, extenders, buffers
- Analog I/O, digital I/O, RS-232, RS-422, SCSI, modem & Centronics converters to IEEE 488

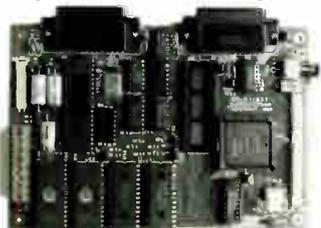
Free Catalog & Demo Disks
(216) 439-4091



25971 Cannon Rd. • Cleveland, OH 44146

Circle 150 on Reader Service Card

**8051, 8096, 68HC11, 68008
SINGLE BOARD COMPUTERS**



We feature a series of single board computers for process control applications. Available as bare boards or assembled and tested. Optional EPROM resident System Monitors and BASIC interpreters are also available.

ALLEN SYSTEMS
2346 Brandon Road
Columbus, Ohio 43221
614-488-7122

**9-Track Tape Subsystem
for the IBM PC/XT/AT**



Now you can exchange data files between your IBM PC and any mainframe or mini-computer using IBM compatible 1600 or 6250 BPI 9-track tape. System can also be used for disk backup. Transfer rate is up to 4 megabytes per minute on PCs and compatibles. Subsystems include 7" or 10 1/2" streaming tape drive, tape coupler card and DOS compatible software. For more information, call us today!



9621 Irontdale Ave., Chatsworth, CA 91311
Telephone: (818) 882-5822

Circle 246 on Reader Service Card

SAME DAY SHIPPING

R & R Electronics

6050-X, McDonough Drive, Norcross, GA 30093
(404) 368-1777 • Fax (404) 368-9659
Prices subject to change without notice

SIMMs

PS/2, AST etc. Call	256Kx9-80	\$22
1Mx9-70	256Kx9-100	\$20
1Mx9-80	1Mx8-80	\$69
1Mx9-100	Other Cards	Call

D-RAMS

256K-70	\$2.50	64x1-100	\$1.90
256K-80	\$2.30	64x4-100	\$3.00
256K-100	\$2.20	256x4-100	\$7.50
256K-120	\$2.10	1Mx1-80	\$7.25
256K-150	\$2.00	1Mx1-100	\$7.00

INTEL - IIT - CYRIX - WEITEK

8087	\$ 88	80287-12	\$275
8087-2	\$115	80387-SX	\$288
8087-1	\$165	80387-16	\$315
80287-6	\$135	80387-20	\$355
80287-8	\$185	80387-25	\$445
80287-10	\$210	80387-33	\$548

800-736-3644

Circle 251 on Reader Service Card

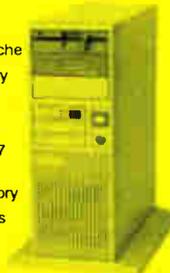
PCS 486 WORKSTATION

FAST! Landmark 155 MHz
Norton SI 101
Power Meter 15.2 MIPS

- Intel 80486 25/33 MHz processor
- 8K internal/64K ext. cache
- 4 Mbytes basic memory
- 1.2 Mbyte 5 1/4" floppy

Options:

- 25/33 MHz Weitek 4167 co-processor
- Up to 16 Mbytes memory
- Hard disk—100 Mbytes to 1 GByte
- Removable hard disk
- Non-stop power supply



PROFESSIONAL COMPUTER SYSTEMS (408) 263-0222
550 Valley Way, Milpitas, CA 95035

Circle 226 on Reader Service Card

Circle 95 on Reader Service Card



3 1/2" DS
6⁹⁵
per box

3 1/2" HD
15⁹⁵
per box

5 1/4" DS
3⁹⁵
per box

5 1/4" HD
6⁵⁰
per box



Authorized Distributor: Magnetic Media Division

5 1/4" DD
5⁹⁵
PER BOX

5 1/4" HD
10⁹⁵
PER BOX

3 1/2" DS
8⁹⁵
PER BOX

3 1/2" HD
17⁹⁵
PER BOX

**Canon
LBP-4
LASER BEAM PRINTER**

OUR PRICE IS SO LOW THAT THE MANUFACTURER WOULD BE VERY UPSET IF WE WERE TO PUBLISH IT. SO WE CAN ONLY SAY "THE PRICE IS LOW & INCLUDES ONE TONER CARTRIDGE & UPS TWO DAY AIR DELIVERY"

CALL FOR PRICE



NORTHEAST & CANADA

1-800-451-1849

PO BOX 10247, WILMINGTON, DE 19850

SOUTHEAST

1-800-940-4600

PO BOX 4183, DERRFIELD BEACH, FL 33442

MIDWEST

1-800-654-4058

PO BOX 1674, BETHANY, OK 73008

WEST - HAWAII & ALASKA

1-800-621-6221

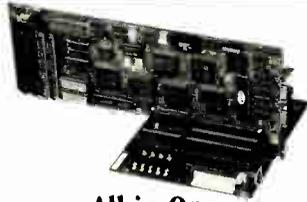
PO BOX 12396, LAS VEGAS, NV 89112

Minimum Order \$20.00 NO SURCHARGE on VISA / MC
COD orders add \$3.50 Shipping charges determined by items and delivery method required by customer.
(Prices are subject to change without notice)

FAX (405) 495-4598



PC-LabCard



All-in-One

80286-12MHz CPU Card

PCA-6125

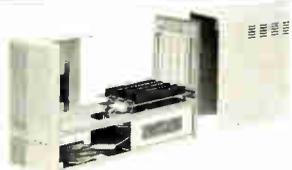
- 12MHz 80286 microprocessor
- Socketed for 80287 math coprocessor
- Popular AMI BIOS assures compatibility
- Up to 4 Mb flexible memory configuration
- Built-in HD/FD interface
- Supports 2 serial/1 parallel ports
- VLSI CMOS for low power consumption

For Your Catalog Call
408-293-6786



Circle 20 on Reader Service Card

PC-LabCard



Compact & Rugged Chassis for PC-Bus Node Computer

PCXU-205

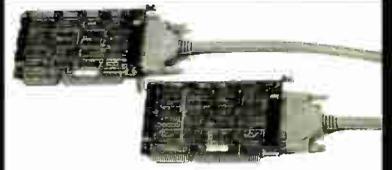
- Passive backplane with 5 AT slots
- Built-in 65 watt power supply
- Supports one 3.5" or 5.25" floppy drive
- Supports one 3.5" hard disk
- Built-in 8 ohm speaker and cooling fan
- Dimensions 4.76" x 15.85" x 9.7"
- Low cost and easy-to-use

For Your Catalog Call
408-293-6786



Circle 20 on Reader Service Card

PC-LabCard



PC Bus Extension Kit for XT's & AT's

PCX-795

- Excellent solution for PC running out of slots
- Bus extender between host PC and expansion unit
- All signals buffered on extended slots
- Supports DMA and wait-state insertion
- Cable assembly for one meter extension

Advantech

USA & Canada: San Jose, CA
Tel: 408-293-6786 Fax: 408-293-4697
International: Taipei, Taiwan
Tel: 886-2-9184567 Fax: 886-2-9184566



Circle 20 on Reader Service Card



(CHOOSE FROM—Blue, Orange, Green, Red, Yellow, Gray, White, & Black—DS/DD, 800K)

SONY Boxes of 10 - 3.5" DD & HD
DD 1MB ... \$ 8.95/Box HD 2MB ... \$ 16.96/Box

3M Boxes of 10 - 5.25" DD & HD
DD 360K ... \$ 6.50/Box HD 1.2MB ... \$ 11.50/Box

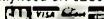
3M DATA CARTRIDGES (Min. 2 each)
● DC-2000... \$ 15.95 ● DC-2120... \$ 24.95
● DC-2080 ... 20.95 ● DC-600A ... 20.95
● DC-6150 ... 22.95 ● DC-6250 ... 28.95

— CALL FOR LARGE QUANTITY DISCOUNTS —

ZOOM 4800bd SecoFax/Modem Internal... \$ 119.
External ... \$ 129. (Cable: \$9.95 Spec. XT/AT)

AMERICAN GROUP

800-288-8025
12132 Sherman Way, N. Hollywood CA 91605
CALL OR MAIL



Circle 19 on Reader Service Card

Cross-Assemblers as low as \$50.00 Simulators as low as \$100.00 Cross-Disassemblers as low as \$100.00 Developer Packages as low as \$200.00 (a \$50.00 Savings)

A New Project
Our line of macro Cross-assemblers are easy to use and full featured. Including conditional assembly and unlimited include files.

Get It To Market—FAST
Don't wait until the hardware is finished to debug your software. Our Simulators can test your program logic before the hardware is built.

No Source
A minor glitch has shown up in the firmware, and you can't find the original source program. Our line of disassemblers can help you re-create the original assembly language source.

Set To Go
Buy our developer package and the next time your boss says "Get to work!", you'll be ready for anything.

Quality Solutions
PseudoCorp has been providing quality solutions for microprocessor problems since 1965.

BROAD RANGE OF SUPPORT
e Currently we support the following microprocessor families (with more in development):

Intel 8048	Intel 8020/05	Intel 8051	Intel 8096
Motorola 6800	Motorola 6801	Motorola 68HC11	Motorola 6805
Hitachi 6301	Motorola 6809	MOS Tech 6502	WDC 65C02
Rockwell 65C02	Intel 8080/85	Zilog Z80	NSC 800
Hitachi HD64180	Motorola 68000/8	Motorola 68010	Intel 80C196

e All products require an IBM PC or compatible.

So What Are You Waiting For? Call us:
PseudoCorp
Professional Development Products Group
716 Thimble Shoals Blvd, Suite E
Newport News, VA 23606

(804) 873-1947 FAX: (804)873-2154

Circle 234 on Reader Service Card

**X.25 SDLC
QLLC HDLC
ADCCP PAD**

- C source code
- ROM-able
- Full porting provided
- No OS required

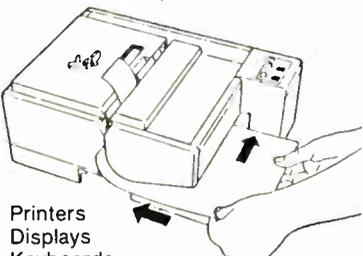


GCOM, Inc.
41 E. University
Champaign IL 61820
(217) 352-4266

Specialists in Computer Communications
FAX 217-352-2215

Circle 124 on Reader Service Card

POS-EQUIPMENT



- Printers
- Displays
- Keyboards
- Scanners
- Drawers

Applications for
MS-DOS/UNIX

dietrich SINCE 1928

Zähringer Straße 326
D-7800 FREIBURG/Germany
Phone 49-761-54915
FAX 49-761-56881

Circle 89 on Reader Service Card

Real Time Waveform Display.

- Only CODAS waveform recording systems offer true real time waveform display.
- For IBM AT, PS/2 Micro Channel*, and compatibles.
- Record up to 16 waveforms to disk in real time at up to 50,000 samples per second for instant playback, analysis, and manipulation.
- Includes all necessary hardware and software for fast, turnkey startup.
- Includes Microsoft C-compatible library of function calls for customization.

For a FREE Evaluation Package, call:
1-800-553-9006. In Ohio, 1-216-434-4284.

DATAQ INSTRUMENTS, INC.
825 Sweitzer Ave., Akron, OH 44311
*IBM, AT, PS/2, and Micro Channel are trademarks or registered trademarks of IBM Corp. Microsoft C is a trademark of Microsoft Corp.

Circle 84 on Reader Service Card

Advertise your computer products through
BYTE BITS
(2" x 3" ads)

For more information call Mark Stone at
603-924-6830

BYTE

One Phoenix Mill Lane
Peterborough, NH 03458

Circle 49 on Reader Service Card

14 YEAR GUARANTEE

Since 1976...Low Prices,
Full Service, Satisfaction or
Your Money Back!

JADE COMPUTER

Ultra 486

\$3698

Double The Power,
Twice The Speed

- Monitor Optional
- True 25 MHz, 80486 CPU
 - 1 MB of 32 BIT RAM
 - Expands to 8+ B MB
 - Built-in High Speed Cache
 - 100% Novell & IBM Compatible
 - 1.2 MB 5 1/4" Disk Drive
 - Fast 1:1 Interleave Dual Hard
 - Disk/Dual Floppy Disk Controller
 - Wetek 3167 FPP Socket

Landmark—113.4 MHz
Power Meter—11.03 MIPS

- Full Size Professional Case
- 101 Key Enhanced Keyboard
- 200 Watt Power Supply
- Built-in Clock/Calendar
- Assembled & Tested in U.S.A.
- One Year Warranty

Monitor & Hard Drive Options

40 MB System	80 MB System	600 MB System
Complete Monographics System	Complete Monographics System	Complete Monographics System
\$4198	\$4298	\$6698
Complete VGA System	Complete VGA System	Complete VGA System
\$4498	\$4698	\$6998

JADE COMPUTER

PRO-286

12 MHz

\$698

Monitor Optional



—286 POWERHOUSE—

- 80286 processor running at 12 MHz or 20 MHz*
- Zero wait state
- 1 Megabyte or RAM
- 1.2 MB or 1.44 MB drive
- Hard/floppy controller
- Six 16 Bit & Two B Bit expansion slots
- 102 key enhanced keyboard
- 200 watt power supply
- 80287 socket
- Clock/Calendar
- Norton S.I. 13.7/20.3*
- Landmark 16/25.9*
- One Year Warranty

Monitor & Hard Drive Options (12 MHz)

Floppy Only	40 Megabyte	80 Megabyte
Complete Monographics System	Complete Monographics System	Complete Monographics System
\$798	\$1098	\$1398
Complete VGA System	Complete VGA System	Complete VGA System
\$1098	\$1398	\$1698

*For 20 MHz System Add \$298

JADE COMPUTER

Super-386

16 MHz (SX)

\$898

Monitor Optional



20 MHz	25 MHz
\$1298	\$1398
25 MHz Cache	33 MHz Cache
\$1798	\$1998

—FIRE BREATHING 386—

- 80386 processor running at 16 MHz (SX), 20 MHz, 25 MHz or 33 MHz
- 1 MB RAM expands to 4 MB
- 384K Shadow RAM
- 1.2 MB or 1.44 MB Drive
- 1:1 Interleave Hard Disk/Floppy Disk Controller
- 80387 Socket
- Full size case
- One 32 Bit, Five 16-Bit or Two 8 Bit slots
- 102 Key enhanced keyboard
- 200 watt power supply
- Clock/Calendar
- Norton S.I. 18/23/31.6/31.6
- Landmark 21/25.5/32.6/43.5

Monitor & Hard Drive Options (16 MHz SX)

Floppy Only	40 Megabyte	80 Megabyte
Complete Monographics System	Complete Monographics System	Complete Monographics System
\$998	\$1398	\$1598
Complete VGA System	Complete VGA System	Complete VGA System
\$1358	\$1698	\$1898

For 20 MHz add \$398 For 25 MHz Cache add \$998
For 25 MHz add \$498 For 33 MHz Cache add \$1198

EPSON

- LX-810 ...\$178
- FX-850 ...Call
- FX-1050 ...Call
- LQ 510 ...\$289
- LQ 850 ...Call
- LQ-950 ...Call
- LQ 1010 ...Call
- LQ-1050 ...Call
- LQ 2550 ...Call

Panasonic

- KX-1180 ...\$169
- KX-1191 ...\$238
- KX-1124 ...\$289
- KX-1624 ...\$428



EPL-6000 Laser Printer...Call

HEWLETT PACKARD

- New LaserJet IIP\$998
- H.P. LaserJet III\$1698
- H.P. DeskJet Plus\$698
- H.P. DeskWriter/For Mac\$848
- Extra Toner\$98
- Extra Ink Cartridge\$19

Tripplete Battery Back-up

- 450 Watt UPS\$398
- 750 Watt UPS\$498
- 1200 Watt UPS\$698

3 1/2" Disk Drives

- 720K internal/external\$78/178
- 1.44 MB internal/external ..\$88/\$188

Tripplete Line Stabilizer

- 600 Watt Line Conditioner\$98
- 1200 Watt Line Conditioner\$158
- 1800 Watt Line Conditioner\$188

No Surcharge
for Credit Cards!



California

Torrance, Costa Mesa, Woodland Hills
Kearny Mesa, Sunnyvale

Texas Georgia Arizona
Addison, Houston Smyrna Phoenix

Not all items in stock at our nine retail locations.



- | | |
|--------------------|------------------|
| 8087\$88 | 80287-12 ..\$278 |
| 8087-2\$118 | 80387-SX ..\$318 |
| 8087-1\$158 | 80387-16 ..\$348 |
| 80287\$128 | 80387-20 ..\$388 |
| 80287-8\$198 | 80387-25 ..\$488 |
| 80287-10 ..\$228 | 80387-33 ..\$598 |
| 80287 XL ..\$228 | |

ITT Co-Processors

- | | |
|-------------------|-------------------|
| 2C87-8\$198 | 2C87-12\$268 |
| 2C87-10\$228 | 2C87-20\$328 |

VGA Package

Card **\$148**

Monitor **\$298**



640 x 480
Hi Res Card

Accessories for Your

HEWLETT PACKARD

- Pacific Page PostScript LJ IIP/III\$398
- Pacific Page PostScript LJ II\$498
- PDP 25 in 1 (172 Fonts) LJ II/IIP\$278
- PDP 25 in 1 (172 Fonts) LJ III\$398
- PDP Plotter in a Cartridge IIP/II/III\$248

4 MB Memory Card for LJ II/III

Without RAM\$98	2 MB\$298
1 MB\$198	4 MB\$498

New! Memory Card for LJ IIP/III

Without RAM\$148	2 MB\$298
1 MB\$198	4 MB\$498

Microsoft DOS

3.3 — \$78
4.01 — \$88

2400 Baud Internal Modem w/Software \$74

- 1200 internal w/software\$44
- 1200 baud external\$88
- 2400 baud external\$128
- 2400 PS/2 internal\$198

Roland Plotters

- DXY-1100\$798
- All Roland Models Available

JADE COMPUTER

Technicon 5102

Printer **\$128**

- 120 CPS, 9 PIN Printer
- Near Letter Quality Printing - Four Print Styles
- EPSON/IBM Compatible
- International Character Set
- One Year Warranty

Tape Back-up

- 40 MB Internal\$268
- 150 MB Internal\$628
- 250 MB Internal\$728
- For External Add\$128

Trackballs

- Logitech Trackman Serial\$98
- Logitech Trackman BUS\$108
- MicroSpeed PC-Trac Serial\$88
- MicroSpeed PC-Trac BUS\$98
- MicroSpeed FastTrap Serial\$108
- MicroSpeed FastTrap BUS\$118

Panasonic VGA

PanaSync Monitor
1024 x 768
14" .28 Dot Pitch
\$468

Logitech

- LogiMouse Hi-Rez. Bus\$88
- LogiMouse Hi-Rez. Serial\$98

Microsoft BUS Mouse

200 DPI
w/Drivers Software
\$48

Scanner

- Diamond Flower HS-3000 Plus ..\$198
- OCR Software for HS-3000\$88

Keyboard

- 102 enhanced click\$68
- Keyboard Drawer\$34

JADE COMPUTER

4901 W. Rosecrans Ave. Box 5046, Hawthorne, California 90251-5046 213-973-7707

Continental U.S.A. 1-800-421-5500 Inside California 1-800-262-1710



10 Day Money Back Guarantee

We accept checks, credit cards (or purchase orders from qualified firms and institutions.) No surcharge on credit card orders. CA, TX, GA, & AZ. residents add sales tax. Prices and availability subject to change without notice. \$4.00 minimum shipping and handling charge.

OVER \$2 MILLION DOLLARS WORTH
OF INVENTORY DROPPED IN OUR LAP
TO SELL TO YOU AT WHOLESALE PRICES



SUPREME

2014 McCULLOCH BOULEVARD, SUITE A
LAKE HAVASU CITY, ARIZONA 86403
(602) 453-9555 • 1-800-752-6016 • Fax (602) 453-9379

FIVE YEAR WARRANTY
ON ALL SPREE SYSTEMS

SPREE COMPUTERS

PLEASE CALL ON
SPECIAL CONFIGURATION

286-12 MHZ

80286 12 MHZ AT
1 MEG MEMORY
1.2 or 1.44 FLOPPY DRIVE
40 MEG HARD DISK
101 KEYBOARD w/TRACKBALL
VGA MONITOR & CARD w/256K
TWO SERIAL PORTS
ONE PARALLEL
\$1499



386-20 MHZ

80386 20 MHZ AT
1 MEG MEMORY
1.2 or 1.44 FLOPPY DRIVE
40 MEG HARD DISK
101 KEYBOARD w/TRACKBALL
VGA MONITOR & CARD w/256K
TWO SERIAL PORTS
ONE PARALLEL PORT
25 MHZ AVAIL-
ABLE CALL **\$1899**

- All Seagates Available -
CALL FOR PRICING



MFM DRIVES DRIVE		Drive Only	XT Kit
ST225	65MS 21MEG	\$199.	\$239.
ST125	28MS 21MEG	\$229.	\$279.
ST138	28MS 32MEG	\$279.	\$329.
ST251-1	28MS 42MEG	\$329.	\$389.
ST151	24MS 42MEG	\$379.	\$439.
ST4096	28MS 80MEG	\$559.	\$609.
RLL DRIVES			
ST225R	70MS 21MEG	\$189.	\$239.
ST238R	65MS 32MEG	\$219.	\$269.
ST138R	28MS 32MEG	\$259.	\$309.
ST250R	70MS 42MEG	\$279.	\$339.
ST157R	28MS 49MEG	\$369.	\$419.
ST277R	28MS 64MEG	\$379.	\$439.
SCSI DRIVES			
ST138N	28MS 32MEG	\$349.	\$399.
ST157N	28MS 48MEG	\$439.	\$489.
ST177N	24MS 60MEG	\$559.	\$609.
ST1096N	24MS 83MEG	\$799.	\$849.

BLOW-OUT SPECIALS

DTK
BAREBONE AT (10 MHZ)
CASE • MB • P.S
\$299

(Unbelievable)
DELTA GOLD XT
(10 MHZ)
512K • 1 DRIVE • I/O CARD
MONOCHROME MONITOR & CARD
KEYBOARD • MS DOS • BASIC
\$449

Panasonic
Office Automation
PANASONIC 1124
\$289

EMERSON
MONOCHROME
CARD & MONITOR
\$109

EMERSON
VGA
MONITOR & CARD
\$399

REPLACEMENT
POWER SUPPLY
150 WATT \$39
200 WATT \$49



HAYES
COMPATIBLE
1200 INTERNAL \$39
2400 INTERNAL \$79

LAPTOP COMPUTER ACCESSORIES

TOSHIBA

T 1000	\$ 599
T 1000 SE	\$1100
T 1200 FB	\$1319
T 1200 HB	\$1799
T 1600 20 MEG	\$2999
T 1600 40 MEG	\$3359
T 3100 E 40 MEG	\$2819
T 3100 SX	\$3550
T 3200 1.44 20 MEG	\$3299
T 3200 SX	\$3779
T 5100	\$3899
T 5100 100 MEG	\$4499
T 5200 40 MEG	\$4619
T 5200 100 MEG	\$4979

ACCESSORIES

T-1000		T-3200	
AC ADAPTER T-100/1100+	42.00	CARRY CASE	99.00
2400 B MODEMS	199.00	3MB MEM. BRD.	1079.00
CARRY CASE FABRIC	39.99		
UNIV. 9 VOLT ADAPTER	CALL	T-5100	
T-1200 F/H		LEATHER CARRY CASE	299.00
2400 B MODEM	199.00	FABRIC CARRY CASE	99.00
BATTERY PACK	79.00	2MG MEM. BRD.	699.00
BATTERY RECHARGER	279.00	T-5200	
CARRY CASE	79.00	16 BIT LAN CARD	49.00
T-1000 SE		2400B EXP SLOT	179.00
BATTERY PACK	CALL	2 MB MEM. BRD.	539.00
2400 B MODEM	CALL	FABRIC CASE	99.00
UPGRADES 132 MEG	CALL	LEATHER CARRY CASE	299.00
T-1600		UNIVERSAL	
BATTERY CHARGER	279.00	LAPTOP	
LOW CAP BATTERY PACK	69.00	PARTS:	
FABRIC CARRY CASE	89.00	M.S. DOS 3.3	99.00
2400 B MODEM	199.00	LAPLINK & ALL LAPTOPS	99.00
2 MB INT. MEM. BRD.	699.00	M.S. DOS 4.01	CALL

- All prices subject to change -

PRINTERS

HP DESK JET PLUS	\$ 699
HP II P	\$ 979
HP II	\$1565
HP II D	\$2750
HP III	\$1775

MEMORY & ACC.

HP II & II D	PACIFIC DATA
1 MB	\$249
2MB	\$359
4 MB	\$599
TONER	\$ 79
HP II P	
1 MB	\$250
2 MB	\$359
TONER	\$ 59
FONTS	
POSTSCRIPTS	\$479
SPREADSHEET	\$110
25 IN ONE	\$265
PLOTTER	\$249
HEADLINE	\$749

How to Protect Your Computer



And Make It Last Longer

FREE money-making literature. What you need to know about UPS - uninterrupted power systems. How to get complete protection from power line problems. 500 VA to 18 KVA models from the world's largest manufacturer of single-phase UPS.

Best Power Technology, Inc.
P.O. Box 280, Necedah, WI 54646

Toll-Free (800) 356-5794, ext. 3869
(608) 565-7200, ext. 3869

Circle 36 on Reader Service Card

VIDEO FRAME GRABBERS



MODEL	RESOLUTION		
HRT 256-4	256 x 256 x 4	495	
HRT 256-8	256 x 256 x 8	795	
HRT 512-8	512 x 512 x 8	995	
HRT 512-24	512 x 512 x 24	1995	

- IBM PC/XT/AT COMPATIBLE
- DIGITALIZE IN REAL TIME
- COMPOSITE VIDEO IN
- 24 BIT RGB OUT except model HRT 256-4
- 16 level gray scale out
- SOFTWARE LIBRARY OF IMAGE ANALYSIS ROUTINES
- FREE SOFTWARE UPGRADES TO REGISTERED OWNERS
- FULL CREDIT ON UPGRADE PURCHASE IN FIRST YEAR RETURN OLD BOARD AND JUST PAY DIFFERENCE

HRT HIGH RES TECHNOLOGIES
P.O. BOX 76
LEWISTON, NY 14092
PHONE 416-497-6493 FAX 416-497-1988

Circle 136 on Reader Service Card

SuperSound™



Easy to Use!
SoundCard™

SoundFX™ Series Editors
IBM-PC DIGITAL VOICE / SOUND
from \$20 (play only) to \$469 (top stereo rec. / play)

Quality Software / Hardware
- in use worldwide!

- 30 Day Money-Back Guarantee if not Satisfied
- JUST LIKE HAVING A TAPE RECORDER IN A PC.
- Fastest, easiest Editors with the most features for the price.
- Quick, simple hardware / software installation.
- Use for Animal / Human communications research.
- For Business: Training, Slide Shows, Works with Grasp QB.C.
- For Engineering: Function Gen, Clear Voice Alarms, Storage Scope.
- For Fun: Control Your Own Mac like Bootup Sounds, Alter Your Voice.

Orders: 800-969-4411 by Silicon Shack FAX: 408-374-4412
5120 Campbell Ave. #112, San Jose, CA 95130.

Technical: 408-446-4521

Ask for FREE PRODUCT CATALOG of IBM-PC sound products.
Developers: Ask about TurboSound™ PC voice sound engine.

Circle 268 on Reader Service Card

386SX SYSTEM SPECIAL



- Intel 386SX Microprocessor
- 1MB RAM Expandable to 8MB
- 20MB Seagate Hard Drive
- 1.2MB or 1.44MB Floppy Drive
- 1:1 Hard & Floppy Controller
- 101 Key Extended Keyboard
- Monochrome Monitor & Adapter w/Printer Port
- Choice of Slimline, Desktop or Mini Tower(\$20 Extra) Case
- One Year Warranty

\$1,095

Same Configuration as above with	Options
286-12 \$895	VGA Color Add \$395
386-20 \$1495	40MB HD Add \$120
386-25 \$1695	80MB HD Add \$350
386-33 \$1995	Second Floppy Add \$89
	All other upgrades CALL

MOTHERBOARD SPECIAL

80286-12	0 Wait, Exp to 4MB, AMI BIOS, 0K	\$129
80386-SX	Shadow RAM, Exp to 8MB, 0K	\$319
80386-20	Norton SI=22.5, AMI BIOS, 0K	\$629
80386-25	0 Wait, AMI BIOS, Exp to 8MB, 0K	\$899
80386-33	64K Cache, 0 Wait, AMI BIOS, 0K	\$1199
Special !!	80486-25 128K Cache, 0 Wait	CALL

Avantech Solutions, Inc.
3 W. Columbia Ave.
Palisades Park, NJ 07650
(201) 941-1961

Circle 31 on Reader Service Card



of discounting
Tandy® computers,
Fax and Radio
Shack® products

Radio Shack® Tandy®

We will meet or beat...
GUARANTEED LOWEST PRICES

MARYMAC INDUSTRIES INC.
22511 Katy Fwy.
Katy (Houston), TX 77450
1-713-392-0747 FAX (713) 574-4567
Toll Free 800-231-3680

Circle 172 on Reader Service Card

PERFORMANCE LEADER

33 MHz 8.3 MIPS System from \$2,799

- 386-33 MHz 64K Cache
- 4 MB memory SIMMs
- 200 MB HD, 1.2 MB FD
- 101 Keyboard, 2S, 1P Ports
- Tower Case

Upgrade Your AT! Best Price/Performer
386-25,33 MHz Cache Boards from \$599



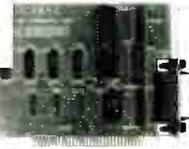
- 64K expandable to 256K Cache
- 33: Landmark 58.7, MIPS 8.3, SI 45.9
- 25: Landmark 43.5, MIPS 6.0, SI 31.6
- Up to 8 MB SIMM on board
- 8 Slots: 6 16-bit, 1 32-bit, 1 8-bit
- Supports INTEL/WAITEK Coprocessors
- 2 Year Warranty

NASCENT
Technology Inc.

Tel. (408) 441-7500, (800) 899-1889
356 South Milpitas Blvd., Milpitas, CA 95035

Circle 196 on Reader Service Card

LOW COST INTERFACE CARDS FOR PC/XT/AT



RS-485/422 Card [PC485] \$95/125

- Serial Async. Communication up to 4,000ft; 2 or 4 wires; NS16450 UART;
- Can be configured as COM1-COM4; Maximum Baud Rate 56KB;
- Flexible configuration options. RTS or DTR control of transmission direction.
- Full/Half duplex operation. Supports hardware handshaking (RTS,CTS).
- Dual drivers/receivers. Handles 64 devices. Compatible with most comm. software.
- High speed version available (supports baud rates up to 256KB) - \$165

Dual-Port RS-485/422 [PCL743] \$175

- Two independent channels (UARTs) 2 or 4 wire operation. Max. Baud 56KB
- Dipswitch configurable as COM1-4 (IRQ2-7). On board terminator resistor.

IEEE-488 Card [PC488A] \$145

- Includes DOS Device Driver and sample Communication program in BASIC.
- Additional libraries for C, Pascal, FORTRAN, Assembly available - \$50
- IRQ (1-6), DMA channel 1 or 2. Up to 4 boards per computer.
- Compatible with most IEEE-488 Software packages for IBM-PC.
- I/O Addresses and Control Registers compatible with NI's GPIB-PC/IA.

IEEE-488 Card [PC488C] With Built-In Bus Analyzer \$445

- Software Support for BASIC, QuickBASIC and GWBASIC.
- Additional libraries for C, Pascal, FORTRAN, Assembly available - \$50 (all)
- Full range of Talker, Listener, Controller, Serial/Parallel Poll, SRQ, etc...
- Powerful menu-driven BUS ANALYZER can be run in the background while 488 programs or commands are executed. Features Program Stepping, Break points, Real Time Bus Data Capture (4K buffer), Instant Screen Toggling.
- Complete Controller/Talker/Listener capability. Based on NEC-7210.
- Memory-resident Printer Port Emulation Utility included (LPT1-3).
- Compatible with NI's GPIB-PC/IA. TMS-9914 based card - \$345.

DIGITAL I/O Card [PCL720] \$175

- Input: 32 TTL compatible channels; Input load is 0.2 mA at 0.4V.
- Output: 32 TTL compatible channels; Sinks 24mA(0.5V); Sources 15mA(2.0V)
- Counter/Timer: DC to 2.6MHz; 3 channels; 16 bit counters; 6 counting modes.
- Breadboard area for prototyping. Dipswitch I/O port selection (200-378 hex).

LOW COST DATA ACQUISITION & CONTROL CARDS FOR PC/XT/AT



12 BIT A/D & D/A [PCL711s] \$295

- A/D converter: 8 single-ended channels; Device: AD574; Conversion time less than 25µsec; Built-in programmable pacer; Input ranges: ±10V, ±5V, ±1V.
- D/A converter: 1 channel; 12 bit resolution; 0 to +5V/10V Output Range.
- Digital I/O: 16 Input / 16 Output channels; All I/Os TTL compatible.
- External Wiring Terminal Board with mounting accessories included.
- Utility Routines and Demo/Sample Programs for BASIC and Quick-BASIC.

12 BIT A/D & D/A [PCL812] \$395

- A/D converter: 16 single ended inputs; Device: AD574; Conversion time less than 25µsec; Built-in programmable pacer; Input ranges: ±10V, ±5V, ±1V.
- D/A converter: 2 channels; 12 bit resolution; Output Range 0-5V.
- Digital I/O: 16 Input / 16 Output channels; All I/Os TTL compatible.
- Counter: 1 channel programmable interval counter/timer; Uses Intel 8254.
- DMA and interrupt capability. Utility software for basic included.

FAST 12BIT A/D/A [PCL718] \$795

- A/D converter: 16 single ended or 8 differential channels; 12 bit resolution; Programmable scan rate; Built-in Interrupt and DMA control circuitry. Conversion speed 60,000 smp/Sec (standard), 100,000 smp/Sec (optional).
- Input ranges: Bipolar ±10V, ±5V, ±2.5V, ±1V, ±0.5V; Unipolar 10.5, 2.1V.
- D/A converter: 2 channels; Resolution: 12 bit res; Settling time: 5µsec; ±5V.
- Digital I/O: 16 OUT, 16 IN; TTL compatible; All I/Os TTL compatible.
- Counter: 16 bit progr. interval counter/timer; Uses Intel 8254; Pacer clock;
- Software: Utility software for BASIC and QuickBASIC included.
- Supported by LabDAS (\$195/495), ASYST, LABTECH1, UniScope

6 Channel 12 bit D/A [PCL726] \$495

- Output Ranges: 0 to +5V, 0 to +10V, ±5V, ±10V or sink 4-20mA.
- Settling time: 70µs. Linearity: ±1/2bit. Voltage output driving capability: ±5mA
- Digital I/O: 16 digital inputs and 16 digital outputs; TTL compatible.

STEPPER MOTOR CARD \$395

- Capable of independent and simultaneous control of up to 3 stepper motors.
- Speed: Programmable from 3.3 PPS to 3410 PPS; Built-in acceleration control.
- Step Mode: One clock (Pulse, Direction) or two clock (CW, CCW pulses)
- Output Position Read-back; Opto-isolated outputs; Crystal based timing.
- Includes 8 bit digital input/output port. Order P/N [PCL-376B]

MC / VISA / AMEX

Call today for datasheets!

Circle 52 on Reader Service Card



B&C MICROSYSTEMS INC.
750 N. PASTORIA AVE., SUNNYVALE, CA 94086 USA
TEL: (408) 730-5511 FAX: (408) 730-5521 BBS: (408) 730-2317

33 MHz 80486 Motherboard

Faster than Everex Step™ & ALR

15 MIPS! \$2,990 Qty 1



Features:

- External 64K or 256K Write Back Cache
- IROS Design/Writer Support
- Burst Mode Design for Maximum Throughput
- Expand up to 16MB

	MIPS	Cache	0k	4M
486/25	11.4	64K	2599	2899
386/33	8.3	64K	1479	1779
386/25	6.2	64K	1229	1529
386/20	4.9	64K	1069	1369

- We manufacture motherboard and complete system with FCC/UL Available

Technology Power Enterprise, Inc.

46560 Fremont Blvd #118, Fremont CA 94538
Tel (415) 623-9162 FAX (415) 623-9462

Circle 289 on Reader Service Card

80C51

BASIC-52 BOARD

\$225 US includes:

- Intel 80C51FA, new PWM array
- RS422/485, auto RX/TX flow
- RS232, auto override select
- 128K static RAM, battery back up
- 32K CMOS EPROM, 8K Basic-52
- Battery operated & NiCd charge
- On board power supply, 300ma
- Hitachi LMxx LCD driver port
- PC communication software

*** **OPTIONS** ***

Prototyping Board \$39US
PC/RS232 ↔ RS422/485 ... \$44US
Prgmr 27Cxxx, 87C51/xx \$159US

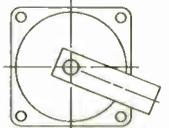
BINARY DATA ACQUISITION CORP.

1735 Bayly Street, Pickering, Ontario L1W 3G7
Canada, Phone (416) 420-8029 Fax (416) 831-0510
Cashiers Cheque or Visa

Circle 39 on Reader Service Card

COORDINATED MOTION CONTROL

Indexer LPT™



- Powerful
- Easy To Use
- Economical \$199

- Software easily converts printer port into multi axis step motor controller.
- Use IBM type personal computer to control movement of cameras, positioning stages, valves, robotics, optics, custom plotters, machine tools, or other motion or positioning applications.
- Accepts "plain English" commands from any language or program that can write to a file including BASIC, C, Pascal, spreadsheet and database macros, high level laboratory software, and even from DOS batch files! I/PGL converter available.
- Full functions for up to six axes including step, direction, reduced current, power, limit switches, home, acceleration, position tracking, line drawing and more.
- Super Manual covers everything. Easy to read. Easy to use. Numerous examples.
- Why fight with RS-232 and cryptic commands AND pay \$500 or more per axis?

Inquire about Indexer LPT today!

Ability Systems Corp.
1422 Arnold Ave. Roslyn, PA 19001 (215) 657-4338

Circle 10 on Reader Service Card



3M DISKS

Item	Unformatted	Formatted
5 1/4" DS/DD	\$.58 ea	\$.63 ea
5 1/4" DS/HD	\$1.01 ea	\$1.07 ea
3 1/2" DS/DD	\$.83 ea	\$.90 ea
3 1/2" DS/HD	\$1.53 ea	\$1.62 ea

Smart™ Mouse



100% Microsoft® Compatible
2-Buttons / Lifetime Warranty
DB9 & DB25 Connectors (serial version)
Order #MOUSE \$29.95

Designed for IBM PC/XT, AT & compatibles.

1-800-258-0028

S&H-FOB Grand Rapids, MI. MI residents + 4% tax.
Prices subject to change. COD + \$5.50.

Precision Data Products™
P.O. Box 8367
Grand Rapids, MI 49518
1-616-688-2242 FAX: 616-688-9047

Circle 224 on Reader Service Card

ICs PROMPT DELIVERY!!!

SAME DAY SHIPPING (USUALLY)
QUANTITY ONE PRICES SHOWN FOR JULY 29, 1990

OUTSIDE OKLAHOMA: NO SALES TAX

2MB Upgrade LJ IIP & III	\$183.00
DYNAMIC RAM	
1MB COMP DeskPro 386S	\$225.00
SIMM AST Prem386 33Mhz	160.00
SIMM 1Mx9 80 ns	72.00
SIMM 256Kx9 100 ns	23.00
1Mbit 1Mx1 80 ns	7.15
41256 256Kx1 100 ns	4.10
41256 256Kx1 80 ns	3.10
41256 256Kx1 100 ns	2.15
41256 256Kx1 120 ns	1.95
4464 64Kx4 100 ns	2.45
41264* 64Kx4 100 ns	5.95
EPROM	
27C1000 128Kx8 200 ns	\$17.50
27512 64Kx8 200 ns	7.50
27256 32Kx8 200 ns	5.75
27128 16Kx8 250 ns	3.75
STATIC RAM	
62256P-10 32Kx8 100 ns	\$7.50
6264P-12 8Kx8 120 ns	4.50

OPEN 6 DAYS, 7:30 AM-10 PM. SHIP VIA FED-EX ON SAT.

SAT DELIVERY INCLUDED ON FED-EX ORDERS RECEIVED BY THE 5:22 PM. \$17.00 1 lb. No minimum order. (Maximum 100 lbs. subject to change) Shipping outside state add \$1.50 packing materials.

MasterCard VISA or UPS CASH COD
MICROPROCESSORS UNLIMITED INC
24 000 S. Peoria Ave.
BEGGS OK 74421
(918) 267-4961

Circle 184 on Reader Service Card

NEW UNIQUE POWERFUL!

INTRODUCING...

NETFAX®

NETWORK FAX SYSTEM



- Send from within WordPerfect
- Automatic inward routing via TTI/CSID
- Uses no TSR Memory
- Includes facsimile modem & network software
- Send FAX messages from any workstation
- Merge text and graphics
- Automatic personalized cover sheets
- Can both send and receive
- Secure Journal to Users

\$995

Get FAX Power Today!

ALL THE FAX® 1-800-289-3329

Circle 14 on Reader Service Card

Special Offer

Introduction of new transputer products

CD-TB10/AT 10 slot TRAM motherboard. Onboard root transputer with 1-20 MB memory, FIFO, C004 and T222. High speed 16-bit AT bus interface. B008 compatible.

Entry level price ... US\$ 2,700

Size 2 TRAM's with T800-20
CD-TRAM2-1, 1MB RAM US\$ 1,040
CD-TRAM2-2, 2MB RAM US\$ 1,320
CD-TRAM2-4, 4MB RAM US\$ 2,240
CD-TRAM2-8, 8MB RAM US\$ 3,590

Cresco Data A/S, 148, Oeresundsvej
DK-2300 Copenhagen S., Denmark

Phone +45 31 55 42 70

Fax +45 31 55 01 53

Circle 79 on Reader Service Card

World Radio History



UNIVERSAL PROGRAMMER & TESTER

MODEL: ALL-03 FOR PC XT/AT/386

\$595

(COD. VISA. MC)



- E(EP)ROMs (general)
- NMOS & CMOS (16k to 512k, 1M to 4M BITS)
- BIPOLAR PROMS
- PAL, CMOS PAL, GAL, PEEL, EPLD, FPL
- Microcomputer (8748, 8751, 87C51 & 28 series)
- IC TEST (TTL 74/54 & 40/45 series)
- MEMORY TEST
- HEX TO BINARY code converter for INTEL 80/86 HEX
- MOTOROLA S1/S2 HEX and TEKTRONICS HEX
- HIGH SPEED
- 40 PIN test socket with 40 sets of software controlled circuit 40 sets of programmable
- "GO" KEY & "GOOD" —LED permit stand alone machine operation
- 4 SOCKET ADAPTER (OPTION)

— 1 Year Warranty & 30 Days Money Back Guarantee —

ORDER TOLL FREE 1-800-633-3449

IN CALIF (Tel) 408 748-8491 (FAX) 408 748-8492

C&J MICRONICS

1400 Coleman Ave., #D-13, Santa Clara, CA 95050

Circle 81 on Reader Service Card

\$120 to repair a hard disk failure!

That same \$120 could have paid for breakdown insurance on a basic computer system for an entire year. Insurance against hard disk failures and any other losses. Now **SAFWARE FIX-IT** provides insurance for mechanical breakdown (wear and tear) as well as external losses (theft, fire, power surges, natural disasters and more). All in a single policy, for as little as \$100. per year. Call free for full information.



1-800-822-2345

Local 1-614-262-0708

Fax 614-262-1714



SAFWARE, The Insurance Agency Inc.
2929 N. High Street
P.O. Box 02211
Columbus, OH 43202

Not Available in All States

Circle 256 on Reader Service Card

Complete PC Systems

For Complex Stand-Alone Applications



- Now Available! Systems that are functionally equivalent to large PC's, in compact packages. Our systems are based on single board CPU's and include all hardware, software, and support needed to run your special applications.
- Run DOS applications without a disk using our BIOS. Store DOS and user programs in EPROM's.
- Debug Monitor, BIOS for disk capability, utilities, and source code are available.
- Compatible with PC systems. Run 8088 code and DOS applications. Use standard PC/AT cards in passive backplanes for expansion.
- Our CPU cards use V40/V50 micros and drive PC AT bus. Options: 1meg RAM, 256K ROM, 5 serial ports, SCSI, CMOS, floppy, printer, graphics.

Kila
CPU Cards \$249 (q25)
Systems \$499 (q1)
Customization available
(303)444-7737
655 Hawthorne Ave. Boulder, CO 80304 FAX (303) 786-9983

Circle 156 on Reader Service Card

UNIPRO,

the PC/XT/AT/386 based universal programmer/tester programs PROMs, EPROMs, EEPROMs up to 4MB and 32-bit wide, PALs, PLDs, GALs, EPLDs, PEELs, and Micro Controllers. JEDEC file compatibility and Test Vector verification allow the use of most popular PLD compilers. The unit also tests TTL/CMOS Logic ICs and Dynamic/Static RAMs. 40-pin Gold ZIF socket, built-in protection for short circuit and over current, high speed parallel interface to the PC, and menu-driven software are included at \$585.



XELTEK
764 San Alejo Ave
Sunnyvale, CA 94086
TEL: (408) 727-6995 • FAX: (408) 727-6996

Circle 323 on Reader Service Card

9-Track Tape For Your IBM PC/XT/AT/PS-2™

Read 1600 bpi 9-track tapes from a micro, mini or mainframe in EBCDIC or ASCII as mirror image or by individual files.

Use the 2000 PC™ for disk backup, data interchange or archival storage.

PC/XT/AT/PS-2 are trademarks of IBM. 2000 PC is a trademark of Digi-Data.

DIGI-DATA CORPORATION
8580 Dorsey Run Road
Jessup, MD 20794-9990
(301) 498-0200
800-782-6395
FAX (301) 498-0771
... First in Value



Circle 92 on Reader Service Card

LOW COST 15-BIT A/D CONVERTER

for IBM PC/XT/AT COMPUTERS

UNUSUAL SPECIFICATIONS:

Years since introduction: 6
Total returns for non-performance: 0
Failures in field (including outright abuse): 4
Total service charges parts and labor: \$0.00
Price: still \$265.00

LAWSON LABS, INC.

5700 RAIBE ROAD
COLUMBIA FALLS, MT 59912
800-321-5355 or 406-387-5355



Circle 160 on Reader Service Card

LOGIC,

the universal PLD programmer supports extensive library of industry-standard logic types, including latest EPLDs, PLAs, GALs, FPLs, and PEELs. The pull-down menu driven software accepts JEDEC files from most PLD design softwares. The full screen editor for Fuse Maps and Test Vectors is included at \$395. Tango-PLD, the logic design software generates JEDEC files by schematic entry, logic minimization, logic simulation, and design compilation at \$495. LOGIC and Tango PLD are bundled for \$745.



XELTEK
764 San Alejo Ave.
Sunnyvale, CA 94086
TEL: (408) 727-6995 • FAX: (408) 727-6996

Circle 324 on Reader Service Card

FREE CATALOG

RS-232C INTERFACE & MONITORING EQUIPMENT CATALOG

WRITE OR CALL for YOUR FREE COMPREHENSIVE B & B ELECTRONICS CATALOG TODAY! Pages and pages of photographs and illustrated, descriptive text for B&B's complete line of RS-232C converters, RS-422 converters, current loop converters, adapters, break out boxes, data switches, data splitters, short haul modems, surge protectors, and much, much more. Most products meet FCC Part 15J. Your RS-232C needs for quality, service and competitive prices will be more than met by B&B ELECTRONICS Manufacturer to you, no middleman! Money-back guarantee! Same-day shipment! One year warranty on products! Technical support is available.

Write For Your FREE Catalog Today!

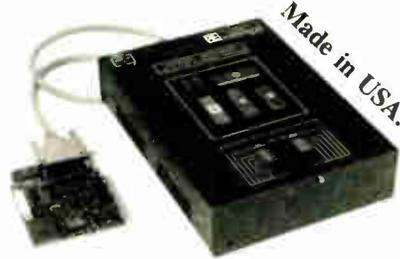
B & B electronics

MANUFACTURING COMPANY
4002J Baker Road P.O. Box 1040 • Ottawa, IL 61350
Phone: 815-434-0846



Order direct from manufacturer TODAY & SAVE!

Circle 33 on Reader Service Card



Made in USA!

PC BASED UNIVERSAL DEVICE PROGRAMMER \$695/895

- Program: EE/PROMs, MICROs, BIPOLARs, PALs, GALs, EPROMs, PEELs. (current libraries support over 900 devices by over 35 manufacturers).
- Software driven pin drivers. DIA generated programming voltages (8 bit DACs used to generate voltages from 5-25V with 0.1V resolution for all pins).
- Fast device programming - verify / read via dedicated parallel interface.
- Upgradeable for virtually any future programmable devices up to 40 pins.
- Self-sustaining operation. No additional modules or plug-in adapters required.
- Includes user friendly MEMORY BUFFER FULL SCREEN EDITOR. Commands include: Fill, Move, Insert, Delete, Search. Data entry can be done in ASCII or HEX form. TISEMAP EDITOR for Logic devices.
- Friendly Menu-Driven interface. Device selection by PIN and Manufacturer.
- Supports 8/16/32 bit data word formats.
- Programming algorithms: Normal, Intelligent I & II, Quick Pulse Programming. Automatic selection of fastest algorithm for any given part.
- Verifies operation performed at normal & worst case operating voltage.
- Functional test: JEDEC standard functional testing for logic devices. TTL Logic functional test for 74xx/54xx series devices and memory devices.
- Test library can be updated by the user. User definable test pattern generation.
- File formats accepted: JEDEC (full), JEDEC (normal), Binary, MOS Technology, Motorola Hex, Intel Hex, Tektronix Hex.
- Base price (\$695) includes Interface card, cable, Memory - Micro 4 Bipolar library, TTL/CMOS MEMORY device test capability, one year free updates.
- Complete price (\$895) includes all of the above plus Logic Device Library.
- Library updates can be received via floppy or B&C Customer Support BBS.
- Full 1 year warranty. Customer support via voice line, Fax & dedicated BBS.



Made in USA!

UNIVERSAL RS-232 PROGRAMMER \$345/495

- Programs EE/Proms, ZIFRAMs, Intel Micros, Flash EPROMs, Memory Cards.
- Stand-Alone Mode for H/E/Prom and Memory Card Duplication. Verify.
- All 24/28/32 pin EE/Proms to 4 Mbits (upgradeable to 32 megalbits).
- Micros: 874 (A, -2A, -4, -8, -9, -51, -C51, -C51FA/B), -52, -53, -55, -C521, -C541, 9761.
- Model UP100 (\$345). Model UP200 (\$495) accepts dedicated modules.
- Memory Cards Programming Module (Seiko/Fpson/Fujitsu) - \$145.
- G&G Programming Module (4 sockets) - \$145.
- Optional built-in Eraser/Timer module - \$50. Conductive foam pad.
- On-Board Programming capability. Custom interface modules available.
- User friendly, Menu-Driven Interface Program for IBM-PC and Macintosh.
- Can be operated with any computer containing an RS-232 serial port.
- OEM open board programmer configurations available (from \$245).
- One year free software updates and Customer Support.
- Customer support via voice line, dedicated BBS or fax. Full 1 year warranty.



Made in USA!

INTELLIGENT ROM EMULATOR \$395

- Emulates 2716 through 27512 EPROMs (2k to 64k bytes) with a single unit.
- Megabit parts can be emulated with multiple units (Mega adapter required).
- Connects to the standard parallel printer port. Uses standard printer cable.
- FAST data loading via parallel printer port (64k bytes in less than 10 seconds).
- Intelligent "In-Circuit-Emulator" type features include: Address Compare (with HALT output), Address Snapshot (for target addr. bus monitoring), Trigger Input (for external events monitoring), Programmable Reset Output.
- Powerful Memory buffer editor. Selectable wordsizes (8,16,32).
- User friendly software. Command set includes: Load, Write, Display, Run, Type, Edit, Fill, Run-Command-File, Monitor, Port, Reset, Help, Calculator.
- Cascadeable to 8 units. Includes target cable with Trigger, Halt & Reset clips.
- CMOS model with NiCad rechargeable 9V battery backup - \$495. (Can be used in stand-alone mode; Built-in battery recharging circuitry.)
- File formats accepted: Binary, Intel Hex, Motorola S.

MC / VISA / AMEX Call today for datasheets!

B & C MICROSYSTEMS INC.
750 N. PASTORIA AVE., SUNNYVALE, CA 94086 USA
TEL: (408) 730-5511 FAX: (408) 730-5521 BBS: (408) 730-2417

EDITORIAL INDEX BY COMPANY

Index of companies covered in articles, columns, or news stories in this issue
Each reference is to the first page of the article or section in which the company name appears

Company, Page #	Inquiry #				
A					
Ad Lib, 65	994				
ADI Systems, 445					
Advanced Concepts, 50	1142				
Advanced Micro Devices, 19					
Aldus, 81	984				
All The Fax, 52	1145				
Altech Systems, 429	1068				
Apple Computer, 19, 89, 159, 162, 169, 212					
Arnet, 50	1140				
Artisoft, 65	995				
Ashton-Tate, 19, 132, 401	1071				
Asymetrix, 159	888				
AT&E, 19					
AT&T, 89					
AutoSoft, 64	1165				
B					
Baen Books, 65	988				
Bartleby Software, 429	1070				
Bell Labs, 89					
Blue Ribbon Bakery, 429	1053				
Borland International, 19, 401					
BV Engineering, 62	1160				
C					
C-Lab/DigiDesign, 429	1181				
C.E. Software, 81	981				
Canon USA, 43	1125				
Cheetah International, 65	987				
Claris, 19, 132	1072				
CMS, 429	1067				
Coda, 429	1061				
Cognivision Research, 65	992				
Commodore Business Machines, 429	1052				
Compaq Computer, 89, 128					
Complementary Solutions, 64	1166				
Cool Shoes Software, 429	1059				
Copam Electronics, 445					
Core International, 65	989				
Cornerstone Technology, 212	853				
Coromandel Industries, 56	1152				
Cray, 89					
Cyma, 58	1156				
D					
Dariana Technology, 50	1141				
Data General, 89, 113					
Dayna Communications, 19					
Decisus, 93	1101				
Delta Point, 132	1073				
DigiBoard, 52	1144				
Digipro, 214	881				
Digital Equipment, 89, 113, 154, 401	854				
Digital Research, 65	990				
Distributed Processing Technology, 65	997				
Dr. T, 429	1063				
Dolch Computer, 42	1121				
Dycam, 48	1136				
Dynamac Computer Products, 169	857				
E					
Enable Software, 113					
Extended Systems, 48	1135				
F					
Feith Systems, 44	1130				
Feldstar Software, 58	1154				
Forval America, 50	1143				
G					
Gold Disk, 429	1185				
H					
HardFacts, 120	1002				
HIP Software, 429	1064				
Huff Software, 132	1074				
Hybrid Arts, 429	1062				
I					
IBM, 89, 401, 414					
Icom Simulations, 81	982				
Information Research, 113					
Intel, 19, 414					
IntelligenceWare, 62	1162				
Intelligent Music, 429	1065				
Intex Solutions, 58	1157				
IXI Software, 81					
K					
KnowWare, 93	1103				
L					
Landmark Research International, 65	986				
Lixco, 401					
Locus, 89					
Lotus Development, 19, 113, 182	887				
M					
MacroMind, 429	1058				
Mark of the Unicorn, 429	1182				
MDBS, 206	887				
Metagraphics Software, 56	1148				
Microelectronics and Computer Technology, 19					
Microlytics, 64	1167				
Micronics Computers, 42	1122				
Microprose Software, 65	998				
MicroSlate, 42	1124				
Microsoft, 132, 159, 414	1075				
MicroSolutions Computer Products, 120	1000				
Microware Systems, 423	1051				
Motorola, 401, 414, 423					
Muszertechnika, 401					
N					
National Science Foundation, 19					
NBI, 120	1001				
NEC, 128					
NEC Technologies, 19					
New Horizons, 132	1076				
New Wave Software, 429	1060				
Nisca, 43	1126				
Novell, 19					
nuLogic, 62	1158				
Number Nine, 44	1134				
O					
Object Management Group, 19					
Oce Graphics, 19					
On Technology, 81	983				
Opcode, 429	1056				
Outbound Systems, 169	856				
P					
Pacific Data Products, 48	1139				
Palantir, 132	1077				
Paragon Concepts, 132	1078				
Passport, 429	1055				
Perceptive Solutions, 65	993				
Personal Composer, 429	1183				
Peter Norton Computing, 120	1003				
Pixel Publishing, 429	1186				
Pocket Soft, 56	1151				
Project Software & Development, 58	1153				
Q					
Q/Cor, 188	882				
QMS, 19					
Quark, 81	985				
Quicksoft, 64, 65	996				
	1163				
R					
Radius, 212	852				
RasterOps, 120	999				
Robotron, 401					
S					
Samna, 132	1079				
Sample Line, 152	1075				
Scorpion Systems, 429	1187				
Seiko, 19					
Seiko Instruments, 43	1127				
Shiva, 185	855				
Siemens, 401					
Softview, 58	1155				
Sony, 43	1128				
Sound Quest, 429	1069				
Spinnaker Software, 132	1080				
SPSS, 93	1102				
Steinberg/Jones, 429	1057				
Strand Software Technologies, 56	1150				
Sun, 89					
Sun Moon Star, 42	1123				
T					
T/Maker, 132	1081				
Tandy, 19, 423					
Tatung, 44	1133				
The Other Guys, 429	1188				
TKI, 64	1164				
Top Level, 56	1149				
TransComputer, 44	1129				
Triobyte, 62	1161				
Twelve Tone Systems, 429	1054				
U					
Unison Technology, 52	1146				
Universal Technical Systems, 62	1159				
USVideo, 65	991				
V					
Very Vivid, 429	1066				
Visionware, 89					
Voyetra Technologies, 429	1184				
W					
WordPerfect, 132	1082				
Working Software, 132	1083				
WYSIWYG, 132	1084				
X					
Xircom, 48	1137				
XTree, 52	1147				
Z					
Zenith Data Systems, 19					

READER SERVICE

To get further information on the products advertised in BYTE, fill out the reader service card by circling the numbers on the card that correspond to the inquiry number listed with the advertiser. This index is provided as an additional service by the publisher, who assumes no liability for errors or omissions.

* Correspond directly with company.

Index to Advertisers by Product Category

Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.
HARDWARE							
800	ADD INS	805	INSTRUMENTATION	811	NETWORK HARDWARE	812	PRINTERS/PLOTTERS
20 AMERICAN ADVANTECH	500	64 DATA INSTRUMENTS, INC	500	1201 3EST	IS-78	58 CANON (PRINTER)	189
1212 AROGSY	IS-44	109 ELEXOR ASSOCIATES, INC	498	1202 404 TECHNOLOGY	IS-66	1340 DEERFIELD DATA SYSTEMS	NE-2
1216 BLUE CHIP TECHNOLOGY	IS-70	200 TELEBYTE	404	457 BAY TECHNICAL ASSOCIATES	247	HEWLETT PACKARD PERIP	25, 27
1382 CACHE COMPUTERS	SO-23			458 BAY TECHNICAL ASSOCIATES	247	HEWLETT PACKARD PERIP	141
59 CAPITAL EQUIPMENT CORP	72	806	KEYBOARDS/MICE	459 BAY TECHNICAL ASSOCIATES	334	1282 LASERMARSTER	IS-69
80 CAPITAL EQUIPMENT CORP	73	471 DATALUX CORPORATION	274	460 BAY TECHNICAL ASSOCIATES	334	1283 LASERMARSTER	IS-69
335 CAPITAL EQUIPMENT CORP	462	472 DATALUX CORPORATION	274	399 BUFFALO PRODUCTS, INC	191	187 MANNESMANN TALLY	189
1224 COMPEX	IS-42	334 GRAPHTEC CORP	449	CLEO COMMUNICATIONS, INC	112	1273 MINOLTA	IS-12, 13
1225 COMPEX	IS-42	139 HOUSTON COMPUTER SERV	490	71 CONTROL	187	200 NATIONAL TELEVAR	152
1226 COMPEX	IS-43	496 KEA SYSTEMS	321	80 CURTIS, INC	94	201 NEC TECHNOLOGIES (N.A.)	175
1227 COMPEX	IS-43	1281 KUN YING ENTERPRISE	IS-93	1232 CYBEX	IS-56	213 OKIDATA	130, 131
85 COMPUTER MODULES, INC	490	508 MOUSE SYSTEMS CORP	313	96 DISTRIBUTED PROCESSING	115	215 PACIFIC DATA PRODUCTS	173
71 CONTROL	187	205 NORTHGATE COMPUTER SYS	12, 13	97 DISTRIBUTED PROCESSING	115	216 PACIFIC DATA PRODUCTS	173
79 CRESCO DATA A/S	504	207 NORTHGATE COMPUTER SYS	435	1250 INES	IS-68	520 PACIFIC DATA PRODUCTS	316
1233 CTS LTD	IS-78	208 NORTHGATE COMPUTER SYS	437	177 MEASUREMENT & CONTROL SYS	486	521 PACIFIC DATA PRODUCTS	316
96 DISTRIBUTED PROCESSING	115	210 NUMONICS	80	525 PERFORMANCE TECHNOLOGY	381	522 PANASONIC (LASER PRINTER)	283
97 DISTRIBUTED PROCESSING	115	220 PERCON	484	287 SAMSUNG	54, 55	235 QMS, INC	444
98 DIVERSIFIED TECHNOLOGY	84			258 SAMSUNG	54, 55	526 QMS, INC	444
100 DP-TEK	184	807	MASS STORAGE	296 THE SOFTWARE LINK	170	1288 SURAH, INC	IS-78
101 DP-TEK	184	1203 ACCEL	IS-64	298 THE SOFTWARE LINK	171	539 TEKTRONIX	314, 315
477 FORVAL AMERICA	345	13 AK SYSTEMS	496	300 THE SOFTWARE LINK	171	540 TEKTRONIX	314, 315
478 FORVAL AMERICA	345	340 ALTEC ELECTRONIC GMBH	486	482 VERRAN	295	1358 UNITED INNOVATIONS	NE-18
479 FRECOM	287	57 CANON (OPTICAL CARD)	63	550 XIRCOM	302	1380 ZERICON	PC-11
1239 GALAXY MICROCRAFT SYS	IS-78	74 CORE INTERNATIONAL	419			813	PRINTER RIBBONS/SUPPLIES
130 GROUNDHOG GRAPHICS	216	78 CORE INTERNATIONAL	419			197 NATIONAL COMPUTER RIBBONS	275
131 GROUNDHOG GRAPHICS	216	82 DATA STRATEGIES INT'L	494			503 MIS	308
132 GTEK, INC	201	DIGI-DATA CORP	506			504 MIS	308
133 GTEK, INC	201	336 FLAGSTAFF	202			1318 MYODA, INC	MW-16
138 HIGH RES TECHNOLOGIES	503	502 MICRO SOLUTIONS COMPUTER PROD	296			1319 MYODA, INC	MW-16
138 HOMESMART COMPUTING	486	180 MICRO SOLUTIONS COMPUTER PROD	440			1348 MYODA, INC	NE-15
488 INTEL	233	518 ONLINE PRODUCTS CORP	320			1349 MYODA, INC	NE-15
489 INTEL	233	519 ONLINE PRODUCTS CORP	320			1373 MYODA, INC	PC-7
150 IQ TECH	496	214 OVERLAND DATA	484			1374 MYODA, INC	PC-7
1260 JC INFO SYSTEMS	IS-21	523 PERCEPTIVE SOLUTIONS, INC	342			1400 MYODA, INC	SO-24
180 LAWSO LABS	505	524 PERCEPTIVE SOLUTIONS, INC	342			1401 MYODA, INC	SO-24
1301 MAXIT/OBSORNE M-H (INT'L)	348	526 PLUS DEVELOPMENT	287			196 NASCENT TECHNOLOGY	503
1302 MAXIT/OBSORNE M-H (INT'L)	348	248 QUALSTAR CORP	499			509 NCR CORPORATION (N.A.)	348, 349
181 MICRONICS COMPUTERS, INC	485	358 SEAGATE TECHNOLOGY	307			514 NORTHGATE COMPUTER SYS	282, 287
185 MICROSTAR LABORATORIES	410	1280 TEXAC	IS-79			515 NORTHGATE COMPUTER SYS	300, 301
MICROWAY	239	293 TEXAS MICROSYSTEMS	32A-8			516 NORTHGATE COMPUTER SYS	382, 383
MICROWAY	239	547 VOGON ENTERPRISES LTD	309			206 NORTHGATE COMPUTER SYS	412, 413
MICROWAY	408					1381 NSTL	PC-22, 23
204 NOHAL	451	808	MISCELLANEOUS			1274 PACIFIC TECHNOLOGIES	IS-35
517 OMNITEL, INC	328	15 ALPHA PRODUCTS	491			226 PROFESSIONAL COMPUTER SYS	499
1350 POWERCARD SUPPLY	NE-4	20 AMERICAN ADVANTECH	500			252 RADIO SHACK	CVF
1351 POWERCARD SUPPLY	NE-4	26 APPLIED DATA COMM	206			1320 RESOURCE CONCEPTS, INC	MW-10
225 PROCOM USA	490	27 APPLIED DATA COMM	206			1321 RESOURCE CONCEPTS, INC	MW-10
237 QUA TECH, INC	488	35 BASF	188			1352 RESOURCE CONCEPTS, INC	NE-10
238 QUA TECH, INC	488	39 BINARY DATA ACQUISITION CORP	504			1353 RESOURCE CONCEPTS, INC	NE-10
239 QUA TECH, INC	488	40 BLACK JACK COMPUTER	493			1378 RESOURCE CONCEPTS, INC	PC-10
240 QUA TECH, INC	488	1230 COPYMASTER INT'L	IS-63			1378 RESOURCE CONCEPTS, INC	PC-10
241 QUA TECH, INC	488	77 COVOX	485			1403 RESOURCE CONCEPTS, INC	SO-12
242 QUA TECH, INC	488	78 COVOX	485			530 RIO COMPUTERS	280
243 QUA TECH, INC	488	89 DIETRICH POS EQUIPMENT	500			531 RIO COMPUTERS	280
244 QUA TECH, INC	488	1237 IGL	IS-9			1279 SAMPO TECH. CORP	IS-99
245 QUA TECH, INC	488	143 IN FOCUS SYS, INC	95			286 SHARP	209
1280 SCHNELLMANN INTERHANDELS AG	IS-51	144 IN FOCUS SYS, INC	95			532 SIA	388
267 SIGMA DATA	486	148 INTEGRAND	286			533 SIA	388
270 SPECIALITY SOFTWARE DEV. CORP	183	148 INTEGRAND RESEARCH CORP	438				
286 TALL TREE SYSTEMS	490	1254 IQ ENGINEERING	IS-31				
1289 TATUNG CO	IS-85	1255 IQ ENGINEERING	IS-31				
289 TECHNOLOGY POWER ENT	504	497 KENSINGTON MICROWARE LTD	261				
542 TOTE-A-LAP	367	186 MACROTRON SYSTEMS, INC	494				
1293 TRIANGLE DIGITAL	IS-90	179 MERRITT COMPUTER PROD., INC	440				
		268 SILICON SHACK LTD	503				
		285 TALKING TECHNOLOGY, INC	490				
		295 THE PERISCOPE COMPANY	69				
		296 THE PERISCOPE COMPANY	69				
		1418 TRIPP LITE	SO-2				
		1418 TRIPPE LITE	SO-2				
		325 Z-WORLD ENGINEERING	493				
		326 Z-WORLD ENGINEERING	493				
801	DRIVES	809	MODEMS/MULTIPLEXORS	815	SOFTWARE SECURITY	816	SYSTEMS
80 CURTIS, INC	94	457 BAY TECHNICAL ASSOCIATES	247	1206 ALADDIN	IS-57	1310 ACT	MW-9
1259 I.E.F.	IS-59	458 BAY TECHNICAL ASSOCIATES	247	1238 FAST ELECTRONIC	IS-53	1311 ACT	MW-9
186 MITSUBISHI	179	457 BAY TECHNICAL ASSOCIATES	334	233 PROTECH	125	1387 ACT	SO-19
167 MITSUBISHI	179	460 BAY TECHNICAL ASSOCIATES	334	526 RAINBOW	305	1388 ACT	SO-19
223 PINNACLE MICRO	147	65 COMPUCOM	485	528 RAINBOW	305	1205 AGC	IS-81
PINNACLE MICRO	147	477 FORVAL AMERICA	345	253 RAINBOW	53	ALLEN SYSTEMS	499
SEAGATE TECHNOLOGY	307	478 FORVAL AMERICA	345	254 RAINBOW	53	16 ALR	2, 3
TRIGEM	IS-2	479 FRECOM	287	534 SOFTWARE SECURITY	244	17 ALR	2, 3
		123 GALACTICOMM	114			18 ALTEC TECHNOLOGY	431
		66 LIGHTSPEED TECH, INC	421				
		1264 LOGIDATA TECH, INC	IS-91				
		304 TOUCHBASE SYSTEMS	86				
		1295 UNIVERSAL DATA SYSTEMS	IS-17				
		1296 UNIVERSAL DATA SYSTEMS	IS-17				
		US ROBOTICS	443				
802	FACSIMILE	810	MONITORS				
14 ALL THE FAX	504	1204 ADI CORP	IS-87				
1336 BUSINESS COMPUTER SYS	NE-16	1209 AOC INT'L USA	IS-33				
1337 BUSINESS COMPUTER SYS	NE-16						
122 FRECOM	406						
479 FRECOM	267						
1252 INTERQUAD LTD	IS-7						
157 KNAPCO	494						
158 KNAPCO	494						
803	GRAPHICS TABLETS						
277 SUMMAGRAPHICS CORP	211						
276 SUMMAGRAPHICS CORP	211						
279 SUMMAGRAPHICS CORP	211						
804	HARDWARE PROGRAMMERS						
BINARY TECHNOLOGY, INC	496						
BP MICROSYSTEMS	490						
CJ MICRONICS	504						
LINK COMPUTER GRAPHICS	485						
LOGICAL DEVICES, INC	494						

READER SERVICE

* Correspond directly with company.

Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.	Inquiry No.	Page No.	
1387	GEMS COMPUTERS, INC.	60-5	198	NATIONAL INSTRUMENTS	471	1284	SOFTWARE CONSTRUCTION	IS-67
1244	GREY MATTER	IS-73	203	NEVADA COMPUTER CORP.	492	271	SPECIALIZED PRODUCTS CO	471
142	I.C. EXPRESS	496	205	NORTHGATE COMPUTER SYS 12, 13		345	STRAWBERRY TREE	470
149	INTEL CORP/DEV. TOOLS	470	206	NORTHGATE COMPUTER SYS 412, 413		283	SUPREME ENTERPRISES	502
151	ITT POWERSYSTEMS CORP.	470	207	NORTHGATE COMPUTER SYS	435	1409	SYSTEM ENTERHOUSE, INC	SO-16
152	JADE COMPUTER PRODUCTS	501	208	NORTHGATE COMPUTER SYS	437	1410	SYSTEM POWERHOUSE, INC	SO-16
490	JAMECO	253	514	NORTHGATE COMPUTER SYS 268, 287		291	TELEPHONE PRODUCT CENTER 498	
491	JAMECO	254, 255	515	NORTHGATE COMPUTER SYS 300, 301		1413	TEXCOMP BUSINESS SYS., INC SO-4	
342	JAMECO ELECTRONICS	470	518	NORTHGATE COMPUTER SYS 382, 383		1414	TEXCOMP BUSINESS SYS., INC SO-4	
6	JDR MICRODEVICES	513, 515		PC CONNECTION	104, 105	309	UNICORN	490
7	JDR MICRODEVICES	513, 515		PC CONNECTION	108, 107	310	UNITEX	488, 489
492	JDR MICRODEVICES	400A	224	PRECISION DATA PRODUCTS	504	311	UNITEX	488, 489
483	JDR MICRODEVICES	400A		PROGRAMMER'S PARADISE	57	1297	USA SOFTWARE	IS-37
154	JENSEN TOOLS, INC.	470		PROGRAMMER'S PARADISE	59	316	VIDEO TEXTBOOK TRAINING	418
172	MARYMAC INDUSTRIES	503		PROGRAMMER'S PARADISE	60, 61	317	VIDEO TEXTBOOK TRAINING	418
1287	MAYFAIR MICROS	IS-40		PROGRAMMER'S SHOP	192, 195	319	WIESEMANN & THEIS GMBH	428
1317	MICROCOM COMPUTERS	MW-11	251	R & R ELECTRONICS	499	341	WLT PC EXPRESS	470
1347	MICROCOM COMPUTERS	NE-6	1320	RESOURCE CONCEPTS, INC	MW-10			
1372	MICROCOM COMPUTERS	PC-15	1321	RESOURCE CONCEPTS, INC	MW-10			
1399	MICROCOM COMPUTERS	SO-15	1352	RESOURCE CONCEPTS, INC	NE-10			
	MICROCOMPUTING MKTG. CNCL	PC-24	1353	RESOURCE CONCEPTS, INC	NE-10			
184	MICROPROCESSORS UNLTD	504	1375	RESOURCE CONCEPTS, INC	PC-10			
1318	MYODA, INC	MW-16	1376	RESOURCE CONCEPTS, INC	PC-10			
1319	MYODA, INC	MW-16	1403	RESOURCE CONCEPTS, INC	SO-12			
1348	MYODA, INC	NE-15	1404	RESOURCE CONCEPTS, INC	SO-12			
1349	MYODA, INC	NE-15	284	SCOTSDALE SYSTEMS	487			
1373	MYODA, INC	PC-7	532	SI	368			
1374	MYODA, INC	PC-7	533	SI	368			
1400	MYODA, INC	SO-24	1283	SMART SOFTWARE	IS-72			
1401	MYODA, INC	SO-24	289	SNW COMPUTERS & ELECT	84			
197	NATIONAL COMPUTER RIBBONS	70						

845 ON-LINE SERVICES	
BIX	215
BIX	450
BIX	460
BIX	466, 487
COMPUERVE	350
COPIA INTERNATIONAL LTD	360
HARD FACTS	231

846 OPERATING SYSTEMS	
DIGITAL RESEARCH	319
KADAK PRODUCTS	110
PROGRAMMER'S ODYSSEY	IS-16
QUANTUM SOFTWARE SYS	425
SANTA CRUZ OPERATION	49
THE SOFTWARE LINK	170
THE SOFTWARE LINK	170
THE SOFTWARE LINK	171
THE SOFTWARE LINK	171
VENTURCOM	91
VENTURCOM	91

844 MISCELLANEOUS	
ANNBOOKS	404
COMPUTER BOOK CLUB	96A-B
COMPUTER BOOK CLUB	97
INFO '90/CANNERS EXPOSITION GRP 3	1338
TECHNICAL TRANSLATION	IS-60
UNIX EXPO	NE-17
VERRAN	285

847 RECRUITMENT	
ACM	203
CENTRAL POINT SOFTWARE	311
SCO COMM COMPUTERS	IS-70

BYTE ADVERTISING SALES STAFF:

Steven M. Vito, Associate Publisher/V.P. of Marketing, One Phoenix Mill Lane, Peterborough, NH 03458, tel. (603) 924-9281
 Arthur Kossack, Eastern Advertising Director, Two Prudential Plaza, 180 North Stetson Ave., Chicago, IL 60601, tel. (312) 616-3341
 Jennifer L. Bartel, Western Advertising Director, 14850 Quorum Drive, Suite 380, Dallas, TX 75240, tel. (214) 701-8496
 Liz Coyman, Inside Sales Director, One Phoenix Mill Lane, Peterborough, NH 03458, tel. (603) 924-2518

NEW ENGLAND
 ME, NH, VT, MA, RI, CT, ONTARIO
 CANADA & EASTERN CANADA
 Dan Savage (617) 860-6331
 MaryAnn Goulding (603) 924-2664
 McGraw-Hill Publications
 29 Hartwell Avenue
 Lexington, MA 02173
 FAX: (603) 924-7507

EAST COAST
 NY, NYC, NJ, DE, PA
 Kim Norris (212) 512-2645
 Ariane Casey (212) 512-2368
 Patricia Payne (603) 924-2654
 McGraw-Hill Publications
 1221 Avenue of the Americas—
 28th Floor
 New York, NY 10020
 FAX: (212) 512-2075

SOUTHEAST
 NC, SC, GA, FL, AL, TN, VA,
 MS, AR, LA, DC, MD, WV, KY
 John Y. Schilin (404) 843-4782
 Patricia Payne (603) 924-2654
 McGraw-Hill Publications
 4170 Ashford-Dunwoody Road
 Suite 520
 Atlanta, GA 30319
 FAX: (404) 252-4056

MIDWEST
 IL, MO, KS, IA, ND, SD, MN,
 WI, NE, IN, MI, OH
 Kurt Kelley (312) 616-3328
 MaryAnn Goulding (603) 924-2664
 McGraw-Hill Publications
 Two Prudential Plaza
 180 North Stetson Ave.
 Chicago, IL 60601
 FAX: (312) 616-3370

SOUTHWEST
 ROCKY MOUNTAIN
 CO, OK, TX,
 Alison Keenan (214) 701-8496
 Patricia Payne (603) 924-2654
 McGraw-Hill Publications
 14850 Quorum Drive
 Suite 380
 Dallas, TX 75240
 FAX: (214) 991-6208

NORTH PACIFIC: San Francisco, CA
 NORTHERN CA, OR, ID, MT,
 WY, NORTHERN NV
 Roy J. Kops (415) 954-9728
 McGraw-Hill Publications
 425 Battery Street
 San Francisco, CA 94111
 FAX: (415) 954-9786

NORTH PACIFIC: Campbell, CA
 SILICON VALLEY, HI, WA, AK,
 W. CANADA
 Bill McAfee (408) 879-0371
 Leslie Hupp (408) 879-0371
 McGraw-Hill Publications
 1999 South Bascom Ave.
 Suite #210
 Campbell, CA 95008
 FAX: (408) 879-9067

SOUTH PACIFIC: Los Angeles, CA
 LOS ANGELES COUNTY, AZ,
 NM, SOUTHERN NEVADA
 Alan El Fay (714) 557-6292
 Jonathan Sawyer (603) 924-2665
 McGraw-Hill Publications
 3333 Wilshire Boulevard #407
 Los Angeles, CA 90010
 FAX: (714) 557-2219

SOUTH PACIFIC: Costa Mesa, CA
 ORANGE COUNTY,
 SAN DIEGO COUNTY, UT
 Ron Cordek (714) 557-6292
 Jonathan Sawyer (603) 924-2665
 McGraw-Hill Publications
 3001 Red Hill Ave.
 Building #1—Suite 222
 Costa Mesa, CA 92626
 FAX: (714) 557-2219

BYTE BITS (2x3)
 Mark Stone (603) 924-6830
 BYTE Publications
 One Phoenix Mill Lane
 Peterborough, NH 03458

The Buyer's Mart (1x2)
 Brian Higgins (603) 924-3754
 BYTE Publications
 One Phoenix Mill Lane
 Peterborough, NH 03458

Regional Advertising
 James Bail (603) 924-2533
 Barry Echavarría (603) 924-2574
 Larry Levine (603) 924-2637
 BYTE Publications
 One Phoenix Mill Lane
 Peterborough, NH 03458

Catalog Showcase/Outserts
 Scott Gagnon (603) 924-2651
 BYTE Publications
 One Phoenix Mill Lane
 Peterborough, NH 03458

BYTE Deck
 Ed Ware (603) 924-2596
 BYTE Publications
 One Phoenix Mill Lane
 Peterborough, NH 03458

Computing for Engineers Deck
 Ellen Perham (603) 924-2598
 BYTE Publications
 One Phoenix Mill Lane
 Peterborough, NH 03458

Peterborough, NH Office
 Inside Sales FAX: 603-924-2683
 Advertising FAX: 603-924-7507

International Advertising Sales Staff:

Uwe Kretschmar, European Advertising and Marketing Manager, BYTE Publications, McGraw-Hill Publishing Co., Wimbledon Bridge House, One Hartfield Road, Wimbledon, London, SW19 3RU, England, Tel: 44 81 543 1234, Fax: 44 81 540 3833

GERMANY
 Uwe Kretschmar (44-81-543-6268)
UNITED KINGDOM
 Roz Weyman (44-81-543-6269)
 McGraw-Hill Publishing Co.
 Wimbledon Bridge House
 One Hartfield Road
 Wimbledon, London SW19 3RU
 England
 Tel: 44 81 543 1234
 FAX: 44 81 540 3833
 TELEX: 892191

FRANCE, ITALY
 Zena Coupé, Amanda Blaskett
 A-Z International Sales Ltd.
 4 Ashmount Road, Hornsey Lane
 Highgate, London N19 3BH
 England
 Tel: 44 71 281 4116
 FAX: 44 71 281 8224

ISRAEL
 Dan Ehrlich
 Ehrlich Communication International
 P. O. Box 11297
 Tel Aviv 61112
 Israel
 Tel: (972) 3 449823
 FAX: (972) 3 5468168

JAPAN
 Masaki Mori
 McGraw-Hill Publishing Co.
 Overseas Corp.
 Room 1528
 Kasumigaseki Bldg.
 3-2-5 Kasumigaseki,
 Chiyoda-Ku
 Tokyo 100, Japan
 Tel: 81 3 581 9811
 FAX: 81 3 581 4018

HONG KONG
 Stephen Marcopoto
 Seavex Ltd.
 503 Wilson House
 19-27 Wyndham St.
 Central, Hong Kong
 Tel: 852-868-2010
 Telex: 60904 SEVEX HX
 FAX: 852 810 1283

SINGAPORE
 Paul Zanowski
 Seavex Ltd.
 400 Orchard Road, #10-01
 Singapore 0923
 Republic of Singapore
 Tel: 65 734 9790
 Telex: RS35539 SEAVEX
 FAX: 65 732 5129

TAIWAN
 Nancy Yin
 The Third Wave Publishing Corp.
 977 Min Shen E. Road, 1-4 Flr.
 Taipei 10581, Taiwan ROC
 Tel: 886 2 763 0052
 Fax: 886 2 765 6874

BENELUX
 Frank Tanis
 Batenburg 103
 3437 AB Nieuwegein
 The Netherlands
 Tel: 31 34 02 49496
 FAX: 31 34 02 37944

REQUEST FREE PRODUCT INFORMATION BY FAX

Just fax this page to 1-413-637-4343. Save time because your request for information will be processed *immediately*.

1 Circle the numbers below which correspond to the numbers assigned to advertisers and products that interest you.

2 Check off the answers to questions "A" through "E".

3 Print your name, address, and fax number clearly on the form.

4 Remove this page or copy this page clearly and fax it to the number above.

Fill out this coupon carefully. PLEASE PRINT.

Name _____
 Title _____
 Company _____
 Address _____
 City _____
 State/Province _____ Zip _____
 Country _____ () _____ () _____
 Phone Number _____ Fax Number _____

A. What is your primary job function/principal area of responsibility? (Check one.)

- 1 MIS/DP
- 2 Programmer/Systems Analyst
- 3 Administration/Management
- 4 Sales/Marketing
- 5 Engineer/Scientist
- 6 Other

B. What is your level of management responsibility?

- 7 Senior-level
- 8 Middle-level
- 9 Professional

C. Are you a reseller (VAR, VAD, Dealer, Consultant)?

- 10 Yes
- 11 No

D. What operating systems are you currently using? (Check all that apply.)

- 12 PC/MS-DOS
- 13 DOS + Windows
- 14 OS/2
- 15 UNIX
- 16 MacOS
- 17 VAX/VMS

E. For how many people do you influence the purchase of hardware or software?

- 18 1-25
- 19 26-50
- 20 51-99
- 21 100 or more

Inquiry Numbers 1-495

Inquiry Numbers 496-990

Inquiry Numbers 991-1479

1	2	3	4	5	6	7	8	9	10	11	496	497	498	499	500	501	502	503	504	505	506	991	992	993	994	995	996	997	998	999	1000	1001
12	13	14	15	16	17	18	19	20	21	22	507	508	509	510	511	512	513	514	515	516	517	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012
23	24	25	26	27	28	29	30	31	32	33	518	519	520	521	522	523	524	525	526	527	528	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023
34	35	36	37	38	39	40	41	42	43	44	529	530	531	532	533	534	535	536	537	538	539	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034
45	46	47	48	49	50	51	52	53	54	55	540	541	542	543	544	545	546	547	548	549	550	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045
56	57	58	59	60	61	62	63	64	65	66	551	552	553	554	555	556	557	558	559	560	561	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056
67	68	69	70	71	72	73	74	75	76	77	562	563	564	565	566	567	568	569	570	571	572	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067
78	79	80	81	82	83	84	85	86	87	88	573	574	575	576	577	578	579	580	581	582	583	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078
89	90	91	92	93	94	95	96	97	98	99	584	585	586	587	588	589	590	591	592	593	594	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089
100	101	102	103	104	105	106	107	108	109	110	595	596	597	598	599	600	601	602	603	604	605	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100
111	112	113	114	115	116	117	118	119	120	121	606	607	608	609	610	611	612	613	614	615	616	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111
122	123	124	125	126	127	128	129	130	131	132	617	618	619	620	621	622	623	624	625	626	627	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122
133	134	135	136	137	138	139	140	141	142	143	628	629	630	631	632	633	634	635	636	637	638	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133
144	145	146	147	148	149	150	151	152	153	154	639	640	641	642	643	644	645	646	647	648	649	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144
155	156	157	158	159	160	161	162	163	164	165	650	651	652	653	654	655	656	657	658	659	660	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155
166	167	168	169	170	171	172	173	174	175	176	661	662	663	664	665	666	667	668	669	670	671	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166
177	178	179	180	181	182	183	184	185	186	187	672	673	674	675	676	677	678	679	680	681	682	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177
188	189	190	191	192	193	194	195	196	197	198	683	684	685	686	687	688	689	690	691	692	693	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188
199	200	201	202	203	204	205	206	207	208	209	696	695	696	697	698	699	700	701	702	703	704	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199
210	211	212	213	214	215	216	217	218	219	220	705	706	707	708	709	710	711	712	713	714	715	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210
221	222	223	224	225	226	227	228	229	230	231	716	717	718	719	720	721	722	723	724	725	726	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221
232	233	234	235	236	237	238	239	240	241	242	727	728	729	730	731	732	733	734	735	736	737	1222	1223	1224	1225	1226	1227	1228	1229	1230	1231	1232
243	244	245	246	247	248	249	250	251	252	253	738	739	740	741	742	743	744	745	746	747	748	1233	1234	1235	1236	1237	1238	1239	1240	1241	1242	1243
254	255	256	257	258	259	260	261	262	263	264	749	750	751	752	753	754	755	756	757	758	759	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254
265	266	267	268	269	270	271	272	273	274	275	760	761	762	763	764	765	766	767	768	769	770	1255	1256	1257	1258	1259	1260	1261	1262	1263	1264	1265
276	277	278	279	280	281	282	283	284	285	286	771	772	773	774	775	776	777	778	779	780	781	1266	1267	1268	1269	1270	1271	1272	1273	1274	1275	1276
287	288	289	290	291	292	293	294	295	296	297	782	783	784	785	786	787	788	789	790	791	792	1277	1278	1279	1280	1281	1282	1283	1284	1285	1286	1287
298	299	300	301	302	303	304	305	306	307	308	793	794	795	796	797	798	799	800	801	802	803	1288	1289	1290	1291	1292	1293	1294	1295	1296	1297	1298
309	310	311	312	313	314	315	316	317	318	319	804	805	806	807	808	809	810	811	812	813	814	1299	1300	1301	1302	1303	1304	1305	1306	1307	1308	1309
320	321	322	323	324	325	326	327	328	329	330	815	816	817	818	819	820	821	822	823	824	825	1310	1311	1312	1313	1314	1315	1316	1317	1318	1319	1320
331	332	333	334	335	336	337	338	339	340	341	826	827	828	829	830	831	832	833	834	835	836	1321	1322	1323	1324	1325	1326	1327	1328	1329	1330	1331
342	343	344	345	346	347	348	349	350	351	352	837	838	839	840	841	842	843	844	845	846	847	1332	1333	1334	1335	1336	1337	1338	1339	1340	1341	1342
353	354	355	356	357	358	359	360	361	362	363	848	849	850	851	852	853	854	855	856	857	858	1343	1344	1345	1346	1347	1348	1349	1350	1351	1352	1353
364	365	366	367	368	369	370	371	372	373	374	859	860	861	862	863	864	865	866	867	868	869	1354	1355	1356	1357	1358	1359	1360	1361	1362	1363	1364
375	376	377	378	379	380	381	382	383	384	385	870	871	872	873	874	875	876	877	878	879	880	1365	1366	1367	1368	1369	1370	1371	1372	1373	1374	1375
386	387	388	389	390	391	392	393	394	395	396	881	882	883	884	885	886	887	888	889	890	891	1376	1377	1378	1379	1380	1381	1382	1383	1384	1385	1386
397	398	399	400	401	402	403	404	405	406	407	892	893	894	895	896	897	898	899	900	901	902	1387	1388	1389	1390	1391	1392	1393	1394	1395	1396	1397
408	409	410	411	412	413	414	415	416	417	418	903	904	905	906	907	908	909	910	911	912	913	1398	1399	1400	1401	1402	1403	1404	1405	1406	1407	1408
419	420	421	422	423	424	425	426	427	428	429	914	915	916	917	918	919	920	921	922	923	924	1409	1410	1411	1412	1413	1414	1415	1416	1417	1418	1419
430	431	432	433	434	435																											

FREE

PRODUCT INFORMATION

Want More Information About the Products and Advertisers Featured in this Issue?

- 1** Circle numbers on reply card which correspond to numbers assigned to items of interest to you.
- 2** Check all the appropriate answers to questions "A" through "E".
- 3** Print your name and address and mail.

Fill out this coupon carefully. PLEASE PRINT.

Name _____ ()
 Title _____ Phone _____
 Company _____
 Address _____
 City _____ State _____ Zip _____

A. What is your primary job function/principal area of responsibility? (Check one.)

- 1 MIS/DP
- 2 Programmer/Systems Analyst
- 3 Administration/Management
- 4 Sales/Marketing
- 5 Engineer/Scientist
- 6 Other

B. What is your level of management responsibility?

- 7 Senior-level
- 8 Middle-level
- 9 Professional

C. Are you a reseller (VAR, VAD, Dealer, Consultant)?

- 10 Yes
- 11 No

D. What operating systems are you currently using? (Check all that apply.)

- 12 PC/MS-DOS
- 13 DOS + Windows
- 14 OS/2
- 15 UNIX
- 16 MacOS
- 17 VAX/VMS

E. For how many people do you influence the purchase of hardware or software?

- 18 1-25
- 19 26-50
- 20 51-99
- 21 100 or more

Please send me one year of BYTE Magazine for \$24.95 and bill me. Offer valid in U.S. and possessions only.

SEPTEMBER
IRSD002

Inquiry Numbers 1-493

Inquiry Numbers 494-966

Inquiry Numbers 967-1479

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	1238	1239	1240	1241	1242	1243	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254	1255	1256	1257	1258	1259	1260	1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272	1273	1274	1275	1276	1277	1278	1279	1280	1281	1282	1283	1284	1285	1286	1287	1288	1289	1290	1291	1292	1293	1294	1295	1296	1297	1298	1299	1300	1301	1302	1303	1304	1305	1306	1307	1308	1309	1310	1311	1312	1313	1314	1315	1316	1317	1318	1319	1320	1321	1322	1323	1324	1325	1326	1327	1328	1329	1330	1331	1332
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

FREE

PRODUCT INFORMATION

Want More Information About the Products and Advertisers Featured in this Issue?

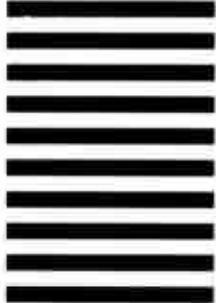
1 Circle numbers on reply card which correspond to numbers assigned to items of interest to you.

2 Check all the appropriate answers to questions "A" through "E".

3 Print your name and address and mail.



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 176 PITTSFIELD, MA

POSTAGE WILL BE PAID BY ADDRESSEE



READER SERVICE
PO Box 5110
Pittsfield, MA 01203-9926
USA



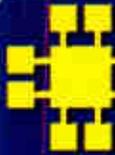
Fill out this coupon carefully. PLEASE PRINT.

Name _____
Title _____ () Phone _____
Company _____
Address _____
City _____ State _____ Zip _____

- A. What is your primary job function/principal area of responsibility? (Check one.)**
- 1 MIS/DP
 - 2 Programmer/Systems Analyst
 - 3 Administration/Management
 - 4 Sales/Marketing
 - 5 Engineer/Scientist
 - 6 Other
- B. What is your level of management responsibility?**
- 7 Senior-level
 - 8 Middle-level
 - 9 Professional
- C. Are you a reseller (VAR, VAD, Dealer, Consultant)?**
- 10 Yes
 - 11 No

- D. What operating systems are you currently using? (Check all that apply.)**
- 12 PC/MS-DOS
 - 13 DOS + Windows
 - 14 OS/2
 - 15 UNIX
 - 16 MacOS
 - 17 VAX/VMS
- E. For how many people do you influence the purchase of hardware or software?**
- 18 1-25
 - 19 26-50
 - 20 51-99
 - 21 100 or more
- Please send me one year of BYTE Magazine for \$24.95 and bill me. Offer valid in U.S. and possessions only.
- SEPTEMBER**
IRSD002

Inquiry Numbers 1-493																Inquiry Numbers 494-986																Inquiry Numbers 987-1479																		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003
18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020
35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037
52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054
69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071
86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088
103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105
120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122
137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139
154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156
171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173
188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190
205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207
222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224
239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	1238	1239	1240	1241
258	259	260	261	262	263	264	265	266	267	268	269	270	271	272			749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	1242	1243	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254	1255	1256	1257	1258
273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	1259	1260	1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272	1273	1274	1275
290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	1276	1277	1278	1279	1280	1281	1282	1283	1284	1285	1286	1287	1288	1289	1290	1291	1292
307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	1293	1294	1295	1296	1297	1298	1299	1300	1301	1302	1303	1304	1305	1306	1307	1308	1309
324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	1310	1311	1312	1313	1314	1315	1316	1317	1318	1319	1320	1321	1322	1323	1324	1325	1326
341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	1327	1328	1329	1330	1331	1332	1333	1334	1335	1336	1337	1338	1339	1340	1341	1342	1343
358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	1344	1345	1346	1347	1348	1349	1350	1351	1352	1353	1354	1355	1356	1357	1358	1359	1360
375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	1361	1362	1363	1364	1365	1366	1367	1368	1369	1370	1371	1372	1373	1374	1375	1376	1377
392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	1378	1379	1380	1381	1382	1383	1384	1385	1386	1387	1388	1389	1390	1391	1392	1393	1394
409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	1395	1396	1397	1398	1399	1400	1401	1402	1403	1404	1405	1406	1407	1408	1409	1410	1411
426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	919	920	921	922	923	924	925	926	927	928	929																							



JDR Microdevices®

2233 BRANHAM LANE, SAN JOSE CA 95124

- BUY WITH CONFIDENCE FROM JDR!
- 30-DAY MONEY BACK GUARANTEE
- 1 YEAR WARRANTY
- TOLL-FREE TECH SUPPORT

DYNAMIC RAMS

PART#	SIZE	SPEED	PINS	PRICE
4116-150	16384x1	150ns	16	1.49
4164-150	65536x1	150ns	16	2.49
4164-120	65536x1	120ns	16	2.89
4164-100	65536x1	100ns	16	3.39
TMS4464-12	65536x4	120ns	16	3.95
41256-150	262144x1	150ns	16	2.59
41256-120	262144x1	120ns	16	2.95
41256-100	262144x1	100ns	16	3.15
41256-80	262144x1	80ns	16	3.75
414256-100	262144x4	100ns	20	12.95
414256-80	262144x4	80ns	20	13.45
1MB-120	1048576x1	120ns	18	11.95
1MB-100	1048576x1	100ns	18	12.35
1MB-80	1048576x1	80ns	18	12.95

SIMM/SIP MODULES

PART#	SIZE	SPEED	FOR	PRICE
41256A9B-12	256K x 9	120ns	SIMM/PC	36.95
41256A9B-80	256K x 9	80ns	SIMM/PC	49.95
421000A8B-10	1MB x 8	100ns	SIMM/MAC	109.95
421000A9B-10	1MB x 9	100ns	SIMM/PC	113.95
421000A9B-80	1MB x 9	80ns	SIMM/PC	119.95
256K9SIP-80	256K x 9	80ns	SIP/PC	54.95
256K9SIP-60	256K x 9	60ns	SIP/PC	64.95
1MBX9SIP-80	1MB x 9	80ns	SIP/PC	124.95

MATH CO-PROCESSORS

8-BIT CO-PROCESSORS

8087	5 MHz	89.95
8087-2	8 MHz	129.95
8087-1	10 MHz	169.95

16-BIT CO-PROCESSORS

80287	6 MHz	139.95
80287-8	8 MHz	209.95
80287-10	10 MHz	239.95
80C827	12MHz	299.95

32-BIT CO-PROCESSORS

80387-16	16 MHz	359.95
80387-SX	16 MHz	319.95
80387-20SX	16MHz	399.95
80387-20	20 MHz	399.95
80387-25	25 MHz	499.95
80387-33	33MHz	649.00

intel 5 YEAR WARRANTY
WITH MANUAL & SOFTWARE GUIDE



NEW! THE ULTIMATE IN 287'S!
80287-XLT\$247.95
FOR COMPAQ LTE/286 TANDY 2800
80287-XL\$247.95
FOR ALL OTHER 286-BASED SYSTEMS

IIT ADVANCED CO-PROCESSORS

INTEL COMPATIBLE! FASTER CALCULATION AND LOWER POWER CONSUMPTION! 2087 AVG. 1.8 X FASTER THAN 80287 (BYTE SEPT. 1987).

16-BIT CO-PROCESSORS

2C87-10	10 MHz	\$239.95
2C87-12	12 MHz	299.95
2C87-20	20 MHz	349.95

32-BIT CO-PROCESSORS

3C87-16	10 MHz	\$359.95
3C87-20	12 MHz	399.95
3C87-25	20 MHz	499.95
3C87-33	20 MHz	649.95

CYRIX CO-PROCESSORS

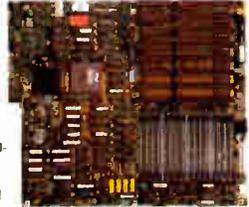
NEW STATE-OF-THE-ART MATH CO-PROCESSORS SAVE YOU LONGEVITY WORRIES! WITH MANUAL & SOFTWARE GUIDE, FULL UNCONDITIONAL 5-YEAR GUARANTEE!

83D87-16	16 MHz	\$299.95	83D87-33	33MHz	549.99
83D87-20	20 MHz	349.95	83D87-16 (SX)	16MHz	269.95
83D87-25	25MHz	439.95	83S87-20 (SX)	20MHz	329.95

A.I.R. 486 MOTHERBOARD!

new!

LANDMARK AT SPEED 113.2 MHz

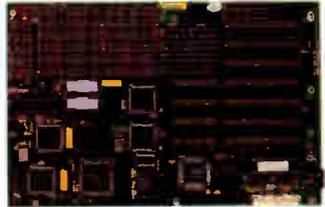
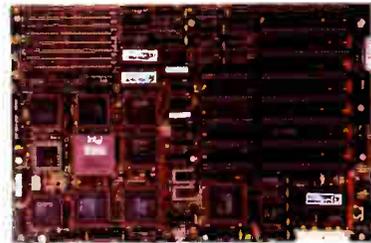


FOR CAD/CAM/CAE WORKSTATIONS, LAN APPLICATIONS, MULTI-TASKING AND MULTI-USER APPLICATIONS. REQ. UNIX OR XENIX!

- 25MHz • BASED ON INTEL 80486 PROCESSOR • SOCKETED FOR WEITEK 4167 MATH CO-PROCESSOR • 8K OF INTERNAL RAM CACHE
- SUPPORTS SHADOW RAM WITH AN INTERNAL CACHE CONTROLLER • EXPANDABLE TO 4, 8 OR 16MB USING 256K OR 1MB SIMMS (OK ON-BOARD) • EIGHT 16-BIT BUS SLOTS • 6 LAYER BOARD DESIGN

AIR-486MB25\$2,999.00

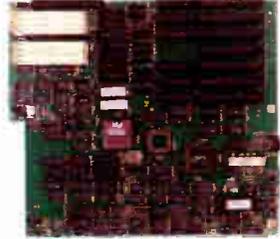
YOUR MOTHERBOARD CONNECTION!



MINI 25MHZ 386 \$799

- NORTON SI 26.6 • LANDMARK AT SPEED 30.1
- MEMORY INTERLEAVING FOR NEAR ZERO WAIT STATES
- SOCKETED FOR 80387 COPROCESSOR
- USES 80NS 256K OR 1MB SIMM DIP RAMS
- 16MB RAM CAPACITY: 8MB ON BOARD, 8MB USING OPTIONAL RAM CARD (OKB INSTALLED)
- ON-BOARD RAM: 1/2MB USING 4/8 256K SIMMS OR 4/6MB USING 4/8 1MB SIMMS • FIVE 15-BIT SLOTS, TWO 8-BIT SLOTS ONE 32 BIT SLOT FOR PROPRIETARY RAM CARD
- AMI BIOS • SIZE 8.5" X 13"

MCT-M386-25
"SELECTED AS TOP PERFORMER" BY BYTE MAG., APRIL 1990
MCT-M386-M25 PROPRIETARY RAM CARD\$99.95
1/2MB USING 36/72 256KX1 DRAMS OR 4/8MB USING 36/72 1MBX1 DRAMS



33MHZ CACHE 386 \$1495

- NORTON SI 45.9 • LANDMARK AT SPEED 50.8
- 33MHZ 80386 CPU • 64K ZERO WAIT STATIC RAM CACHE
- 1/2 4MB ON-BOARD RAM USING 80NS SIMMS (OKB INSTALLED)
- 1/2MB USING 4/8 256K SIMMS OR 4/8MB USING 4/8 1MB SIMMS • SOCKETED FOR 80387-33 MATH CO-PROCESSOR
- 8 EXPANSION SLOTS (ONE 32-BIT, SIX 16-BIT, ONE 8-BIT)
- AMI BIOS ASSURES IBM COMPATIBILITY
- 8/33MHZ KEYBOARD ADJUSTABLE SPEEDS

MCT-386MBC-33\$1495.00
MCT-386MBC-25 25MHZ VERSION\$999.00

MINI 25MHZ CACHE 386 \$1299

- NORTON SI 30.5 • LANDMARK AT SPEED 40.7
- 25MHZ 80386 • REQUIRES 1 OF THE RAM CARDS BELOW
- SHADOW RAM FOR ROM BIOS
- MEMORY CACHING FOR SUPERIOR PERFORMANCE
- MEMORY INTERLEAVING FOR NEAR 0 WAIT STATE OPERATION (8 BANKS OF MEMORY REQUIRED)
- SOCKETED FOR 80387 OR WEITEK 3167 COPROCESSORS

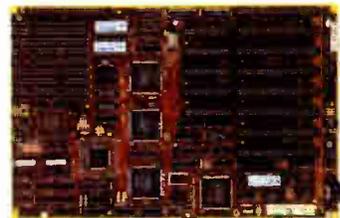
MCT-C386-25\$1199.00
RAM CARDS (ONE REQUIRED FOR OPERATION):
1/2 4MB USING 8/16/32 256KX4 DRAMS AND 4/8/16 256KX1 DRAMS (OK INSTALLED)
MCT-C386-M4\$99.95
1/2MB USING 46/72 256KX1 DRAMS OR 4/8MB USING 36/72 1MBX1 DRAMS (OK INST)
MCT-C386-M8\$99.95
1/2 4MB USING 4/8/16 256K SIMMS, 4/8/16MB USING 4/8/16 1MB SIMMS OR TO 8MB USING 8 1MB SIMMS AND 8 256K SIMMS (OK INSTALLED)
MCT-C386-M16\$99.95

CALL FOR A COPY OF OUR NEW CATALOG!

12.5MHZ 286 \$199.95

- NORTON SI 14.3 • LANDMARK AT SPEED 16.5
- STANDARD 9088 LAYOUT
- 286-COMPATIBLE • 6/12.5MHZ KEYBOARD SELECT SPEEDS
- EXPANDABLE TO 4MB ON BOARD, 512K/1MB USING 18/36 256KX1 DRAMS; 2/4MB USING 18/36 1MBX1 DRAMS (OKB INSTALLED)
- MEMORY SPEED: 120NS FOR 1 WAIT, 100NS FOR 0 WAIT

MCT-M286-12\$199.95



16MHZ MINI 386-SX \$399.95

- NORTON SI 15.3 • LANDMARK AT SPEED 20.8
- USES 16MHZ INTEL 60386SX CPU
- EXPANDABLE TO 8MB ON BOARD
- 512K/1MB USING 18/36 256KX1 DRAMS OR 2/4 256K SIPS OR 4/8 256KX4 AND 3/4 256KX1 DRAMS, 2/4MB USING 18/36 1MBX1 DRAMS OR 2/4 1MB SIPS; 6/8MB USING 36 1MBX1 DRAMS AND 2/4 1MB SIPS AMI BIOS
- CHOOSE FAST 0 WAIT STATE OR 1 WAIT STATE FOR ECONOMICAL USE OF SLOWER RAM
- FIVE 16-BIT & THREE 8-BIT EXPANSION SLOTS
- CHIPS & TECHNOLOGY NEW ENHANCED ADVANCED TECHNOLOGY (NEAT) CHIPSET
- SOCKET FOR 80387SX 15 COPROCESSOR
- 8.5 X 13" SIZE FITS IN MINI-286 AND FULL SIZE 286 CASES

MCT-386SX\$399.95

20MHZ 286 \$389.95

- NORTON SI 20.3 • LANDMARK AT SPEED 26.3
- NEAT CHIPSET HAS POWER TO COMPETE WITH 386 SYSTEMS
- EXPANDABLE FROM 512K TO 8MB, 512K/1MB USING 18/36 256KX1 DRAMS OR 2/4 256K SIPS; 2/4MB USING 18/36 1MBX1 DRAMS OR 2/4 1MB SIPS; 6/8MB USING 36 1MBX1 DRAMS AND 2/4 1MB SIPS
- 20/10MHZ KEYBOARD SELECTABLE SPEEDS • AMI BIOS
- SHADOW RAM AND PAGE INTERLEAVED MEMORY
- FAST 0 WAIT STATE OR 1 WAIT STATE FOR SLOWER RAM
- 8.5" X 13" FITS MOST 3088, MINI-286 & FULL SIZE 286 CASES
- FIVE 16 BIT & THREE 8-BIT SLOTS
- SOCKET FOR 80287 12 MATH CO-PROCESSOR

MCT-M286-20N\$389.95

16MHZ 286 W/NEAT CHIPSET \$289.95

MCT-M286-16N NORTON SI 16.2 / LANDMARK AT 21.1

12MHZ 286 W/NEAT CHIPSET \$269.95

MCT-M286-12N NORTON SI 12.0 / LANDMARK AT 15.5

10MHZ 8088 NORTON SI 2.1 \$99.95

- 8088-COMPATIBLE, OPERATES AT 4.77/10MHZ
- KEYBOARD SELECTABLE CLOCK SPEEDS • SOCKET FOR 8087-1 COPROCESSOR • 8 SLOTS • MCT BIOS • 640K RAM CAPACITY (OKB INST.)

MCT-TURBO-10\$99.95

CUSTOMER SERVICE 800-538-5001
TECHNICAL SUPPORT 800-538-5002

MON.-FRI. 7 A.M. TO 5 P.M., SATURDAY, 9 A.M. TO 3 P.M. (PST)

ORDER TOLL-FREE 800-538-5000

KEY CODE 10



JDR Microdevices®

ORDER TOLL-FREE 800-538-5000 KEY CODE 10

- BUY WITH CONFIDENCE FROM JDR!
- 30-DAY MONEY BACK GUARANTEE
- 1 YEAR WARRANTY
- TOLL-FREE TECH SUPPORT

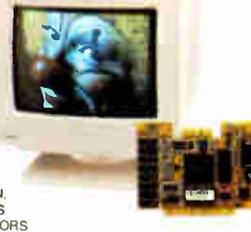
MONITORS

VGA PACKAGE
\$499.95

VGA COLOR AND CLARITY AT AN EGA PRICE! • 8-BIT VGA CARD IS FULLY COMPATIBLE WITH IBM VGA • 720 X 540 MAXIMUM RESOLUTION, 640 X 480 IN 16 COLORS • 528 X 480 IN 256 COLORS • HIGH RESOLUTION ANALOG MONITOR • EGA/CGA MONO AND HERCULES COMPATIBLE • DRIVERS FOR WINDOWS, GEM, 1-2-3, SYMPHONY, AUTOCAD & VENTURA

VGA-PKG-8 \$499.95

16-BIT VGA PACKAGE
16-BIT VERSION INCLUDES MCT-VGA 16
VGA-PKG-16 \$529.00



RELISYS MULTISYNCH \$429.95
• 14" NON-GLARE SCREEN • 800 X 560 MAX RESOLUTION • CGA/EGA/VGA COMPATIBLE • TTL/ANALOG MODE
JDR-MULTI

RELISYS VGA MONITOR \$379.95
• 14" ANALOG VGA MONITOR • GLARE RESISTANT SCREEN • 720 X 480 MAXIMUM RESOLUTION • TILT SWIVEL BASE
VGA-MONITOR

EGA MONITOR \$339.95
• 14" NON-GLARE SCREEN WITH 640 X 350 MAXIMUM RESOLUTION • DISPLAY 16 COLORS SIMULTANEOUSLY
EGA-MONITOR

14" SCREEN MONO \$139.95
• GLARE-RESISTANT 14" SCREEN WITH AMBER DISPLAY • 720 X 350 RESOLUTION • TILT SWIVEL BASE
GM-1489

MONO-SAMSUNG SAMSUNG 12" FLAT SCREEN \$129.95
JDR-MONO 12" MONO WITH GREEN SCREEN \$69.95
MONO-VGA PAPERWHITE VGA MONITOR \$139.95
NEC-MULTI-3D NEC MULTI-3D MULTISYNCH \$649.00
CM-1440 SEIKO DJAL FIXED FREQUENCY \$599.00
TAXAN-P DUAL PAGE MONO MONITOR & CARD \$1499.00

Littlefoot™ CASE \$249.95

• ACCOMMODATES ALL MOTHERBOARDS
• INCLUDES 250 WATT POWER SUPPLY
• MOUNTS FOR 3 FLOPPY AND 4 HARD DRIVES
• TURBO AND RESET SWITCHES
• SPEED DISPLAY, POWER, DISK LEADS
• MOUNTING HARDWARE
FACEPLATES AND SPEAKER INCLUDED

CASE-100 \$249.95
CASE-200 "SUPERFOOT"-HOLDS 11 DRIVES \$499.95
CASE-120 "MINIFOOT" W/200 WATT PS \$199.95



STANDARD CASES

FULL SIZE SLIDE CASE
CASE-70 \$89.95

CASE-50 FOR 8088 OR MINI-86 MOTHERBOARDS \$59.95
CASE-FLIP FLIP TOP XT STYLE CASE \$39.95
CASE-SLIDE SLIDE TYPE XT-STYLE CASE \$39.95
CASE-JR \$149.95
WITH 150W POWER SUPPLY FOR 8088 OR MINI 286 BOARDS
CASE-JR-200 \$189.95
WITH 200W POWER SUPPLY FOR 8088 OR MINI 286 BOARDS
NOTE: CASES DO NOT INCLUDE DRIVES.



PC POWER SUPPLIES

PS-135 1.5 WATT FOR 8088 - U.L. APPROVED \$59.95
PS-150 150 WATT FOR 8088 - U.L. APPROVED \$69.95
PS-200X 200 WATT FOR 8088 - U.L. APPROVED \$89.95
PS-200 200 WATT FOR 8088 - U.L. APPROVED \$89.95
PS-250 250 WATT FOR 286/386 \$129.95

UNINTERRUPTABLE POWER SUPPLIES

CONDITIONED CRITICAL LOAD BACK-UP DURING BLACKOUT

PART NO.	VA FREQ.	CURRENT	BATTERY	PRICE
EMERSON-20	300 60hz	2.50A	10min.	\$299.95
EMERSON-30	500 60hz	4.20A	10min.	\$499.95
EMERSON-40	800 60hz	6.70A	10min.	\$699.95

POST CODE DIAGNOSES SYSTEM PROBLEMS!

TO DIAGNOSE, PLUG IT INTO A CARD SLOT, READ THE INDICATOR DISPLAY & CHECK THE MANUAL FOR THE CORRESPONDING POWER-ON SELF TEST CODE COMPATIBLE W/ 80286 & 80386 BASED SYSTEMS

PCODE \$49.95
PCODE WITH OA PLUS \$69.95



DISPLAY CARDS

16-BIT VGA \$169.95
• 640 X 480 IN 16 COLORS • 256K VIDEO RAM EXPANDABLE TO 512K • 64 LEVELS OF GRAY SCALE
MCT-VGA-16
MCT-VGA-8 8 BIT VERSION \$149.95
MCT-VGA-1024 1024X768 INTERLACED VGA \$189.95
MCT-VGA VGA WITH TTL SUPPORT \$189.95

MONO GRAPHICS/PRINTER \$49.95
8088/286 COMPATIBLE • HERCULES COMPATIBLE MONOGRAPHICS • SUPPORTS LOTUS 1-2-3 • 720 X 348 DISPLAY • ADDRESS PARALLEL PRINTER PORT AS LPT1 OR 2
MCT-MGP

OTHER DISPLAY CARDS

MCT-MG 8-BIT MONO W/OPTIONAL SERIAL PORT \$79.95
MCT-MG AIO 286 MONO WITH SER PAR GAME \$99.95
MCT-CGP CGA GRAPHICS FOR RGB MONITOR \$49.95
MCT-EGA EGA CARD WITH 256K RAM \$149.95

CABLES AND GENDER CHANGERS

MOLDED; GOLD-PLATED CONTACTS; 100% SHIELDED

CBL-PRNTR-25 25 FT. PC PRINTER CABLE 15.95
CBL-PRNTR-RA RIGHT ANGLE PRINTER CABLE 15.95
CBL-DB25-MM DB25 MALE-DB25 MALE 6 FT 9.95
CBL-DB25-MF DB25 MALE-DB25 FEMALE 6 FT 9.95
CBL-9-SERIAL DB9 FEMALE-DB25 MALE 6 FT 6.95
CBL-CNT-MM 36 PIN CENTRONICS -MM 14.95
GENDER-VGA DB9 DB15 ADAPTOR 8.95
HUNDREDS MORE AVAILABLE - CALL FOR MORE INFO

DEVELOPERS' WORLD

JDR caters to the developer with a full line of prototyping and programming products. Here are just a few examples. Request our catalog for our complete line!



SOLDERLESS BREADBOARD CARDS

• LOGICALLY GROUPED • ACCESSES ALL I/O SIGNAL CONNECTIONS • ACCEPTS 9, 15, 19, 25 OR 37-PIN D-SUBS
PDS-600 8-BIT \$49.95 PDS-610 16 BIT \$59.95

ABOVE CARDS WITH DECODE

• INCLUDES ADDRESS DECODING LOGIC, DATA BUFFERING, 2LSI CIRCUITS FOR PROGRAMMABLE DIGITAL I/O AND COUNTER-TIMER FUNCTIONS
PDS-601 8-BIT \$79.95 PDS-611 16 BIT \$89.95



PROTOTYPE CARDS

JDR-PR1 8-BIT WITH +5V AND GROUND PLANE 27.95
JDR-PR2 ABOVE WITH I/O DECODING LAYOUT 29.95
JDR-PR2-PK PARTS KIT FOR JDR-PR2 ABOVE 8.95
JDR-PR10 16 BIT WITH I/O DECODING LAYOUT 34.95
JDR-PR10-PK PARTS KIT FOR JDR-PR10 ABOVE 12.95

EPROMS

PART#	SIZE	SPEED	Vpp	PINS	PRICE
27116-1	2048x8	350ns	25V	24	3.95
2732A	4096x8	250ns	21V	24	3.95
2764	8192x8	450ns	12.5V	28	3.49
2764-250	8192x8	250ns	12.5V	28	3.69
2764-200	8192x8	200ns	12.5V	28	4.25
27128	16384x8	250ns	12.5V	28	4.25
27128A-200	16384x8	200ns	12.5V	28	5.95
27256	32768x8	250ns	12.5V	28	4.95
27C256	32768x8	250ns	12.5V	28	5.95
27512	65536x8	250ns	12.5V	28	7.95
27C101-20	131072x8	200ns	12.5V	32	24.95

EPROM PROGRAMMER \$129.95

• PROGRAMS 27XX AND 27XXX EPROMS UP TO 27512 • SPLIT OR COMBINE CONTENTS OF SEVERAL DIFFERENT SIZED EPROMS (VARIOUS FORMATS AND VOLTAGES) • READ, WRITE, COPY, BLANK CHECK AND VERIFY • HEX AND INTEL HEX FORMATS SOFTWARE
MOD-EPROM



DATARASE II EPROM ERASER \$39.95

• SMALL SIZE! • ERASES ALL SIZE EPROMS UP TO 4 AT A TIME - MOST IN 3 MINUTES • WALL PLUG POWER SUPPLY
DATARASE II



MODULAR PROGRAMMING SYSTEM

EACH MODULE IN THIS SYSTEM USES A COMMON HOST ADAPTOR CARD, SO YOU CAN USE JUST ONE SLOT TO PROGRAM EPROMS, PROMS, PALS & MORE!

COMMON HOST ADAPTOR CARD \$29.95

• UNIVERSAL INTERFACE FOR ALL THE PROGRAMMING MODULES!
• SELECTABLE ADDRESSES
PREVENTS CONFLICTS
• MOLDED CABLE
MOD-MAC



UNIVERSAL MODULE \$499.95

• PROGRAMS EPROMS, EEPROMS, PALS, BI-POLAR PROMS, 8748 & 8751 SERIES DEVICES; 16V8 AND 20V8 GALS (GENERAL-IC ARRAY LOGIC) FROM LATTICE, NS, SGS • TESTS TTL, CMOS, DYNAMIC & STATIC RAMS
• LOAD DISK, SAVE DISK, EDIT, BLANK CHECK, PROGRAM, AUTO, READ MASTER, VERIFY AND COMPARE • TEXT TOOL SOCKET FOR 3" TO .6" WIDE C'S (8-40 PINS)
MOD-MUP
MOD-MUP-EA 4-UNIT ADAPTOR \$99.95



EPROM MODULE \$119.95

• PROGRAMS 24-32 PIN EPROMS, CMOS EPROMS & EEPROMS FROM 16K TO 1624K • HEX TO OBJ CONVERTER • AUTO BLANK CHECK/PROGRAM/VERIFY • VPP 5, 12.5, 12.75, 13, 21 & 25 VOLTS • NORMAL, INTELLIGENT, INTERACTIVE & QUICK PULSE PROGRAMMING ALGORITHMS
MOD-MEP
MOD-MEP-4 4-EPROM PROGRAMMER \$169.95
MOD-MEP-8 8-EPROM PROGRAMMER \$259.95
MOD-MEP-16 16-EPROM PROGRAMMER \$499.95

PAL MODULE \$249.95

• PROGRAMS MMI, NS, TI 20 & TI 24 PIN DEVICES • BLANK CHECK PROGRAM, AUTO, READ MASTER, VERIFY & SECURITY FUSE BLOW
MOD-MPL

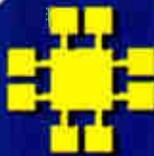
OTHER MODULES

MOD-MMP MICROPROCESSOR PROGRAMMER \$179.95
MOD-MIC DIGITAL IC & MEMORY TESTER \$129.95
MOD-MBP BI-POLAR PROM PROGRAMMER \$259.95

PAL DEVELOPMENT SOFTWARE \$99.95

ENTRY-LEVEL PAL DEVELOPMENT FROM CUPL. FULL SUPPORT FOR 16L8, 16R4, 16R6, 16R8, 20L8, 20R4, 20R8 AND 20X8.
MOD-MPL-SOFT

TERMS: Minimum order \$80.00. For shipping & handling include \$4.00 for ground and \$5.50 for air. Orders over 1 lb. and foreign orders may require additional shipping charges—contact our Sales Dept. for the amount. CA residents must include applicable sales tax. Prices subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities and to substitute manufacturer. All merchandise subject to prior sales. A full copy of our terms is available upon request. Items pictured may only be representative. JDR, the JDR logo, JDR Microdevices, and the MCT logo are registered trademarks of JDR MICRODEVICES, INC. Modular Circuit Technology, Littlefoot, Minifoot and Superfoot are trademarks of JDR MICRODEVICES, INC. Copyright 1990 JDR MICRODEVICES.



JDR Microdevices®

2233 BRANHAM LANE, SAN JOSE CA 95124

BUY WITH CONFIDENCE FROM JDR!

- 30-DAY MONEY BACK GUARANTEE
- 1 YEAR WARRANTY
- TOLL-FREE TECH SUPPORT

HIGH DENSITY HARD DRIVES

NEW! NEC 153.5MB!

- 153.5MB CAPACITY
- ESDI INTERFACE
- AVG ACCESS TIME .18MS
- RECORDING: 19.612 BPI/BIT, 1.240 TRACK DENSITIES
- 20 SEC. START/STOP TIME
- REQ. DC-5V, +12V POWER
- LSES 2-7 RLL METHOD AND NRZ TRANSFER MODE



5655\$849.00

MICROPOLIS DRIVES

- KITS: F/H CONTROLLER, CABLES, NCVELL NETWORK-286
- 1355 157.5MB ESDI, 23MSKIT: \$1049DRIVE: \$949
- 1375 157.5MB SCSI, 23MSKIT: \$1099DRIVE: \$899
- 1558 338.1MB ESDI, 18MSKIT: \$1799DRIVE: \$1619
- 1578 338.1MB SCSI, 18MSKIT: \$1799DRIVE: \$1619
- 1566 676.8MB ESDI, 16MSDRIVE: \$2499
- 1588 676.8MB SCSI, 16MSDRIVE: \$2499

HARD DISKS

- 21.4MB \$199 65.5MB \$389
- 32.7MB \$219 80.2MB \$569
- 42.8MB \$339 84.9MB \$499

SIZE	MODEL	AVG. SPEED	FORM FACTOR	DRIVE ONLY	XT KIT	ATF/H KIT
21.4MB	ST-225	65MS	5-1/4"	\$199	\$249	\$309
32.7MB RLL	ST-238	65MS	5-1/4"	\$219	\$279	\$379
42.8MB	ST-251-1	28MS	5-1/4"	\$339	\$389	\$449
43.1MB SCSI	ST-251N	40MS	5-1/4"	\$419	-	-
65.5MB RLL	ST-277-1	28MS	5-1/4"	\$389	\$449	\$549
80.2MB	ST-4096	28MS	5-1/4"	\$569	-	\$679
84.9MB SCSI	ST-296N	28MS	5-1/4"	\$499	-	-
122.7MB RLL	ST-4144R	28MS	5-1/4"	\$699	\$759	\$859
21.4MB	ST-125	40MS	3-1/2"	\$259	\$299	\$373
32.1MB RLL	ST-138R	40MS	3-1/2"	\$289	\$339	\$429

DRIVE KITS

- 21.4MB \$249
- 32.7MB \$279



KITS INCLUDE HARD DRIVE, DRIVE CONTROLLER, CABLES AND JDR'S DETAILED INSTRUCTION MANUAL

\$99⁹⁵

1.44MB 3-1/2" DRIVE

- 80 TRACKS • 135 TPI • ULTRA HIGH DENSITY
- READ/WRITE 720K DISKS, TOO
- INCLUDES ALL NECESSARY MOUNTING HARDWARE

- FDD-1.44X BLACK FACEPLATE
- FDD-1.44A BEIGE FACEPLATE
- FDD-1.44SOFT SOFTWARE DRIVER\$19.95
- MF355A 3-1/2" MITSUBISHI 1.44MB, BEIGE\$129.95
- MF355X 3-1/2" MITSUBISHI 1.44MB, BLACK\$129.95
- FDD-360 5-1/4" DOUBLE-SIDED DD 360K\$69.95
- FDD-55B 5-1/4" TEAC DOUBLE-SIDED DD 360K\$89.95
- FDD-1.2 5-1/4" DOUBLE-SIDED HD 1.2M\$89.95
- FDD-55G 5-1/4" TEAC DOUBLE-SIDED HD 1.2M\$129.95

ENHANCED KEYBOARDS

- FC-3001 101-KEY, 12 F-KEYS & CALCULATOR\$74.95
- BTC-5339 101-KEY WITH 12 FUNCTION KEYS\$69.95
- BTC-5339R COMPACT 101-KEY, 30% SMALLER\$79.95
- MAX-5339 101-KEY MAXI-SWITCH (286 ONLY)\$84.95
- K103-A AUDIBLE "CLICK" 101-KEY KEYBOARD\$84.95

STANDARD KEYBOARDS

- BTC-5060 84-KEY WITH 10 FUNCTION KEYS\$59.95
- MAX-5060 MAXI-SWITCH 84-KEY (286 ONLY)\$64.95

PC-TRAC \$89⁹⁵

- HIGH RES. (200 PULSE/INCH)
- 2-AXIS POINTING DEVICE (X & Y)
- INCLUDES MAP DEVICE DRIVE WITH BALLISTIC GAIN



PC-TRAC W/RS 232C SERIAL INTERFACE

FAST-TRAP THE 3-AXIS MOUSE ALTERNATIVE!\$109.95

LOGITECH TRACKMAN

- TO 300 DPI RES. • MOUSEWARE UTILITIES
- MENUS, MOUSE-2.3 • REQ. 256K MIN. MEMORY

TRACKMAN SERIAL VERSION—NO CARD REQ\$98.95

TRACKMAN-B BUS VERSION\$95.95

W/SHORT CARD FOR 8088, 286, 336 OR PS/2 MODELS 25 & 30

LOGITECH MICE

- 3 BUTTON SERIES 9 • 320 DPI RES. • SERIAL PS/2 COMPAT.
- LOGC9 SERIAL MOUSE\$98.95
- LOGC9-C SERIAL MOUSE (NOT PS/2 COMPATIBLE)\$79.95
- LOGC9-P SERIAL MOUSE WITH PAINTSHOW\$109.95
- LOGC9-PC SERIAL MOUSE WITH PAINT CAD\$154.95
- LOGB9 BUS MOUSE\$89.95
- LOGB9-P BUS MOUSE WITH PAINTSHOW\$104.95
- LOGB9-PC BUS MOUSE WITH PAINT CAD\$149.95

GENISCAN SCANNER

\$199⁹⁵

- UP TO 400 DPI • 32 LEVELS OF GRAY SCALE
 - W/INTERFACE CARD, SCAN-EDIT II AND DR GENIUS
- GS-4500\$199.95



MODULAR CIRCUIT TECHNOLOGY INTERFACE CARDS

DRIVE CONTROLLERS

1.44MB FLOPPY \$49⁹⁵



- 8088 OR 286 COMPATIBLE • SUPPORTS 2 FLOPPY DRIVES (360K, 720K, 1.2MB & 1.44MB)
 - USER SELECTABLE AS A PRIMARY OR SECONDARY (3RD OR 4TH) FLOPPY DRIVE
- MCT-FDC-HD

HIGH DENSITY 4-FLOPPY CARD \$59.95

- INTERFACES UP TO 4 FLOPPY DRIVES • CABLES FOR 4 INTERNAL DRIVES • BIOS FOR ANY COMBO OF DRIVES
- MCT-FDC-HD4

FLOPPY DISK \$29.95

- INTERFACES UP TO 4 FLOPPY DRIVES TO IBM PC OR COMPATIBLE • DS/DD AND DS/OD COMPATIBLE
- MCT-FDC

HARD DISK \$79.95

- SUPPORTS 16 DRIVE SIZES INCLUDING 10, 20, 30 AND 40MB • CAN DIVIDE 1 LARGE DRIVE INTO 2 LOGICAL DRIVES
- MCT-HDC

286/386 FLOPPY/HARD \$119.95

- FLOPPY/HARD DISK CONTROL IN AN AT DESIGN • FOR UP TO 2 FLOPPIES (360K/720K/1.2MB/1.44MB) & 2 HARD DRIVES
- MCT-AFH

286/386 1:1 INTERLEAVE \$169.95

- CONTROLS 2 HARD & 2 FLOPPY DRIVES (360K/720K/1.2MB, 1.44MB) • CONCURRENTLY USE HARD & FLOPPY DRIVES
- MCT-FAFH

MULTIFUNCTION I/O CARDS

MULTI I/O CARD \$59.95

- SERIAL PORT • CLOCK/CALENDAR WITH BATTERY
 - PARALLEL PORT IS ADDRESSABLE AS LPT4 OR LPT2
- MCT-IO

MULTI I/O FLOPPY \$79.95

- SUPPORTS UP TO 2 360K FLOPPIES
 - SERIAL, PARALLEL, GAME PORT AND CLOCK/CALENDAR
- MCT-MIO

286/386 MULTI I/O CARD \$59.95

- SERIAL, PARALLEL AND GAME PORTS • USES 16450 SERIAL SUPPORT CHIPS FOR HIGH SPEED OPERATION
- MCT-AIO

MEMORY CARDS

576K RAM CARD \$49.95

- USER SELECTABLE CONFIGURATION TO 576K • USES 54K AND 256K DRAMS (OK INSTALLED)
- MCT-RAM

286/386 EXPANDED MEMORY \$129.95

- USER EXPANDABLE TO 2MB USING 1MB DRAMS • CONFORMS FULLY TO LIM EMS 3.2 • RAM DISK SOFTWARE
- MCT-AEMS

MCT-AEMS-256 USES 41256 DRAMS\$129.95

8088 EXPANDED MEMORY \$129.95

- 2MB RAM CAPACITY • USES 4K OR 256K DRAMS
- MCT-EMS

INTERNATIONAL ORDERS WELCOME

We speak English, Spanish, Portuguese & Italian!
Our International Department will help with customs documentation — Ask for Sonia (408) 559-1200

4800/2400 BPS FAX MODEM \$119⁹⁵

- 4800 BAUD GROUP III FAX TRANSMISSION ONLY • 2400 BPS DATA MODEM • W/MENU DRIVEN PROFX SOFTWARE
- SENDS DOS TEXT, PCX & TIF FILES TO FAX TRANS.

MCT-FAXM\$119.95

MCT-24I INTERNAL 2400 BAUD DATA MODEM\$89.95

MCT-12I INTERNAL 1200 BAUD DATA MODEM\$59.95

VIVA 2400 BAUD MODEM \$119⁹⁵

- 2400/1200/300 BAUD OPERATION • HAYES AT COMMAND SET COMPAT. • EXTENDED S-REGISTER PROGRAMMING • SPEAKER
- 2ND PHONE JACK • AUTO DIAL TONE/REDIAL • STD RS 232C INTERFACE

VIVA-24E\$119.95

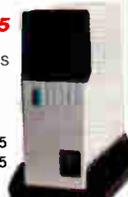
VIVA-24MPP\$129.95

ERROR CORRECTING VERSION

FAX SWITCHER

- ROUTES CALLS FROM 1 PHONE LINE TO YOUR FAX, MODEM AND ANSWERING MACHINE • OPERATES ON SINGLE OR MULTI-LINE SYSTEMS • AUXILIARY PORT

FAXM-SWITCH\$109.95



PRODUCT SPOTLIGHT

VOICEMASTER KEY

\$129⁹⁵



URNS KEYSTROKE ENTRIES INTO MACROS YOU COMMAND WITH SPEECH! OPERATES AS A TERMINATED AND STAY RESIDENT PROGRAM; NEEDS ONLY 67K OF MEMORY

- RECALLS CONTROL ALT/SHIFT COMMANDS! • COMPATIBLE W/LOTUS 1-2.3, WORDSTAR, WORDPERFECT, DBASE III+, SIDEKICK, MOST BUSINESS PROGRAMS; CONTROLLABLE FROM CUSTOM PROGRAMS IN C, BASIC, PASCAL OR ASSEMBLER • 1/2-SIZE CARD
- HEAD-SET AND SOFTWARE (5-1/4") • 16 FIELDS, EACH CAPABLE OF STRINGING 16 MACROS (256 TOTAL)
- REQUIRES 8088, 286, 386 OR PS/2 25 OR 386, 256K OF MEMORY AND MSDOS 2.1 OR HIGHER

VOICEMASTER INTERNAL MODEL\$129.95

VOICEMASTER-E EXTERNAL\$187.95

CUSTOMER SERVICE 800-538-5001

TECHNICAL SUPPORT 800-538-5002

MON.-FRI. 7 A.M. TO 5 P.M., SATURDAY, 9 A.M. TO 3 P.M. (PST)

ORDER TOLL-FREE 800-538-5000

KEY CODE 10

Circle 6 on Reader Service Card (RESELLERS: 7)

SEPTEMBER 1990 • B Y T E 515

CHAOS MANOR MAIL

*Jerry Pournelle answers questions about his column
and related computer topics*

Lefties Unite

Dear Jerry,

Could I ask you to take up the cudgel on behalf of an undefended minority? We lefties are used to being called "sinister" and "gauche," and we've adapted remarkably to a hostile world, but sometimes it seems to have gone too far in its oppression.

Logitech seems to have come out, finally, with the perfect trackball in the TrackMan. It is, however, unrelenting in its right-handedness. A few inquiries to Logitech force me to conclude that the company has no plans for a left-handed model. Were the company to make one, thousands of us southpaws would flock to it—in gratitude, if nothing else. Perhaps you could put a few bees in Logitech's (or somebody's) bonnet.

David A. Frecker
Corpus Christi, TX

I think you should take up your Bible and look into Matthew 21. Actually, if a right-handed trackball becomes a commercial success, a left-handed one will not be far behind, while saddling a company with the necessity to do both when introducing the product is a fair way to prevent it from happening at all.

I find that my computer table isn't set up for a trackball, which is a surprise; I need one that is 3 inches wide or less so that it will sit in my keyboard drawer with my keyboard.—Jerry

BASIC Fear and Loathing

Dear Jerry,

You and others said nice things about QuickBASIC 4.5, so I persuaded my wife to buy it for me.

Although I last professionally programmed in about 1972 (PL/I on an IBM 360), six years ago I used the family Apple II to write a boat-race scoring system for the junior section of our local sailing club. This resulted in a loss of all human knowledge of how to score the races, so when my home computer changed to a PS/2, I needed to rewrite. Hence, I used QuickBASIC.

First, all went well—it was a super

new environment, had great color, could validate input every which way, and could tidy everything away in subroutines. Maybe I went overboard in trying these things; I'd be the last to claim that the resulting code was neat, disciplined, or elegant. But beyond a certain size, the RUN instruction locked the machine with no error message—which I take to mean that the product, and not my code, is at fault.

I called the Microsoft help number in the U.K., and the people there said to save the code in a text file, not the special fast file type supported in QuickBASIC. They called it "binding." This worked for a while, but then the program hung again.

Is this binding peculiar to QuickBASIC 4.5 (maybe the European version), or is it a well-known though undocumented characteristic of QuickBASIC?

Garry Owens
Dublin, Ireland

I haven't had your problem, although I am told that if a program gets extremely large it can happen, and the code must be compiled external to the programming environment. I always compile externally anyway, because the internal compiler links in all the library routines whether used or not, resulting in enormous code.

I also recommend the Crescent QuickBASIC toolkit.—Jerry

APL Minority

Dear Jerry,

I must take issue with a comment you made in response to a letter regarding a system that was written in APL (December 1989). In these days when the trade magazines are full of warnings regarding the amount of experience needed to code C for Presentation Manager, it sounds odd to me that someone would make a remark about not wanting to maintain APL code. I personally wouldn't want to maintain C code, but that is because I am so inexperienced with C.

I also don't choose to read and write Russian, but that is not a reflection on Russian; it's a reflection on the fact that I

am not literate in Russian. I am very literate in APL, however, and I think I could maintain just about any system written in one of its several dialects.

Unfortunately, there are not a whole lot of programmers who are APL-literate. This, however, has not prevented novices from coding in APL, and there's a lot of code written in APL by people who have not been professionally trained to code within standards of readability, documentation, or efficiency. Nevertheless, they get the job done—and leave the maintenance for others. My years of experience at several companies have indicated that code written by novices is far more difficult to maintain than sophisticated code written by professionals. This has led me to believe that the problems programmers have with APL have more to do with their competence level (literacy level, if you prefer) than with the language.

So while you may not want to maintain an APL system, I thrive on doing so. On the other hand, I would not ask someone to pay me to maintain C code.

Gregg W. Taylor
Keller, TX

I agree that there are not many people who are APL-literate. I am persuaded that it is a wonderful language for the small number of people who are.—Jerry

Computers for Cetaceans

Dear Jerry,

I am a marine biologist with the University of Houston—Clear Lake Dolphin Research Team. The Dolphin Research Team is a volunteer organization consisting primarily of behavioral psychologists and environmental biologists. Although UHCL gives us office space, we depend entirely on donations to continue operating.

The primary objectives of the research team are interdisciplinary behavioral research and public education about marine mammals and their role in the marine environment. The research consists of observation of wild populations of dolphins near Galveston Island, compilation

of a fin photo-identification catalogue, and anatomical studies of dolphin corpses and skeletons.

To raise awareness and educate the general public about dolphins and their relation to the marine environment, team members have assisted in painting two cetacean murals on Galveston's seawall, writing and publishing a booklet called *Galveston's Dolphins*, and assembling a skeletal display at UHCL. In addition, team members regularly give presentations to all interested groups. The research and education that the team participates in is important in understanding these animals and their environment.

Our present efforts are hampered by the lack of adequate computer equipment for data analysis. Presently we are subsisting with a dual floppy disk drive Leading Edge computer and an old Macintosh system. This is fine for a small database, but as our volume of data grows, so do our computer needs. In addition to database use, we are growing into other applications as well, namely: setting up computer communications between the main office at the UHCL and the office on Galveston Island; using computer mapping programs to track animals' movements within the study area; and computer imaging to enhance and help analyze photographs used to identify individual animals. It recently came to my attention that you cannot keep systems that you review, and frequently donate them to worthy causes. If you have a system that you think would be appropriate for us (either an IBM compatible or a Macintosh), we would appreciate being considered for such a donation.

Chiara DeNeve
University of Houston-Clear Lake
Houston, TX

You would not imagine—or perhaps you would—just how many letters I get requesting equipment. The sad truth is that I don't have surplus equipment: Either the companies that send me stuff want it back, or it's pretty thoroughly used up before it ever leaves here. Cheetah, Priam, and Maximum Storage did make up a sys-

tem for the Lowell Observatory, but I'm on the board of that institution.

My advice to you and all the others who write me is to ask a local organization; in your case, I'd say Texas Instruments in Austin, Tandy in Fort Worth, or any of the myriad good to excellent small computer companies. I've found that Texans are usually willing to take care of their own!

You can also try Non-Profit Computing, Inc., at 40 Wall St., Suite 2124, New York, NY 10005. Good luck.—Jerry

Perfect Word Processors?

Dear Jerry,

I was so intrigued with your January column that I have decided to subscribe to BYTE in order to follow more closely your quest for a new word processing program. I, too, am looking for a new word processor.

I started out with MultiMate. I had no real complaints, but for a long time the company seemed to take little interest in providing improvements, and I decided that it was about to go the way of the dinosaurs. It turns out that my gloomy prediction was wrong, but by then I had gone on to Microsoft Word. Although I don't pretend to have mastered it, Word seems to be able to do just about everything except wash the dishes. Unfortunately, it also has an extremely irritating gimmick. To issue a command, you must first press the Escape key. This goes against all logic. Most software programs use the Escape key as a whoops-I-made-a-mistake-get-me-out-of-here button, and keyboards put it in an out-of-the-way location so you don't press it accidentally. I thought I would get used to this peculiarity, but I have not. In fact, I find myself trying to do things in Lotus 1-2-3 that are much easier done in a word processor, so it is time to look for something else.

Everyone seems to think that WordPerfect is the ultimate, but I don't agree. Since most offices use the program, it has become a fad. But those things come and go. I remember when MultiMate was the office standard. In any case, I can't get excited about a program whose com-

mands are so arcane that you need a translator like PluPerfect.

In a slightly different vein, I am curious to know if I am the only person in the world who doesn't care about bigger and better spelling checkers and computerized style editors. Most of my work involves large numbers of proper names, so a spelling checker is virtually useless. And a spelling checker can't solve the worst problem of modern newspaper and magazine writers, which is learning the difference between words like *sights* and *sites* or *affect* and *effect*. As for style checkers, I think they are an abomination. There are always a few exceptions, but most articles you read these days on any subject might just as well have been written by a computer. There is so little human personality left after the thing has been "style checked" that you end up with pabulum for the mind.

Since you are in the rather enviable position of being able to do some hands-on exploration of various word processors, I look forward to reading about your reactions.

Elaine Obenchain
Woodstock, IL

Recently, the MultiMate people have started a veritable campaign to get me interested in their word processor, and I finally have a copy, after some years.

Although Escape as a menu and command-introduction key probably is counterintuitive, Write (following Electric Pencil) did it that way, and I was able to write quite a few books with it.

With spelling checkers, good enough is usually good enough; I do like having the ability to add case-sensitive names to my own dictionary, since I tend to make up character names like Chowpeentulk, and creatures like grendels. . . .—Jerry ■

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. He can be reached c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458, or on BIX as "jerry.p."

PRINT QUEUE

Hugh Kenner

Images Beget Images

*Mighty images from tiny blobs
—and shoots, and branches—do grow*

Let's attempt what the physics mavens call a thought experiment. Here, before your eyes, is a card mottled with blobs of gray, a photo of fat Uncle Felix. And right here, by golly, is fat Uncle Felix himself, by no definition a card of any sort. Yet the eye does detect some match between photo and Uncle Felix.

Next: Here, before your eyes, is a graph (1979–1989) of the Gross National Product, a card scrawled with lines. And right here...but wait a minute, where's the GNP we'd hoped to match to the card? No. The GNP, unlike Uncle Felix, is not producible—except as the graph itself, or else as some columns of numbers the graph models, or maybe as some figment the numbers claim to clothe, a fey Salome a-dance in economists' heads.

So we're long used to pictures of things that do not exist the way fat Uncle Felix does. Those are special cases? Not according to *Visualization* by Richard Mark Friedhoff and William Benzon (Harry N. Abrams, 1990, \$49.50), which sets out to persuade you of a further proposition: that *nothing*, not even Uncle Felix, exists for your eye the way you thought Uncle Felix did. Your eye and brain *create* an Uncle Felix, whether scanning his bulky presence or his photo. And that's not too remote from the way you accept a visual GNP.

Time was when we thought otherwise. The eye just relaxed as photons streamed toward its retina, where receptors sorted out red, blue, and green for the brain to merge (hence Uncle Felix's salmon-pink necktie). That notion, now more than two centuries old, never did explain why we see things "truly" colored through green sunglasses, or under ruddy late-day light; or why reds next to blues look different from reds next to yellows.

Visualization is dedicated to Dr. Edwin H. Land, and if you accept Land's Retinex

model of how vision works (as an astonishing demonstration I saw in 1975 inclines me to do), you'll be prepared to accept that the brain is ever busy at computing visual results from minimal cues. Feed your retina merely *two* colored images, and your brain can show you a whole spectrum. The key word is *images*, not *blobs*. Of images we always try to make sense, in a way that extends to filling in colors and shades. Making sense of the blobs that constitute Uncle Felix's photo, we perceive them as an image and then as a man. And our knowledge of "man" is what enables our skill at perceiving a man-image.

Moreover, "images" can be pretty abstract. On page 26 of *Visualization*, we're shown a rectangle cut into dark-gray and light-gray halves. But lay a pencil over the boundary: Lo, the whole thing becomes medium-gray! Once the frontier where two shades collide is removed, we no longer know that we're meant to see two shades. So we simply don't see them. They become as one.

What all this has to do with a book subtitled *The Second Computer Revolution* is something the authors aren't deft at explaining. Never mind, look at the pictures, some 140 of them in color. They are pictures of things never seen: Things for which either (1) no corresponding Uncle Felix is producible, or (2) some real Uncle Felix never got within camera range.

Example of no Uncle Felix: A picture where reds and blues map magnetic polarities in an iron crystal; that's quite as abstract as the GNP. Example of an inaccessible Uncle Felix: A cinema flyover of a moon of Uranus, which no one has really flown over with a movie camera. It was synthesized from flat *Voyager II* images, "combining image processing, computer graphics, computer stereopsis, and animation."

We're shown four frames, with alarming deep canyons and craters, side views mathematically re-created from the plan-views *Voyager II* re-



turned across 2 billion miles. Imagine the illusion the projected film produces, of gazing across Miranda from a moving bubble a mere dozen miles up! Imagine, too, from what subtle cues it was reconstructed! Yet how firmly.

Image processing, computer graphics, computer stereopsis, animation: Those are all frighteningly computation-intensive—millions upon millions of instructions per second, weeks of CPU time. And then we merely glance at what they yield. Pictures seem *quick*, till we learn to look at them the way we've learned to look, long, long, at Botticelli's *Venus*, though for other satisfactions. If she's just an undressed lady atop a seashell, our way of looking is skewed. And a fractal "mountain" that has never existed, something synthesized by algorithms out of bytes? If that can seem just another hunk of rock, well, we need educated eyes to look again.

And a synthesized tree? In July 1984, Alvy Ray Smith wrote of graftals in the SIGGRAPH annual, *Computer Graphics*. In July 1986, the magazine *Computer Language* published Turbo Pascal graftals programs that Steve Estvanik and Ken Birdwell had derived from Smith's article (buggy as printed, still they're fun to play with). Graftals was Smith's term for graphics programs that mimic, more or less, the way plants and trees grow, programs that don't start from the final image but build it, so to speak, in the plant's way, from the moment a shoot breaks ground.

That there's a graspable order in the way plants build is a very old intuition. Leonardo da Vinci in the sixteenth century thought that "in each year the total estimated size of the branches . . . equals the size of the trunk." By "size," he seems to have meant "volume of wood"; thus, when a trunk splits into two boughs, their summed cross-sectional area (assuming proportional lengths) should equal the trunk's.

In the 1840s, the Victorian art critic John Ruskin had a similar idea; artists had to understand how trees grew to draw them right, and equivalent splitting was the way Ruskin said they grew, right down to the tiniest twigs. Though not exact, the Leonardo/Ruskin Law does seem acceptably close for making drawings look right.

In 1917, late in a horrible war, D'Arcy Wentworth Thompson published *On Growth and Form*. He revised it in 1942, when we were immersed in another horrible war. Its 1116 pages seem to say: Whatever may be passing, some things do abide; and whatever abides obeys mathematical laws. Such laws tell us that 300 feet is about the maximum height of a tree, before it bends and falls of its own weight. If its foliage is heavy (as in oak versus pine), that maximum will be less. No matter what the numbers may be, Thompson persuades us over and over that they do exist.

So if we want to set a computer to drawing a tree (or a tumbleweed), we're hemmed in by enough numerical constraints to set any programmer aglow. A plant, moreover, seems to be following a program; it rises from its root, divides; rises some more, divides, even as the earlier divisions are dividing. . . . But at each division it preserves, so to speak, *meaning*; thus, the branch of an elm doesn't suddenly resemble a cactus. The scenario has been likened to the one Noam Chomsky offered, decades ago, for language: Concise rules that change simple sentences into complex ones without loss of essential content.

Concise rules, likewise, for a plant?

Maybe. But plants grow by parallel computation—analogue things all happening at once—which does complicate matters. *The Algorithmic Beauty of Plants* by Przemyslaw Prusinkiewicz and Aristid Lindenmayer (Springer-Verlag, 1990, \$39.95) summarizes what seems to be known of the algorithms, has sumptuous photos of computer-generated images (the color plates include unbelievably lifelike roses), and unhappily reads like a set of SIGGRAPH papers stunned and laid end to end.

After 1968, the late Dr. Lindenmayer, known for his L-System, was the doyen of this field; the bibliography lists no fewer than 11 of his papers. His death shifted the compiling of a text to Prusinkiewicz and four collaborators. They've been rigorous to (I'd almost say) the point of unreadability. Actually, they are transparently readable for their intended audience: workers who need firm theory to underpin envisaged graphics programs. The rest of us can skim, and can gaze at the marvelous pictures.

And we can note how Benoit Mandelbrot's fractal self-similarities turn up on the first page. Yes, plants are self-similar; a young shoot's favoring of the south side can continue, out to the furthest branches. Yet (following a hint in the bibliography) we can learn, from Norman MacDonald's *Trees and Networks*, that "self-similar" may be a theme to use with caution. Lung airways, tree branchings, paradigms of self-similarity, resemble one another, yes. But not exactly, because trees must sustain their own weight and lungs need not. That's the sort of thing Thompson insisted on: There are always physical constraints.

The gist of *The Algorithmic Beauty of Plants* is that "production rules" are feasible and fruitful; rules that derive a complex configuration from a simple one by systematic replacement of terms. Thus, two rules: (1) replace *a* by *ab*; (2) replace *b* by *a*—allow us to start with *b* and obtain, successively, *a*, *ab*, *aba*, *abaab*, *abaababa*, *abaababaabaab*. . . where you can see a wild symmetry (note how *a*'s tend to pair). Let *a* and *b* denote laws by which twigs branch, and you see a tree taking more and more intricate shape.

You see, too, how self-similarity comes in; hence, why trees (as Mandelbrot insists) are fractal. Still, remember the physical! And devise some more rules.

Addendum: After my review of books on fractals (June) was finished, the mail brought a program called Mandelbrot 3 (Midnight Beach, 1805A Felt St., Santa Cruz, CA 95062, (408) 479-9916) for the IBM PC and clones. Unlike the Fract-Int I discussed, it handles only the basic Mandelbrot and Julia sets. But it handles them *very* fast and with superexcellent graphics. Be sure to get version 2.03, which won't lock up in the absence of a mouse. (You *have* a mouse? Well, even mice are mortal.) ■

Hugh Kenner is a professor of English at Johns Hopkins University. His reviews have appeared in publications like the New York Times and Harper's. His recent books include A Sinking Island and Mazes. He can be contacted on BIX as "hkenner."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.



LITIGATION VS. INNOVATION

Let's strike a balance between protecting intellectual rights and encouraging innovation

The personal computer revolution was catalyzed by young rebels, dropouts, and visionaries who helped forge what has become a multibillion-dollar industry of global import. These people fundamentally changed how computers were used and how business—and government—got work done, by making computers useful and accessible to millions of ordinary citizens without special computer expertise. I like to think that the company I founded, Lotus Development, played an important role in that.

As a software entrepreneur, my perspective on intellectual property isn't grounded in theory or law—it's based on my experiences trying to turn innovative ideas into real businesses.

Let me make a bias clear up front: I like new ideas. I like being part of a creative community of software designers, each trying to surpass the others. I like having the market tell us which innovations are exciting and which aren't. I like the fact that copying and distributing pirate versions of our software is a punishable crime.

Let me tell you what I don't like. I don't like companies acting as if they have a monopoly on a good idea. I don't like companies forgetting that, like it or not, they also learn from their competitors and their competitors' customers.

Pamela Samuelson, an intellectual-property scholar at Emory University in Atlanta, describes intellectual-property advocates as ranging along a scale from minimalists, who believe in the bare essentials of protection, to maximalists, who insist that intellectual property is so

precious that it must be surrounded by a phalanx of razor-edged laws.

I am a minimalist. That doesn't mean I don't care about intellectual-property protection; it means that I don't want protection to become the dominant theme, or even a dominant theme, of this industry. If you want to keep this industry as vibrant and successful as it's been, then a properly constructed intellectual-property policy will respect protection but give preference to innovation. Overprotection of intellectual property is as pernicious as underprotection in its stifling effects on innovation and the consequent loss to society.

Unfortunately, the computer industry is experiencing an unsteady but stubborn march to extend the scope of copyright. Twisting and straining each step of the way to secure additional copyright protections, too many companies seem to have decided that it's easier to sue their rivals than compete with them. Litigation is becoming a business tactic, not a practice of last resort. Software should not be an industry driven by litigation. That would be bad for both the industry and its millions of customers.

It would be great if we could just draw a line and, say, outlaw software clones of specific application programs. But I'm concerned about where the line ultimately gets drawn. The next foreseeable step, in which litigants seek to protect individual features and elements of programs, per se, under copyright, would be one step too far.

Speaking from my own observation, the so-called spreadsheet clones have achieved but the tiniest of market shares, and I don't believe that's an accident. Cloning applications is an unviable business strategy. Success in the software business depends on many factors: documentation, training, customer support, and the quality of customer relations in general. All these factors favor the large, well-financed software companies.

Software is complex and idiosyncratic;

unless someone is deliberately copying the internals of the code, reproducing a sophisticated application with quality and utility equivalent to the original is difficult and expensive. Any firm with the resources to do a good job at this prefers to create original products that represent a greater opportunity.

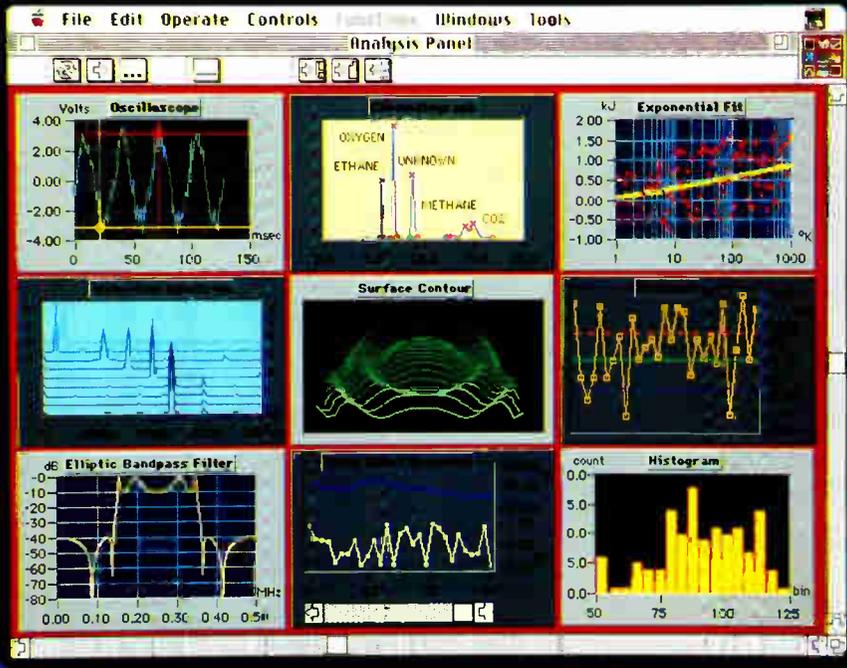
It's the nature of software for ideas to slosh and flow back and forth between competitors, companies, and industries. Like architecture and the movies, software is a medium for ideas.

Some firms would like to have their works fully protected but be free to benefit from the efforts of others without much regard for intellectual-property rights. They must be reminded that the law has an obligation to be evenhanded.

Of course, complicating all this is that software is a different kind of intellectual-property beast. Professor Samuelson observes that software is both a writing and a machine—in a legal system that has assumed something can be either a writing or a machine, but not both.

Increasingly, the economic value that we add to this society and the global economy is this intangible, crystallized mindstuff called software. America's software industry happens to be the best in the world, and that isn't due to intellectual-property lawsuits. The challenge is, what regime is going to continue to support our ability to do well? If our policy comes out of court battles, then we're going to have an industry that looks as though it were shaped by lawyers and judges, not by technically innovative and market-sensitive entrepreneurs. ■

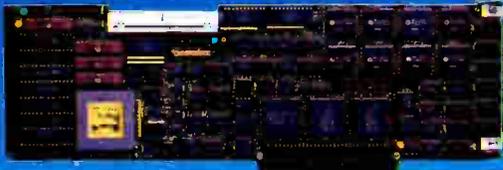
Mitch Kapor, founder of Lotus Development Corp. and co-creator of Lotus 1-2-3, is president of On Technology. This column is adapted from testimony offered to the congressional committee on intellectual-property rights, to which he made the opening remark, "Software has been very, very good to me." He can be reached on BIX c/o "editors."



The Brightest Star in Real-Time Data Analysis... Just Got Brighter

New DSP Board Delivers 33.33 MFLOPS

The brilliant analysis capabilities of LabVIEW® 2 just received a power boost from our NB-DSP2300 digital signal processing and analysis accelerator board for the Macintosh II. The new board stars the Texas Instru-



ments TMS 320C30 DSP chip. With a full complement of LabVIEW 2 modules and C development tools for writing custom routines, you can easily harness this processing power to incorporate real-time analysis in the most demanding instrumentation applications.

Extensive Analysis Library

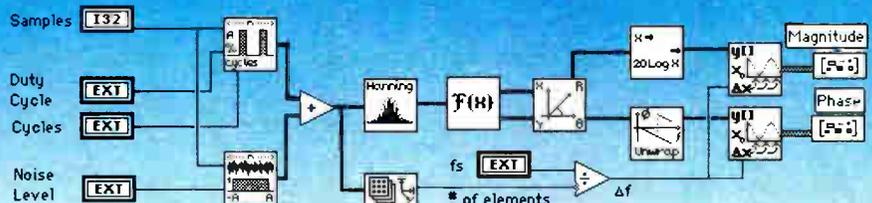
- DSP - FFTs, FHTs, spectral analysis, convolutions, correlations
- Filters - IIR filters, FIR filters, smoothing windows
- Waveform Analysis - integration, differentiation, pulse analysis, peak detection
- Waveform Generation - impulse, geometric, sinusoidal, sinc, noise
- Statistics - descriptive statics, histograms, regressions
- Vector/Matrix Algebra - inversions, products, linear system solutions
- Numerical Analysis - conversions, complex numbers, evaluations, curve-fitting

Complete Graphical Programming Language

LabVIEW is a stellar solution for scientists and engineers accustomed to drawing block diagrams, because they can simply connect, interchange, combine, and define new executable blocks to create software modules called virtual instruments.

Easy Development

LabVIEW's innovative, time-saving approach for building data acquisition and instrument control systems includes sophisticated routines for digital signal processing and analysis.



Compiled Language Speed

Thanks to the new graphical compiler of LabVIEW 2, block diagrams execute at blazing speeds, comparable to compiled C. Thus, LabVIEW 2 offers the productivity gains of graphical programming without sacrificing performance.



6504 Bridge Point Parkway
Austin, TX 78730-5039

Nihon National Instruments K.K. (Japan) (3) 788-1922
National Instruments of France (1) 4865-3370
National Instruments of Italy (2) 4830-1892
National Instruments United Kingdom (06) 355-23-545

Call for **FREE** Catalog
(800) 433-3488 (U.S. and Canada)
(512) 794-0100

Circle 199 on Reader Service Card

You've got to hear it to believe it.

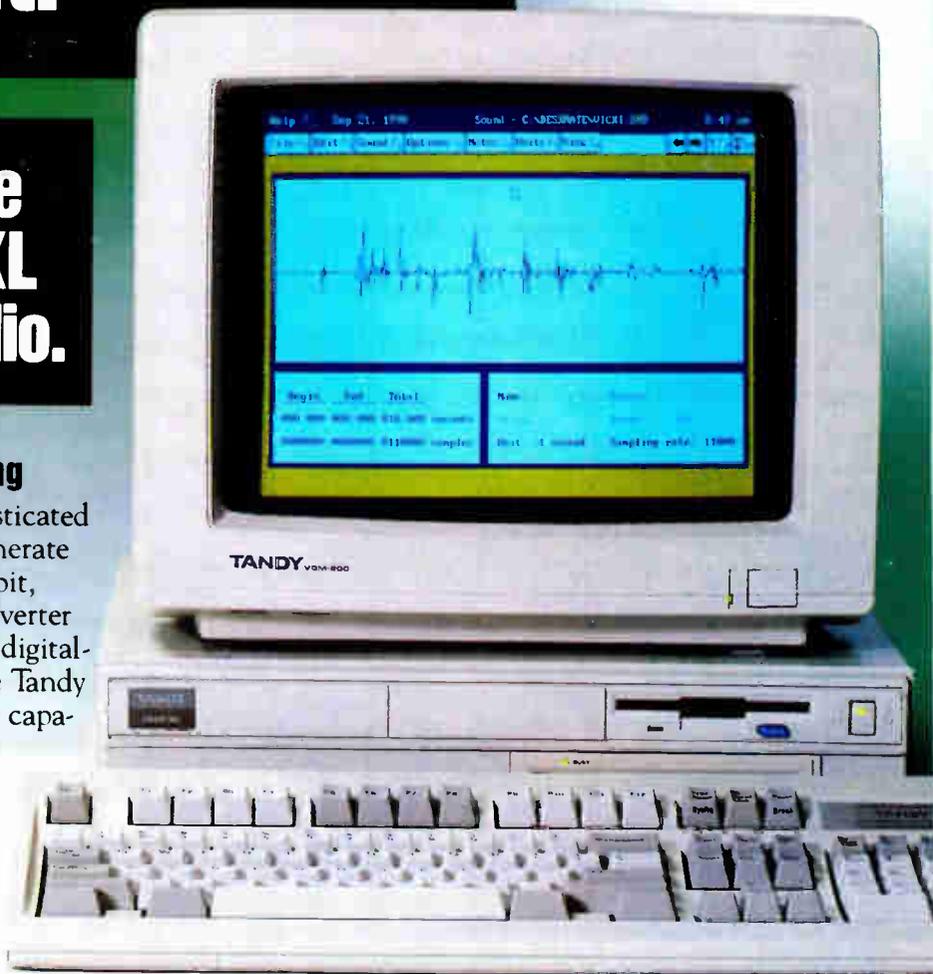
Presenting the Tandy® 2500 XL with digital audio.

Hear what you've been missing

The Tandy 2500 XL, with its sophisticated sound-reproduction system, will generate new life into your programs. An 8-bit, DMA-driven, analog-to-digital converter (ADC) and an 8-bit, DMA-driven, digital-to-analog converter (DAC) give the Tandy 2500 XL amazing speech and music capability. You'll be able to record, edit and play back sound effects from a variety of sources, then save them onto diskette for playback at a later time.

Compact design, yet packed with advanced features

The Tandy 2500 XL boasts maximum features and expansion capability in a low-profile, small footprint. MS-DOS® and the DeskMate Graphical User Interface® are built into ROM. With an 80286 processor operating at 10 MHz, the 2500 XL includes a built-in 1.44MB 3 1/2" floppy drive and 1 megabyte of memory. Plus, it supports three full-length, 16-bit expansion cards and three expansion devices—including a CD-ROM drive. The innovative case design has



hinged expansion bays which swing open for easy access to card slots and devices. High-resolution VGA graphics support is also included.

Easy to buy . . . or lease

Hear the USA-made Tandy 2500 XL at any participating Radio Shack Computer, store or dealer. And remember, we have much more to offer: printers, software and the credit and leasing deals to put it all together!

CREATING NEW STANDARDS

PROVEN LEADERSHIP

Over 7,000 USA locations, 39,000 employees, seven research and development centers, 31 USA and overseas manufacturing plants—NOBODY COMPARES!

GUARANTEED SATISFACTION

Over 35 million customers benefit annually from our satisfaction guarantee. Putting you first has made us #1 in PC compatibles—NOBODY COMPARES!

Radio Shack
AMERICA'S
TECHNOLOGY
STORE™

Radio Shack is a division of Tandy Corporation. MS-DOS/licensed from Microsoft Corp.

Circle 252 on Reader Service Card

World Radio History

ELECTRONICS INDEX

Vol. 51, 1978

ELECTRONICS INDEX

Vol. 51, 1978

Notes: ED (Editorial); EI (Electronics International); EN (Newsletter); ER (Electronics Review); IN (Newsletter); NP (New Products)
NPI (New Products International); NU (News Update); PN (Probing the News); WC (Washington Commentary); WN (Newsletter)
(International edition page references are shown in parentheses)

AIR NAVIGATION See Avionics; Navigation Systems

AMPLIFIERS
Amplifier-filter replaces relays NP 168 Nov 9
Amplifier Research's 10-W amplifier covers wideband NP 252 Oct 26
Bi-FET: How the bi-FET process benefits linear circuits 113 June 8
Europe: Philips power amps to up synchrontron's particle energy IN 73 (75) Jan 25
FCC ban on linear amps takes effect April 28 WN 60 Apr 13
Great Britain: Impatt-diode amp aiming at TWTs EI 74 Dec 7
Hybrid a-d unit breaks 2- μ s barrier NP 115 Mar 30
Hybrid track-and-hold amp does it fast NP 180 Mar 16
Isolation amplifier: Hybrid circuit isolation amplifier includes transformer NP 135 July 6
Isolation amplifier: Transformer design shrinks hybrid isolation amplifier's size and cost 105 July 20
Japan: Silicon process shrinks op amp to fit onto digital chip EI 69 June 8
Linear process makes possible 1-volt devices ER 39 Mar 2
Op amp converts square waves into triangular ones EN 180 Jan 5
Op amp has low bias current and drift—WESCON preview NP 174 Aug 31
741 op amp: Another way to utilize the handy 741 EN 148 July 20
West Germany: IR amplifier, receiver ICs introduced for remote-control uses NPI (3E) Mar 30

ANTENNAS
Great Britain: It's green all the way for emergency vehicles using planar antennas to control signals EI 74 June 8
Navy: Airborne radars seen enhanced by NRL antenna technique WN 56 Mar 2
Omnidirectional antenna covers 4-30 megahertz NP 168 Jan 19
WQTV's customers to get antennas ER 44 Nov 9

ASTRONOMY
Radio telescope uses 19,500 chips for complex signal processing at 100 MHz ER 44 Oct 12

AUTOMOTIVE
Antiskid: German autos to offer antiskid units soon IN 64 July 20
Antiskid regulations for trailers have come to an abrupt halt NU 8 May 25
Auto makers: Will Detroit's needs outpace capacity of the semiconductor industry? PN 103 Jan 5
Who's selling what to Detroit PN 105 Jan 5
Dashboard driven by microprocessor ER 40 Mar 2
Electric cars
DOE picks five firms to operate 160 electric vehicles WN 56 July 6
DOE will hike spending for electric cars and solar power generation PN 76 Feb 2
GE developing electric vehicles using high-power Darlington transistors ER 51 Apr 27
Ford readies electronic distributor ER 40 Apr 27
France: Tiny runabout, Citroen Visa, uses electronic ignition EI 70 Oct 26
Great Britain: It's green all the way for emergency vehicles using planar antennas to control signals EI 74 June 8
Great Britain: Mini controls timing tests on 14 new engines EI 72 May 11
Great Britain: Traffic information service broadcasting may begin soon IN 64 Mar 2
Great Britain: UK car makers going electronic for fuel, ignition control IN 64 Oct 12
Half-effect device from TI could open car market EN 25 Dec 21
Optical inspection for car makers PN 90 June 22
Optical system checks out car axles ER 44 May 25
Sweden: Microprocessor-equipped auto keeps track of runway conditions EI 70 Apr 13

BUSINESS
AMI agrees to buy Millennium Systems ER 50 June 8
Analog Devices banks on monolithics PN 88 June 8
Antitrust
Antitrust threat seen killing merger of GE, Hitachi TV WN 57 Dec 7
Electronic mail: Postal Service denied monopoly WN 49 Mar 30
Postal Service hit on test plans WN 60 Apr 13
Controversy over Postal Service's role—should it compete WN 57 Aug 17
Postmaster General forces the issue WC 58 Dec 7
Plan stirs opposition ER 36 Dec 21
Fairchild attacks Data General on competition EN 34 Oct 26, ER 55 Oct 26
FCC to weigh Telenet acquisition plan by GTE WN 49 Dec 21
MCI hits AT&T tariff filing for Execunet WN 59 June 8
Memorex antitrust case against IBM: mistrial declared gives hope to some ER 46 July 20
SBS, facing legal snag, pushes on ... as

Transportation/Automotive Committee: Jeduc forming transport unit outside SAE WN 58 Oct 26
West Germany: Auto seat control remembers positions EI 64 (14E) Jan 19
West Germany: Electronic cruise control for autos uses electric motor to move accelerator pedal EI (9E) Feb 16

AVIONICS
Air Force see **Military Electronics**
Army see **Military Electronics**
Aerospace forecast for 1979: 15% sales rise WN 49 Dec 21
Aerospace sales by U.S. will rise 8% in 1978 ER 62 Jan 5
Air traffic control: Sanders, Raytheon to build color ATC radars WN 59 Aug 31
Awards: heading toward NATO buy ER 50 Nov 9
Awards: Military buy-out of Motorola MECL-2 line proposed WN 57 Oct 12
Awards: NATO approval nears PN 90 May 11
Boeing to use Rockwell flight computers ER 36 Dec 21
Czechoslovakia: Prague airport has British mini to measure noise IN (76) Jan 5
DABS: FAA to test and evaluate 3 DABS stations NU 9 July 20
Europe's consortium concept helps competition with the U.S.: Missiles, satellites and warplanes production PN 90 Aug 31
F-14: Grumman, Hughes seek to extend life of Navy's F-14 Tomcat WN 57 Feb 2
F-14: Tarps converting the Tomcats into RF-14 reconnaissance aircraft NU 8 July 6
F-16: GAO gives the F-16 a cautious blessing ER 48 May 11
Great Britain: Branier radar planned for UK Tornado IN 65 Aug 3
Infrared sensor outclasses thermocouples in checking metal fatigue in jet engines ER 54 Jan 5

Manchester II succumbs to LSI NP 206 May 25
Manchester II comes off the shelf NP 206 July 20

Landing systems
MLS: House hearings set on British MLS charges WN 57 Jan 19
Britain's contrived controversy on MLS ED 25 Mar 2
British want reversal of decision making U.S. scanning-beam future standard PN 78 Mar 2
Hazelint's new "Compact" PN 81 Mar 2
Battle flares as decision nears on world standard EN 34 Mar 30
FAA to speed domestic MLS after international OK WN 59 Apr 27
Bendix gets \$2 million for microwave landing prototype from FAA WN 57 Sept 14
West Germany: ICAO ponders German supplement—Azimuth IN 63 Oct 26
Laser-gyro: Boeing craft to use Honeywell laser gyro ER 36 Dec 21
Sweden: Microprocessor-equipped auto keeps track of runway conditions EI 70 Apr 13
West Germany: TV image joins head-up display in military prototype IN 69 Nov 23

BUSINESS
AMI agrees to buy Millennium Systems ER 50 June 8
Analog Devices banks on monolithics PN 88 June 8
Antitrust
Antitrust threat seen killing merger of GE, Hitachi TV WN 57 Dec 7
Electronic mail: Postal Service denied monopoly WN 49 Mar 30
Postal Service hit on test plans WN 60 Apr 13
Controversy over Postal Service's role—should it compete WN 57 Aug 17
Postmaster General forces the issue WC 58 Dec 7
Plan stirs opposition ER 36 Dec 21
Fairchild attacks Data General on competition EN 34 Oct 26, ER 55 Oct 26
FCC to weigh Telenet acquisition plan by GTE WN 49 Dec 21
MCI hits AT&T tariff filing for Execunet WN 59 June 8
Memorex antitrust case against IBM: mistrial declared gives hope to some ER 46 July 20
SBS, facing legal snag, pushes on ... as

Sperry uses 5-m earth stations ER 46 Sept 14
Telephone competition: the Bell System's challenge for Charlie Brown WC 64 Nov 23
AT&T stalled technology, U.S. says PN 98 Nov 23
AT&T recognizes competitors but vows to stay on top EN 36 Dec 7
U.S. hits Spectra-Physics with antitrust suit ER 48 Aug 31
Associations: Trade associations thrive in California: AEA, EAC, SEMI, SIA PN 85 Aug 31
Baruch's plan for cooperative technology: NBS to have two new national centers WC 58 Jan 19
California losing its glow?—taxes and high cost of real estate PN 74 Mar 30
Canada: Business group seeks aid for technology ER 52 June 22
Bell Canada says it is still an uphill battle NU 8 Nov 9
Capital gains tax: Survey shows tight money stalls U.S. technology ER 42 Feb 16
Drive to cut is nip and tuck WN 59 Apr 27
Jimmy Carter and capital gains WC 64 May 25

China: Computer scientists to view technology of the Chinese EN 34 Sept 14
China: Mainland Chinese show satcom interest in U.S. visits WN 57 Oct 12, WN 57 Oct 26
Contractors: GSA consolidates buying power for data communications WN 57 Dec 7
Counterfeiting: Great Britain—Magnetic-stripe watermark process proposed for passports IN 70 Nov 23
Cutler-Hammer acquires Singer Instrumentation ER 50 June 8
Cutler-Hammer to acquire Addington ER 50 May 11
Denmark: Smiling Danes peer out of niches PN 86 Nov 9
DEC reorganizes to consolidate responsibilities ER 50 June 8
Distributors: Growth creates financing problems PN 84 Mar 16
Distributors: Hamilton/Avnet takes on DEC's LSI-11 ER 48 June 8
Distributors' component orders jump 20% in March—EIA survey ER 46 May 25
Distributors look to the future ED 24 Mar 30
Double ordering: Chip makers report double ordering is creeping in EN 30 Nov 23
Double ordering: Wyle's Spiegel sees signs of double ordering EN 33 Oct 26
Economic cycles: Growing up in good times and bum times ED 24 June 22
EIA wants data to promote U.S. contracting out WN 70 Jan 5
EIA's new subdivision for fiber optics headed by Wilson WN 59 Apr 13
Electronics' market forecasts: Looking forward from the past 20 years ED 24 Jan 5
Europe: Components sales up across Europe PN 90 Oct 26
European firms in deals with U.S. companies EN 34 Jan 19

European markets
French economy has a chill PN 108 Jan 5
Britain ready to break out black ink PN 77 Jan 19
Spain beset by economic woes PN 84 Feb 2
Outlook in Scandinavia mostly gloomy PN 86 Feb 16
Italian politics casts shadows PN 86 Mar 16
For Britons, 1979 may be deja vu PN 87 Dec 7
Clouds part for West Germany PN 72 Dec 21
Exxon unit acquires maker of point-of-sale terminals ER 50 July 6
Federal loan program: Small-business aid finds few takers PN 86 Oct 12
Ferranti Ltd. has bought Interdesign Inc. ER 62 Jan 5, EN 34 Jan 19
France: atomic unit gears up for components plan IN (76) Jan 5
France: CII-Honeywell Bull says business is booming, with 1977's orders advancing by a third EI 60 (6E) Mar 2
France entices companies with Riviera PN 92 July 6
French and British governments set aid amounts for electronics firms IN 73 (75) Jan 5
GI to broaden its chip business from consumer to nonconsumer ER 42 Sept 14
GenRad kicks up heels PN 96 July 20

GenRad to make its first public stock offering ER 50 May 11
Globe-Union, Square D set merger accord ER 46 May 25
Great Britain: Dept. of Industry's plan to aid domestic industry with NEB money
Government plans to aid IC makers PN 88 May 11
NEB to back memory maker with \$40 million IN 65 June 8
Industry backs governments IC strategy IN 63 July 6
E-beam could be the key for planned new memory company PN 86 July 6
Semiconductor venture launched amid U.S. doubts ER 42 Aug 3
Mostek seeks Inmos halt ER 42 Aug 31
NEB thrives amid controversy—commentary PN 95 Sept 28
Inmos wins first round in court ER 52 Oct 12
Great Britain: GEC talking to U.S. firms about expansion IN 63 June 22
GEC and Fairchild plan joint production of n-channel MOS ICs IN 63 Aug 17
Great Britain: Government funds Compeda's CAD sales effort EI 62 Mar 30
Great Britain: Mergers mulled for telecommunications makers in UK IN 63 Oct 26
Great Britain: Solution offered for TV, audio makers' woes IN 63 May 11
HP: Computers help HP near \$2 billion PN 74 Dec 21
HP ends sales of low-cost devices by distributors EN 35 Feb 16
Hy-gain files bankruptcy, lays off 500 workers ER 50 Jan 19
Intel sues U.S. Copyright Office over registering microprocessor chips ER 40 Jan 19
IBM and Intel exchange royalty free licenses on bubbles and ICs ER 39 Apr 27
IBM on brink of diversification, says consulting firm EN 33 Mar 2
IBM reorganization suggests new units ER 44 Aug 17
IBM, Xerox end all litigation, exchange licenses ER 46 Aug 17
ICL, at 10, is sitting pretty PN 102 Nov 23
IECO: EIA position on components certification gets Justice support WN 57 Aug 17
IECO: Pentagon chills NATO adoption of electronic components standards WN 61 Sept 28
—Letter 6 Nov 23
IECO: UL to supervise U.S. role in new quality system WN 70 Jan 5
ITT, Qume set merger accord ER 52 Oct 12
ITT's Semiconductor Group's headquarters move to Freiburg, West Germany PN 86 Mar 2

Intersil to acquire Datel Systems ER 38 Dec 21
Italy ready to aid electronics firms IN 64 May 11
Italy to push R&D PN 84 Aug 3
Itel thrives by taking on IBM PN 96 Sept 14
Japanese firms stepping up U.S. operations IN 66 Dec 7
Leeds & Northrup acquiring Systron-Donner ER 46 Feb 2
Litronix' forte becomes optoelectronics ER 50 Mar 2
Massachusetts firms strive for change—want to cut taxes, fill jobs PN 112 Jan 5
Massachusetts, technology, and history ED 24 Jan 19
Vote encourages firms PN 90 Oct 12
Mergers in the electronics industry up 8% in 1977 ER 46 Mar 2
Motorola forms industrial-control market group—Subsystem Products group EN 35 Feb 16
Motorola keeps sailing along: sales, profits, new products—1977 ER 42 Mar 30
Motorola, Thomson-CSF, French atomic agency set technology transfer IN 70 Nov 23
New England Digital Corp.: Simplicity pays off PN 82 Aug 3
1978 World market survey and forecast 125 Jan 5
U.S. markets 126 Jan 5
U.S. consumption data 134 Jan 5
Europe markets 138 Jan 5
Japan markets 143 Jan 5
Japan/Europe consumption data 147 Jan 5
—Letter 8 Mar 30
Nippon Electric to acquire Electronic Arrays ER 50 July 6
Norden, at 50, is feisty again PN 82 Mar 2
A North American alliance? ED 24 Mar 30

Northern Telecom acquires 87% of Data 100
ER 46 Aug 17
Northern Telecom Ltd.: U.S. growth spells survival
PN 72 Mar 30
Outlook: Electronics executives are smiling—sales up
PN 81 June 22
Analysts see health
PN 82 June 22
Outlook: Top executives look at 1979 with a sprinkling of optimism despite world economic concerns—ELECTRONICS' annual survey
105 Dec 21
RCA: Nipper given bigger role at RCA
ER 50 Nov 9
RCA to make Intel parts using SOS
ER 41 Apr 13
SOS pact has 'em guessing
PN 94 Apr 27
RCA reaffirms version of 8085A due in 1979
EN 33 May 11
Rockwell-Synertek deal is blissful
PN 98 Dec 7
Semiconductor market: Electronics executives are smiling
PN 81 June 22
Semiconductor market: SIA forecasts 9% growth rate in 1979
PN 88 Oct 12
Semiconductors: Starting a company
ED 24 Nov 23
Sensor Technology Inc. sold to Aspro Inc.
ER 46 Mar 2
Siemens: U.S. is vital component—interview with F. Baur
PN 90 Mar 16
Siemens acquires line of floppy disk drives from General Systems International
ER 52 Apr 13
Siemens, AMD proceed with joint venture, Advanced Micro Computers
ER 62 Jan 5
Siemens rides high on microprocessors
PN 92 July 20
Western world's microprocessor market
PN 94 July 20
Siemens to sell big computers from Fujitsu
IN 63 May 11
Signetics eyes \$200 million level
ER 43 Mar 30
SMC, TI complete microprocessor royalty deal
EN 33 Mar 2
Storage Technology forms subsidiary, STC Communications Corp.
ER 52 Apr 13
TI management shift looks to future
ER 52 Mar 2
TI pushes minicomputers
PN 92 Aug 31
Trade
America's Cold War mentality on trade
WC 62 Sept 28
—Letter
6 Dec 7
CB radio: White House seen slow to act on CB imports
WN 57 Feb 2
Prospects dim for U.S. aid to counter imports
WN 59 Feb 16
Price hikes follow increase in tariff to 21%
WN 60 Apr 13
Color TV imports rise despite cut in Japanese share
WN 57 Jan 19
Japan: As yen goes up, so do prices of TVs and VCRs in U.S.
PN 80 Jan 19
Japan: U.S. demand dropping for color TVs, CB transceivers
IN 63 (65) Feb 16
Taiwan: And now it's Taiwan TVs
ED 25 Apr 27
Imports fall, exports soar
ER 48 Aug 31
Japan supplies 65% of U.S. color TV imports
WN 57 Sept 14
U.S. eyes extension of imports controls to most color TVs
WN 57 Oct 12
Taiwan's TV makers getting nervous
PN 85 Oct 26
Customs Procedural Reform Act: New law eases customs hassles
ER 45 Aug 31
DISC law provisions: Companies battle to retain DISC
PN 76 Mar 30
Electronics trade surplus up in 1977
ER 50 July 6
Great Britain: Viewdata export sales near as trials get under way
IN 65 June 8
India: Free-trade zone grows; new firms come
IN 63 Nov 9
Industry seeks lower taxes, trade barriers
ER 46 Nov 9
Japan: Commerce Dept. helps firms in dealings with Japan
ER 46 June 22
Japan: Doing more business in Japan
ED 24 Aug 17
Japan: Selling Japan—Commentary
PN 78 Aug 17
Japan: SIA unveils 4-point program for freer Japanese trade... but says it doesn't expect improvement
EN 33 Nov 23
Japan: Supreme Court to rule on penalties for Japan imports
WN 55 Mar 2
Japan: U.S. pressures Tokyo to open telecom market to imports
WN 49 Dec 21
Japan and other misunderstandings
ED 24 Oct 26
Japan offers to cut tariffs—U.S. widens issues
WN 59 Aug 3
SIA prepares to take position on Japanese trade
EN 34 June 22
Soviet computers: better than expected—survey by American experts
PN 85 Sept 28
U.S. unwilling to loosen export controls
PN 86 Sept 28
U.S. consumer imports up 23% to \$3.6 billion
WN 59 Apr 13
U.S. imports of ICs show sharp rise
ER 44 Apr 27
U.S. trade deficit: Putting the U.S. on an exports offensive
WC 59 July 6
Zenith's bid for protection rejected by court
ER 48 July 6
U.S. companies want a say in NATO coproduction deals
WN 57 July 20

U.S. innovation may be ebbing, but not in semiconductors
ED 10 Sept 28
Venture capital: Bankrolling electronics with petrodollars
ED 25 Apr 27
Venture capital: Exxon seeks big strike in electronics
PN 88 Apr 27
Video-cassette recorder sales on display
ER 50 July 6
Wage hike ceiling: AEA seeks exemptions from 7% ceiling
ED 16 Dec 21
Electronics firms get exemptions
ER 33 Dec 21
WEMA changes its name to American Electronics Association
ER 50 Feb 16
West Germany: VW, Nixdorf are negotiating a partnership
IN 70 Nov 23
West Germany hikes electronics role in U.S. by 20%
IN 61 (63) Jan 19
Western Digital starts climb back
PN 86 Aug 3
Winter Olympics: TI to supply gear for 1980 Winter Olympics
ER 50 June 22
Yugoslavia: State-owned firm buys West German outfit
IN 63 July 6
Zilog: high flyer is first of its kind
PN 110 Jan 5

CALCULATORS
Comsat slide rule aids design of satellite links
EN 158 Nov 23
HP reducing price of programming cards for the HP-67 and HP-97 calculators
EN 130 Jan 19
Japan grants TI a calculator patent
ER 54 Aug 17
Oscilloscopes: Calculator program generates scope waveforms
EN 138 Nov 9
SR-52: How to double the program steps
EN 152 Mar 16
SR-52 program can be plotted without a printer
EN 122 Dec 21
TI-58: Read-out data from stack registers of TI-58
EN 138 Apr 13, EN 154 June 8

CAPACITORS See also **Integrated Circuits**
Disk capacitors can replace tubular trimmers
NP 251 Jan 5
Electronic Components Conference: Meeting reflects growing IC compatibility
127 Apr 13
Tantalum wet-slug capacitor overcomes catastrophic failure
105 Feb 16

CAREERS
Careers are opening up in computer modeling, data communications
EN 138 Apr 13
CCIA grows in influence, members
ER 42 Mar 16
IEEE: Emberson named permanent general manager
EN 36 Feb 16
IEEE: Herz takes over as IEEE general manager
ER 44 Nov 23
IEEE: Is the U.S. Activities Board falling short?
PN 85 Nov 95
IEEE election
Feerst running for IEEE president, talks of new group
EN 34 Feb 2
IEEE board chooses election slate - Suran and Young
EN 34 Mar 2
Give the IEEE's members a break... and how about one for the candidates?
ED 24 Aug 31
—Letter
6 Oct 26
They're off and running - Feerst-Suran contest
PN 96 Aug 31
Whatever happened to the GGG?
PN 98 Aug 31
—Letter
6 Oct 12 (6 Dec 7)
IEEE's routine election
ED 24 Nov 23
Suran elected IEEE president as voter turnout falls below 30%
ER 44 Nov 23

CHARGE-COUPLED-DEVICES
AF: Fairchild packs 180,000 elements on chip
EN 34 Nov 23
Belgium: Archival store digitizes data and saves money
EI 67 May 11
Bubble memories compete with CCDs
PN 75 Feb 16
Bubbles, CCDs challenge big memories—report
106 Apr 13
—Letter
8 June 8
Chip helps detect targets automatically
ER 41 Mar 16
Fairchild gets contract to develop a CCD imaging system
NU 8 May 25
Great Britain: New CCD TV camera shrugging off blooming problems
IN 63 June 22
Great Britain: Single-chip transversal filter uses 256-stage CCD
IN 55 Dec 21
Intel decides against entering CCD market
EN 34 Nov 23
Intel's 64-K CCD on hold
EN 35 June 8
Japan: Sony unveils color TV camera using CCD chips
IN 64 Mar 16, EI 59 Mar 30
Japan: Two-CCD camera for TV coming from Toshiba
IN 63 July 20
Long-loop CCD gain as short-loop versions fizzle
EN 35 Sept 28
Memories: Motorola stops selling 64-K CCD memories
EN 35 Dec 7
Memories: New look in bulk storage for computers - charge-coupled memories
133 June 22
RCA's CCD TV camera is a first
EN 33 Jan 19
Radiation: Memories racked by radiation
ER 42 June 8
STC has mixed reaction to CCDs in memories
ER 43 Sept 28
West Germany: CCD filter reverses structure with parallel-in/serial-out - hikes performance
EI 67 Aug 17

COLOR TELEVISION
Belgium: Stereophonic receiver is controlled by microprocessor—picture-in-a-picture set also in works
EI 76 (3E) Jan 5
Chip generates 16 color video signal
NP 166 Mar 2
East Germany's color TV industry is booming
EI 74 Apr 27
GE to market projection TV in one cabinet
EN 35 Apr 13
Great Britain: Digital recording method heads for TV studios
IN 63 Oct 12
Imports see **Business - Trade**
Japan: Matsushita to offer bipolar chip for VIR color control
IN 61 (63) Jan 19
Japan: Portable color TV has efficient tube for low power
IN 67 Sept 28
Japan: Sony unveils color TV camera using CCD chips
IN 64 Mar 16, EI 59 Mar 30
Japan: Two-CCD camera for TV coming from Toshiba
IN 63 July 20
Japan: Victor's portable VCRs and color TV cameras
EI (4E) Feb 16, IN 64 June 22
Personal computers: Custom ICs improve image of new home computer on ordinary TV set
ER 60 Jan 5
Price: Hikes despite sales slip worry White House
WN 63 Nov 23
RCA to discuss flat-panel display at SID session
EN 34 Jan 19
RCA's CCD TV camera is a first
EN 33 Jan 19
TV monitor has high resolution
NP 194 June 22
Tuning: Digital channel tuning systems based on frequency synthesizers
NPI (3E) July 20
West Germany: TV picture looks good after long trip by satellite
EI 70 Aug 3
West Germany: Video-game integrated circuit will work with wireless control unit
EI 64 (8E) Jan 19

COMMERCIAL ELECTRONICS See also **Automotive; Avionics; Environment; Marine Electronics; Railroads**
Alarms see Detection
Banking
France: Bank credit card incorporating a microprocessor
IN 61 (63) Feb 2
Supermarkets, banks will use LCDs
ER 50 Aug 17
Billing: Will Japan's NTT buy American for computer billing?
WN 61 Sept 28
Business machines
Exxon unveils 'intelligent' typewriter
ER 46 Mar 2
Italy: Olivetti to show word processor - electronic typewriter
IN 56 Mar 30
Wang combines printer, copier - linked to computer
EN 35 Dec 7, ER 42 Dec 21
Calculators see Calculators
Electronic funds transfer: New EFT rules permit terminal sharing by savings and loan associations
WN 57 June 22
Great Britain: Work on multimicro systems for airlines, brokerage houses and banks
PN 92 Sept 14
Law enforcement
Digital technology protects voice links
ER 46 May 25
Great Britain: Magnetic-stripe watermark process proposed for passports
IN 70 Nov 23
Great Britain: Optical fiber warns of trespassing
EI 74 Sept 28
Law enforcement see also Communications - Police electronics
Locks: Electronic lock stores its code in nonvolatile semiconductor MNOS memory
ER 40 Mar 16

Mail
British facsimile unit can store its transmissions until night time
IN 61 (63) Feb 2
Computerized mail system to speed bills
ER 53 Sept 28
Data-gathering system to help a post office smooth its workload
ER 53 Jan 5
Electronic mail: Postal Service denied monopoly
WN 49 Mar 30
Postal Service hit on test plans
WN 60 Apr 13
Controversy over Postal Service's role—should it compete
WN 57 Aug 17
Postmaster General forces the issue
WC 58 Dec 7
Plan stirs opposition
ER 36 Dec 21
Europe: Electronic mail service is poised for takeoff, study predicts
EI 69 Nov 9
French post office looks to telecopier service as a major growth area for the 1980s
EI 76 (6E) Jan 5
Technology update
178 Oct 26
West Germany: Mail-sorting system reads addresses and verifies zip code
EI 60 Dec 21
Military's eye set on commercial microprocessors for its programs
ER 44 Mar 2
Office automation to almost triple in 5 years says CSI
ER 46 Aug 17
Point-of-sale
Exxon units acquires maker of point-of-sale terminals
ER 50 July 6
Japan: 60-mW dot matrix display offers two rows of 16 characters
NPI (5E) July 16
Printers see Printers & Printing
Rockwell prepares to go commercial with CMOS on sapphire
EN 34 May 25
Subways: Cubic Corp. hit by Washington subway on fare system
WN 57 Nov 9
Supermarkets: States may doom electronic checkout, OTA study says
WN 57 Dec 7

Supermarkets, banks will use LCDs
ER 50 Aug 17

COMMUNICATION SATELLITES
Canada: Digital satellite link may speed newspapers from Europe for printing
EI 72 Dec 7
China: Mainland Chinese show satcom interest in U.S. visits
WN 57 Oct 12, WN 57 Oct 26
Comsat, IBM seek to expand satellite data tests
ER 48 Mar 16
Comsat slide rule aids design of satellite links
EN 158 Nov 23
Europe looks to space for TV but political problems hang heavy
PN 99 May 25
ESA moves closer to launching its own satellites
IN 63 Mar 16
Europospace to cut costs of satellite communications - new organization called Spacecom
IN 71 May 25
France puts stress on space communications
IN 68 Sept 28
GAO's Navstar plans are not very popular
ER 50 June 23
Great Britain: Cable & Wireless to study interference in Intelsat - may be caused by sunspot activity
ER 52 Aug 3
Great Britain: Firm readies speech-interpolation gear for satellite tests
IN 61 (63) Jan 19
Hughes signed \$50 million contract for communication satellites ordered by SBS
ER 42 Jan 19
India's satellite (Insat) to combine TV and meteorology
WN 59 Aug 3
Inmarsat: Competition scores Inmarsat proposals favoring Comsat
WN 63 Apr 13
Intelsat-4: Transatlantic trials of TDM are under way
EN 47 Jan 5
Italians draft space program aimed at TV
IN 55 Mar 30
Japan moves ahead in TV broadcast satellites
WC 50 Mar 30
—Letters
6 May 25
Japanese communication satellite goes live in March
EI 41 Jan 19
Marisat: GAO urges Congress to scrap Marad ship-shore project
WN 70 Jan 5
Satcom 1: Frequency reuse by cable net starts in fall
EN 36 June 8
SBS, facing legal snag, pushes on... as Sperry uses 5-m earth stations
ER 46 Sept 14
SBS picks Harris, Fujitsu to compete for TDM modems
WN 59 Feb 16
SBS satellites seen triggering change in data distribution
EN 34 July 6
SBS wants bids on rf terminals by Feb. 28
WN 69 Jan 5
Spectrum: U.S. seeking a-m space at ITU meeting
ER 40 Dec 21
Spinner craft vs body-stabilized platforms: battle lines form over satellite type
PN 84 Apr 13
Technology update
178 Oct 26
Teleconferences: Businessmen say yes to teleconferences
ER 48 July 20
TI setting up Dallas-London satellite link
WN 57 Nov 9
TDM is in the air at Montreal conference on digital satcom
PN 95 Nov 9
Transatlantic trials of high speed data satellite transmission planned
IN 63 May 11
U.S.-Soviet hotline goes space age
WN 58 Feb 2
WESCON preview
162 Aug 31
West Germany: TV picture looks good after long trip by satellite
EI 70 Aug 3
World's communications satellites - pullout guide
120 Oct 12
Future satellites - Technology update
183 Oct 26

COMMUNICATIONS See also **Data Communications**
AF: Four companies picked for Seek-Talk design
WN 63 May 25
Atomic particles (neutrinos) communicating?
PN 73 July 17
Communications Reform Act/Communications Act of 1978
Industry proposals (4 categories) draw independents' ire - Fogarty calls legislation premature
ER 58 Jan 5
Van Deerlin wants more competition in telecommunications but protection via a new agency
WN 55 Mar 2
Congress: Rethinking telephone reforms while support cools for PIC
ER 57 May 25
Van Deerlin's impractical principle
WC 58 June 22
Communications bill finds few friends: key provisions of H.R. 13015
PN 84 June 22
Deregulation seen as easy by Justice
ER 50 Aug 3
Reforming the FCC: views of the veterans
WC 60 Aug 3
FCC turns down primary-instrument plan
WN 57 Aug 17
Piecemeal rewriting of Communications Act forecast for 1979
WN 57 Oct 26
Couplers: Low-loss Tee coupler looking for possible makers
IN 63 (65) Feb 16
DABS see Avionics
Electronic funds transfer see **Commercial Electronics**
East Germany: Quiet teletypewriter uses mostly ICs
EI 72 Apr 27
Europe: Packet switching network will link railways
IN 66 Dec 7
Facsimile
Burroughs fast fax machines
EN 34 Jan 19

Digital facsimile service between U.S. and Hong Kong went into service this month
 NU 8 Aug 31

French post office looks to telecopier service as a major growth area for the 1980s
 El 76 (6E) Jan 5

Graphic Sciences' sub-minute fax
 ER 46 Feb 2

Great Britain: British fax unit can store its transmissions until night
 IN 61 (63) Feb 2

Japanese facsimile system ready for crucial coding choice
 El 67 Mar 16

Japanese high-speed fax pushes a page to 28 receivers
 IN 63 (65) Feb 16

Japanese technology used in international digital facsimile service, "Q-Fax"
 NU 8 Mar 16

Rapidcom Inc. formed to develop high-speed fax products
 ER 52 Apr 13

Service set between U.S. and Switzerland
 IN 56 Dec 21

Fiber optics see Optoelectronics

France: Government expands developmental aid
 El 61 Dec 21

Chinese pact to benefit French firms
 El 61 Dec 21

France: LED-photodiode chip for fiber optics transmits and receives - EROS
 El 70 Dec 7

Ghana, Eire go for communications gear
 IN 66 Aug 3

Great Britain: Communications/78 - converging technologies produce a plethora of products
 El 72 Apr 13

Great Britain: Teletext smartened by microprocessor
 El 74 Sept 28

Teletext: getting America into the competition
 WC 58 Nov 9

Great Britain: Time-encoded speech uses bits economically
 IN 66 Aug 3

Great Britain: 23 symbols digitize speech
 El 68 Aug 17

Handicapped: Communicator aids palsy victims
 ER 42 May 11

Communicators help the handicapped
 PN 94 June 8

- Letter
 6 Aug 17

Handicapped: Deaf and hearing-impaired persons - FCC wants comments on ways to help
 WN 56 Mar 2

Handicapped: Telesensory readies aids for handicapped - mute and blind
 ER 55 Nov 23

Laser: Trapatt diode yield speed, power
 ER 46 Aug 3

Manchester II succumbs to LSI
 NP 206 May 25

Manchester II comes off the shelf
 NP 206 July 20

Microwaves: GE proposes low-power microwave system at 22 - 23.6 GHz
 WN 57 Dec 7

Multiplexers get 20 dB better
 NP 137 Feb 2

Multiplexing: Japan - Lasers on a chip with waveguides give multiplexing
 El 63 (3E) Feb 2

Multiplexing: Programmable multiplexer solves data-flow problems
 132 May 11

NTIA to begin operations April 1
 WN 57 Mar 16

Can NTIA make telecommunications policy?
 WC 58 Mar 16

1978 World market survey and forecast
 125 Jan 5
 U.S. markets 129 Jan 5
 Europe markets 140 Jan 5
 Japan markets 145 Jan 5

Northern Telecom Ltd.: U.S. growth spells survival
 PN 72 Mar 30

Optical waveguides see **Optoelectronics - Fiber optics**

Paging: Swedes finding each other with paging system
 IN 65 Dec 7

Plasma laser has tunability, power
 ER 43 Dec 7

Police electronics

Digital technology protects voice links
 ER 46 May 25

SDC to build LA's police communications system
 ER 46 Mar 2

PCM filter fits on a single chip
 NP 220 Nov 23

Radio

Algeria ready to produce TVs, radios, recorders
 IN 63 Mar 16

A-m stereo: Belar, Motorola perform best in tests - IC demodulator seen as key
 WN 69 Jan 5

A-m stereo: National has designs on chip
 ER 42 Feb 2

A-m stereo: Sound and fury of a new product
 ED 24 July 6

- Letters
 6 Aug 31, 6 Oct 12

A-m stereo getting mixed reviews
 PN 88 July 6

Army: Singcars radio - Cincinnati, ITT named finalists
 WN 59 Apr 13

Collins named to develop faster Singcars radio
 WN 59 Apr 27

Belgium: Computer to monitor TV/radio signals right off the air
 IN 68 Aug 31

Belgium: Stereophonic receiver is controlled by microprocessor
 El 76 (3E) Jan 5

Chip tunes radios, TVs
 NP 157 Nov 9

Firefighters: Grumman designs new fire helmet
 ER 56 Nov 23

Fm i-f circuit (improved) includes meter drive
 NP 198 Mar 2

France: Broadcast switching matrix/automatic mixer, uses MOS logic for up to 10,000 connections
 El 74 Apr 13

Great Britain: Digital compensation technique in crystals yields ultrastability
 El 67 Sept 14

Great Britain: Frequency-synthesizer ICs ready assault on the mobile-radio communications market
 El 74 Aug 31

Great Britain: Impatt-diode amp aiming at TWTs
 El 74 Dec 7

Great Britain: Military manpack single-channel repeater exploits new fm signal-nulling technique
 El 70 Oct 12

Great Britain: SAW delay line brings a new balance to rf voltage-controlled oscillators
 El 59 (2E) Mar 2

Great Britain: Traffic information service broadcasting may begin soon
 IN 64 Mar 2

Ham radio: That boom you hear is nam radio
 PN 90 Nov 9

Mississippi to get new communications system
 ER 48 Aug 31

Mobile radio: FCC studies proposals to ease uhf crowding
 ER 46 Mar 2

Uhf users object to FCC spectrum plan
 ER 40 Aug 17

Controversy rises over FCC docket
 WN 57 Nov 9

Mobile radio: Japanese hybrid IC packs mobile components
 El 72 July 6

Mobile radio: Two new digital techniques approved
 WN 59 Feb 16

Modulation analyzer determines power, frequency and modulation
 NP 218 Aug 31

Motorola's digital scrambler to use unique modulation
 EN 33 May 11

Mysterious radio signals are neither mystery nor radio
 EN 36 Apr 13

NAB to set up engineering lab in Washington
 WN 61 Sept 28

Netherlands: Digital signal accompanies fm broadcast to give station information to the listener
 El 68 Oct 12

Quark uses bubble memories to measure performance of digital radio equipment
 NU 8 May 11

Radio-frequency interference inquiry set by FCC: comments due May 1
 WN 63 Nov 23

Radio telescope uses 19,500 chips for complex signal processing at 100 MHz
 ER 44 Oct 12

Snooper locates radio transmitters
 ER 46 May 11

Spectrum: Watching the spectrum slip away at WARC
 ED 24 Oct 12

- Letter
 8 Dec 21

U.S. seeking a-m space at ITU meeting
 ER 40 Dec 21

Switzerland: Tone-control chip sets 4 parameters in stereo radios
 IN 64 July 20

Toys and hobbies: Radio remote control
 EN 36 Dec 7, PN 78 Dec 21

TRW puts most of an rf receiver on single silicon LSI chip - L-band receiver
 ER 41 Aug 3

TRW knows its "OATS"
 ER 42 Aug 3

TRW's rf circuit on one chip
 EN 34 July 6

V-FETs: Vertical geometry is boosting FETs into power uses at radio frequencies
 105 Mar 2

West Germany: Precision potentiometer for a-m, fm bands produced by laser trim
 NPI (3E) Apr 27

Radio, Citizens' Band

CB price hikes follow increase in tariff to 21%
 WN 60 Apr 13

FCC ban on linear amps takes effect April 28
 WN 60 Apr 13

FCC drops tests of new CBs: cites improvements
 WN 56 Mar 2

Japan: U.S. demand dropping
 IN 63 (65) Feb 16

Licenses climb 22% in year, total a record 14 million
 ER 60 Nov 23

RCA drops out of games field, pares CB line
 EN 34 May 11

White House seen slow to act on CB imports
 WN 57 Feb 2

Prospects dim for U.S. aid to counter CB imports
 WN 59 Feb 16

Radio-telephone: Audio IC chip drops crosstalk down 83 dB
 ER 42 July 6

Sound maker: GI develops programmable sound generator
 EN 33 June 22

Speech synthesis: Three-chip system synthesizes human speech
 109 Aug 31

Other products that talk
 116 Aug 31

Speech synthesizer: France - mini-based speech synthesizer system has unlimited vocabulary
 El 71 Aug 31

Speech synthesizer: Single silicon chip synthesizes speech in \$50 learning aid
 ER 39 June 22

Technology update
 178 Oct 26

Telecommunications: France - Protocol-linkup plan would stymie IBM
 El 69 June 8

Telecommunications: U.S. pressures Tokyo to open telecomm market to imports
 WN 49 Dec 21

Teleconferences: Businessmen say yes to teleconferences
 ER 48 July 20

Telephone

Advanced Communications Service (ACS) see **Data Communications** - AT&T's Advanced Communications Service (ACS)
 Air Force works to ready digital phone
 ER 42 May 25

AMI charts broad attack on communications market with LSI
 ER 46 Mar 16

AT&T and competition: the Bell System's challenge for Charlie Brown
 WC 64 Nov 23

AT&T stalled technology, U.S. says
 PN 98 Nov 23

AT&T recognizes competitors but vows to stay on top
 EN 36 Dec 7

Astech's system permits hook-up of phone to ac outlet
 EN 34 June 22, NP 155 July 20

Bell develops telephone powered by light-waves alone
 ER 39 Nov 23

Bell to install light-wave communications system for voice and data in Atlanta
 NU 8 Nov 23

Branch exchange still relies on space-division switch
 ER 39 May 11

Broadband cable services sought for rural America
 WN 57 May 11

Canada to get phone-link video-text link
 EN 33 Aug 31

Canadians to try electronic phones
 NU 8 Nov 9

Codec chip loses British accent
 NP 147 Apr 13

Codec filter goes monolithic on Intel n-MOS chip
 ER 42 Sept 28

Codecs: AMD to enter codec market with 2-chip, 2-channel set (μ - or A-law)
 EN 33 Sept 14, EN 35 Dec 7

Codecs: Motorola's interface (SLIC) relies on bipolar technology
 ER 48 Sept 14

Codecs: National 2-chip codec set hits the market; Motorola prepares C-MOS part for market
 EN 33 Aug 31

Codecs: Signetics develops an iPL codec
 ER 51 Apr 27

Codecs: Technologies, architecture compete for huge codec market
 105 Sept 14

Multichannel shared codecs cost less and save on power
 108 Sept 14

N-MOS codec packs in analog and digital circuitry
 111 Sept 14

C-MOS codec splits transmitting, receiving sections - saves power
 141 Sept 28

iPL gives codec superior ac performance
 130 Oct 12

Conrac's Visual Display Unit: military effort to obtain battlefield telephone exchange system
 NU 8 Oct 12

East Germany may grab Greek phone deal from Western firms
 IN 63 June 22

Electronic phone to be sold in U.S. by Bell Canada
 EN 25 Dec 21

Electronic telephones: New firms rush into new market
 PN 81 July 6

What is the Bell System doing?
 PN 82 July 6

- Letters
 6 Aug 3, (6 Sept 28)

Electronic telephones bow at Consumer Electronics Show
 ER 40 June 22

Executiv: MCI hits AT&T tariff filing for Execucut
 WN 59 June 8

Fiber cables to be strung from phone poles
 EN 36 Feb 16

France: French working on 90-Mb/s coaxial phone link
 IN 64 Sept 14

France: Sales curves flatten for French telephone makers
 IN 64 June 22

France: Thomson aims electronic PABX at low end
 IN 64 Sept 14

GI's iPL chips for phone market are due in spring
 EN 47 Jan 5

Great Britain: BPO pushes work on codec modulator and new exchanges
 IN 65 Apr 13

Great Britain: BPO set to go on exchanges for packet switching
 IN 66 Dec 7

Great Britain: Firms add new wares to PABX market
 IN (66) Feb 16

Great Britain: Mergers mulled for telecommunications makers
 IN 63 Oct 26

Great Britain: Microcircuit manufacturers rush to fill demand for coder-decoders (codecs)
 El (3E) May 11

Great Britain: Microprocessor figures call charges for phone users with timing unit
 IN 64 May 11

Great Britain: Multichannel codec from Plessey challenges per-channel units
 IN 69 Nov 23

Great Britain: Packet-switching net to use 8080 processors?
 IN 64 Mar 16

Great Britain: STC to test telephone lines with microprocessors
 IN 64 Mar 16

Great Britain: STL develops a rugged single-mode cable for telecommunications
 IN 55 Mar 30

Harris to build 32-mi fiber-optic phone system
 EN 33 Apr 27

Intel produces one-chip filter for codec
 EN 33 Sept 14

Intel to announce production of n-MOS codec at Paris show
 EN 33 Mar 30

IEDM describes tomorrow's devices
 ER 64 Jan 5

ISSCC preview: Powerful LSI devices bow at silver anniversary - report
 116 Feb 16

Italy: Phone fight attracts another competitor
 El 72 Apr 27

Italy: SGS/Ericsson chip integrates functions for phone sets
 IN 68 Sept 28

Japan: 4-megabyte bubble memory to fill phone role
 El 78 May 25

Japan: Integrated switch holds four crosspoints
 El 78 Nov 23

Japan: Microcomputer, other ICs in each phone build a PAX that needs no switchboard
 El 72 Aug 31

Japan: Will NTT buy American for computer billing?
 WN 61 Sept 28

Marine Corps: ITT awards Harris contract to develop ICs for unit-level phone switch program
 NU 10 June 8

Mostek readies phone parts - pulse dialers and tone dialers
 ER 43 Apr 13

Mostek's IC tone decoder
 NP 234 Apr 27

Netherlands: Flexible voice response unit will have many messages for telephone subscribers
 El 64 (6E) Feb 2

Netherlands: Phone net boosting stored-program lines
 El 76 (9E) Jan 5

Picturephone: Conference video phone links West German plants
 El 64 Mar 30

Rural Telecommunications Administration, new agency suggested
 WN 55 Mar 2

Saudi Arabian network order goes to Philips, Ericsson and Bell Canada
 ER 62 Jan 5

Semiconductor makers making codecs and other ICs that phone companies will need
 PN 77 Apr 13

Storage Technology developing advanced telecom system
 ER 52 Apr 13

Technology update
 178 Oct 26

West German PO to spend billions for expanded services
 IN 67 Aug 31

West Germany: Chip for phone keeps user up to date
 IN 55 Dec 21

West Germany: Growing PABX race attracts German competitor
 NPI (3E) May 25

West Germany: Pay phone has 6800 to adapt it to worldwide use
 IN 65 Apr 27

West Germany: Train riders can direct-dial telephone calls
 IN (64) Jan 19

West Germany: U.S. forces to buy German gear for phone modernization
 IN 65 Dec 7

Telex: West Germany - 8080s give versatility to Telex control
 IN 64 Oct 26

Translating computer fits in hand - relies on plug-ins
 EN 34 Nov 23, ER 50 Dec 7

Translators: Language translator from Craig
 ER 34 Dec 21

Video-text systems

Canada to get phone-line video-text link
 EN 33 Aug 31

Germany mediates French-British viewdata squabble
 IN 70 Nov 23

Great Britain's Viewdata serves users
 IN (64) Jan 19

GI Microelectronics' interface unit
 IN (64) Feb 2

Export sales; trials under way
 IN 65 June 8

Flat-screen display
 IN 63 Sept 14

Microbit: Software house seeks Viewdata expansion
 El 72 Nov 9

Will video-text systems travel well?
 ED 24 Sept 14

WESCON preview: Focus on telecommunications, microprocessors
 157 Aug 31

West Germany: Cyclists' intercom gives the word while adjusting its volume for noise level
 El 70 May 11

West Germany: PCM codec with \$10 price tag due from Siemens
 IN 66 June 9

Xerox's telecommunications network - XTEN
 PN 84 Dec 7

COMPUTER-AIDED-DESIGN

Great Britain: CAD language aids design of VLSI chips
 El 64 Dec 21

Great Britain: CAD service zips through design work of CMOS ICs
 El 74 Aug 3

Great Britain: Government funds Compeda's CAD sales effort
 El 62 Mar 30

Hybrid designer sells for \$16,460
 NP 196 Nov 23

Pc boards: How design automation can optimize printed-circuit board layout
 102 Jan 19

Symbolic layout system speeds IC mask design - uses CAD procedure
 125 July 20

COMPUTERS See also **Microcomputers & Microprocessors; Minicomputers; Terminals**

AMC aims at Intel with five new boards
 EN 34 Oct 12

AF forecast of computer weapons in year 2000 due
 WN 57 Oct 26

Air Force's SOS-based fault-tolerant unit has budget ills
 ER 41 Sept 14

Amdahl, Intel add new mainframes
 ER 50 Nov 9

Burroughs readies mainframe networking entry
 EN 34 Aug 31, ER 42 Oct 12

China: Computer scientists to view technology of the Chinese
 EN 34 Sept 14

China plans research in microelectronics and computers
 IN 65 Apr 13

CompCon 78: Computer producers unveil designs for data communications
 ER 41 Sept 28

Computer makers seek the ideal field tester - Board inventories mount
 PN 83 June 8

Data General packs power on single board
 EN 33 May 11

DOD-1: DARPA looking toward a high-level common language for computers
 WN 59 Aug 3, ED 24 Aug 17, ER 39 Oct 26

DEC mainframe has 16-k RAMs, bit slices
 ER 44 Mar 16

IBM, HP price cuts - more than a reaction
 ER 46 Mar 16

Eastern Bloc starts new series of small computers
 IN 63 Mar 16

Electroplating: Computer cleans up electroplating
 EN 154 June 8

Fairchild acquiring interest in computer maker
 ER 50 May 11

Foamed plastic, Lexan FL1800, for computers, resists flames
 NP 186 Mar 2

France: CII-Honeywell Bull says business is booming, with 1977's orders advancing by a third
 El 60 (6E) Mar 2

- France: Government expands developmental aid EI 61 Dec 21
Chinese pact to benefit French firms EI 61 Dec 21
France: Subnanosecond CML circuitry in the works for French computers IN 64 Mar 2
Gate arrays have marketers raring to go: Motorola and Ferranti are optimistic PN 83 Apr 27
Great Britain: Amdahl chalks up two more UK orders IN 64 Oct 12
Great Britain: Big array processor to be installed for research and number-crunching tasks IN 56 Mar 30
Great Britain: British push international computer protocol IN 64 July 6
Great Britain: ICL may sell new number cruncher to other OEMs IN 65 Apr 27
Great Britain: ICL readies 1-n, 400-gate standard logic array IN 63 Mar 16
Great Britain: Mainframe computer reaches 100 million operations a second EI 69 Apr 27
Great Britain: One-chip version due of associative parallel processor using PL IN 73 (75) Jan 5, EI 63 (7E) Jan 19
New architecture in associative computer: integrating it all on a wafer ER 48 Mar 2
Harris Computer Systems - new top-of-the-line-unit EN 50 June 22
HP: Computers help HP near \$2 billion PN 74 Dec 21
HP adds systems to both ends of computer line - HP3000 and HP250 EN 33 July 6
HP computer gives SOS technology big boost ER 39 Oct 12
Honeywell, GE to combine international computer operations ER 50 June 22
Honeywell scraps large computer, wary about CML and high costs ER 46 Mar 30
Intel's 16-bit single-board computer maintains 8-bit family ties 105 Oct 12
IBM architecture bows - new System/38 PN 81 Nov 9
IBM builds own 64-K RAMs for new computer EN 33 Oct 12, PN 88 Oct 26
IBM moves in on distributed processing PN 88 Oct 26
IBM on the brink of diversification, says consulting firm EN 33 Mar 2
IBM plug-compatibles market PN 88 Sept 14
ICL and Hitachi exchanging data IN 71 May 25
Japan: Fujitsu M-200 computer takes over top of the line... while Hitachi readies a new top, M-210 IN (64) Feb 2
Japan's largest computer (M-300H) due at end of 1979 IN 63 Sept 14
Magnuson Systems' M80 CPU series takes a new route to IBM country PN 93 May 25
Memories see **Memories**
Microcomputers see **Microcomputers & Microprocessors**
Microprogramming a computer: Replacing hard-wired logic with microcode 125 Nov 9
Minicomputers see **Minicomputers**
Mitsubishi announces IBM-compatible computers ER 48 Aug 31
Multilayer boards: Mass molding a boon to fast logic PN 102 May 25
NCR announces fast mainframes ER 44 Dec 7
National Computer Conference: NCC eyes new roles for computer with emphasis on energy problem 157 May 25
Product Preview 171 May 25
National Computer Conference: Next year sold out, but costs worry ER 41 June 22
NOAA converting computer operations to Univac 1100/42 replacing IBM, CDC computers ER 50 May 11
Navy: effort to equip vessels and aircraft with standard, militarized computers and peripherals NU 8 June 22
Network architectures from U.S. manufacturers - distributed processing report 114 Dec 7
New networks tie down distributed processing concepts - report 107 Dec 7
U.S. scene 111 Dec 7
Europe and Japan 118 Dec 7
1978 World market survey and forecast 125 Jan 5
U.S. markets 127 Jan 5
Europe markets 140 Jan 5
Japan markets 145 Jan 5
Nixdorf, Brazil firm sign pact on computer know-how IN 65 Dec 7
Patent issue called a matter for Congress ER 46 July 6
- Peripherals see Peripherals**
Personal computers
Atari moves into personal computers EN 33 Nov 23, ER 38 Dec 21
Custom ICs improve image of new home computer on ordinary TV set ER 60 Jan 5
Disk system made for personal computers NP 140 Feb 2
Great Britain: Apple computers with ITT linkup... sales flourish IN 72 May 25
Personal-computer makers clash over best way to interest consumers ER 46 Jan 19
RCA has lowered the price of the Video Interface Processor NU 8 Aug 17
Super Sound Board permits users to transcribe or compose music for playing on the VIP NU 8 Sept 14
Programming struggle: writing new software is a labor-intensive task PN 92 May 11
Perplexing world of software PN 90 June 8
Schottky-coupled logic combines speed of ECL and low power level of TTL 107 Nov 9
- Siemens rejoins computer joustings in France IN 69 Nov 23
Siemens to sell big computers from Fujitsu IN 63 May 11
Signetics to offer a family of ISL gate arrays EN 26 Dec 21
Single-board computer built around Z80 NP 159 Jan 19
Soviet computers: better than expected - survey by American experts PN 85 Sept 28
U.S. unwilling to loosen export controls PN 86 Sept 28
Standards: Federal standard for magnetic tape proposed by NBS WN 56 July 6
Standards: Report blasts lack of standards for Federal computer installations ER 39 Feb 2
Why computer bids are noncompetitive ER 40 Feb 2
Symbols (standard) let designers grasp logic operation quickly and easily 143 Dec 7
Tandem concept goes nationwide ER 50 Nov 9
Technology update 152 Oct 26
Traffic control see **Automotive**
Wang combines printer, copier - linked to computer EN 35 Dec 7, ER 42 Dec 21
West Germany: Boom times for computer firms IN 64 Aug 17
West Germany: Siemens plans new models to chase IBM IN 63 Nov 9
West Germany: Siemens testing fiber-optic cables in computers IN 67 Sept 28
- CONFERENCES & SHOWS**
Annual Test Conference 1978: LSI-board testing bedevils users PN 81 Oct 26
Data Communications conferences offer update EN 124 Aug 17
Electro/78 returns to Boston showing increase in booths and exhibitor ranks 144 May 11
Electro/78 Product Preview NP 155 May 11
Electronic Components Conference: Components meeting reflects growing IC compatibility 127 Apr 13
Electronica: Caution, optimism share spotlight NPI (9E) Oct 26
Electronica to see Siemens 32-K ROM and IC kit for digital tuning on TV sets IN 63 Oct 12
France: Salon International des Composants Electroniques - Components show draws offerings from all of Europe NPI (11E) Mar 16
View from Paris show is multihued PN 81 Mar 16
Great Britain: Communications/78 - converging technologies produce a plethora of products EI 72 Apr 13
Industrial Robot Conference and Exposition: New robot, Puma, shown ER 40 Nov 23
IEEE Computer Society's CompCon 78: Computer producers unveil designs for data communications ER 41 Sept 28
International Electron Devices meeting: IEDM describes tomorrow's devices ER 64 Jan 5
International Electron Devices Meeting focuses on VLSI, GaAs, and sensors 129 Dec 7
International Solid State Circuits Conference - 1978: Powerful LSI devices bow at silver anniversary - report 116 Feb 16
Digital design: scaling new heights 117 Feb 16
Lines: a mixing bag of controllers, opto, converters 122 Feb 16
Dedicated LSI chips aim at communications 125 Feb 16
- ISSCC
Combined MOS and bipolar chip spots fast, low-power RAM ER 41 Mar 2
Monolithic supply powered by 110V ER 41 Mar 2
Trimos combines triac, MOS devices ER 42 Mar 2
ISSCC advances on all fronts PN 70 Dec 21
Japan Electronics Show 78 NPI (6E) Sept 28
Midcon 78 show faces a test in Dallas ER 48 Nov 23
National Computer Conference: NCC eyes new roles for computer with emphasis on energy problem 157 May 25
Product Preview 171 May 25
National Computer Conference: Next year sold out, but costs worry ER 41 June 22
Wescon/78 rescheduled, pared to three days ER 48 Mar 16
WESCON preview: Focus on telecommunications, microprocessors 156 Aug 31
Telecommunications components 157 Aug 31
Microprocessors & Microcomputers 158 Aug 31
Logic & memory; Bubbles 160 Aug 31
Instruments 161 Aug 31
Satellites and fiber optics 162 Aug 31
New products 171 Aug 31
Wescon heads for Anaheim in 1980 ER 53 Sept 28
World Administrative Radio Conference (WARC): Watching the spectrum slip away ED 24 Oct 12
- Letter 8 Dec 21
U.S. seeking a-m space at ITU meeting ER 40 Dec 21
- CONNECTORS See Interconnections**
- CONSUMER ELECTRONICS See also Automotive; Calculators; Color Television; Marine Electronics; Television; Video Recorders**
Audio tape deck: National packs active electronics on a chip EN 36 Feb 16
Coffee: Microcomputers to vend coffee ER 55 Jan 5
Food processor and blender: Hamilton Beach uses microprocessor ER 42 Aug 17
Games: Microprocessors play bigger part in toys ER 52 Feb 16
Great Britain's Teletext see **Communications**
Hi-fi: Philips readies PCM audio set EN 33 May 25
Imports: U.S. consumer imports up 23% to \$3.6 billion WN 59 Apr 13
Imports: Zenith's bid for protection rejected by court ER 48 July 6
Italian ICs will make organ music IN 64 Oct 26
Japan: EIA-J seeks four changes to aid consumer industry IN 65 June 8
Japan: Hi-fi cassette gets new hearing in data recorders NPI (5E) Dec 7
Lights: West German thermistor banishes fluorescent flicker EI (4E) Mar 2
1978 World market survey and forecast 125 Jan 5
U.S. markets 128 Jan 5
Europe markets 139 Jan 5
Japan markets 143 Jan 5
Ovens: Microwave range and oven sales to top \$1 billion in 1978 ER 46 Feb 2
Technology update 212 Oct 26
Toys and hobbies: Radio remote control EN 36 Dec 7, PN 78 Dec 21
- Video games
Game-computer chip sets emerge ER 51 Feb 2
RCA halts production of its Studio II monochrome programmable games NU 8 Mar 2
RCA drops out of games field, pares CB line EN 34 May 11
TV games may burn in images, FTC says ER 66 Jan 5
West Germany: Big deal on for TV-game chips IN 63 Mar 2
West Germany: Video-game integrated circuit will work with wireless control unit EI 64 (8E) Jan 19
- Watches
Electronic watch has LCD hands ER 44 Aug 3
54% of wristwatches sold in 1985 to be quartz-controlled EN 48 Jan 5
Japanese firm slims down analog watch IN 66 June 8
Solid-state watch with single time and date selector button - patent to Commodore ER 52 Oct 12
West Germany: Quartz-watch IC incorporates a 4-MHz oscillator IN (64) Feb 2
West Germany: Grundig casts eye on American consumer market IN 64 Oct 26
West Germany: Magnetofluids appear in full range of German loudspeakers IN 65 Apr 13
Western companies join with Japanese companies on consumer products IN 56 Dec 21
- CONVERTERS**
Analog Devices cuts cost of 8- and 12-bit d-a converters EN 35 Feb 16
Analog Devices' d-a converters keep growing NP 178 Oct 12
Analog lists fast synchro-to-digital converter family EN 33 Mar 16
Analog's 12-bit d-a converter C-MOS chip sells for only \$12 NP 141 Mar 2
A-d converter chip resolves 10 bits NP 137 Jan 19
A-d converter likes microprocessors NP 130 Aug 17
A-d converters are fast, stable NP 174 Feb 16
Canon camera has microcomputer plus programmed logic array and 8-bit a-d converter controls EI 60 Mar 30
'Compromise' a-d converter enters from Micro Networks NP 196 Apr 27
Data acquisition: British tracking a-d chip converts swiftly EI 67 May 11
D-a converter: How to generate a hyperbola with a d-a converter EN 112 Mar 30
D-a subsystem (MP8308) runs at 100-MHz NP 125 Aug 3
Dc-dc converter isolates 3,500 V NP 174 June 22
Flyback converters: solid state solution to low-cost switching power supplies 100 Dec 21
Great Britain: a-d conversion - Solartron pushing new technique IN 66 Apr 27
Hybrid a-d unit breaks 2- μ s barrier NP 115 Mar 30
Hybrid d-a converter (DAC-80) needs little power NP 136 Aug 3
Hybrid d-a converter spans 20 MHz NP 132 Aug 17
I²L puts it all together for 10-bit a-d converter chip 99 Apr 13
Intel's 8022 packs a-d converter, plus NP 183 May 11
Japan: Microcomputers do on-chip a-d conversion EI 67 July 20
Japan: NEC, Mitsubishi build converters into processors IN 64 July 6
Low-cost forward converters ease switching supply design - uses novel transformer 119 Feb 2
Microcontroller includes a-d converter for lowest-cost analog interfacing 122 May 25
National's 8-bit converter has interfacing logic on chip EN 34 Oct 26
One-chip 8-bit converter has multiplexer NP 178 Apr 13
Op amp converts square waves into triangular ones EN 185 Jan 5
- Rockwell adds analog inputs to 4-bit family EN 34 Nov 23
Synchro-to-BCD rotary converter tracks at 75rps NP 156 Apr 13
Synchro-to-digital converter: Angle indicator sells for \$495 NP 244 Aug 31
Technology update 206 Oct 26
TI lowers price of 7-bit converter to 50 cents EN 33 Oct 12
TRW brings out 6-bit a-d converter for non-broadcast video EN 33 Aug 17
V-f converter puts out 10-MHz - Electro/78 Product Preview NP 162 May 11
Video converter from Analogic features attractive price EN 33 July 27
West Germany: Production tool uses image converter and microprocessor IN 64 July
- COUNTERMEASURES**
AF: Tactical systems move to production a Ford, Litton WN 56 Mar 2
- Correction 8 Apr 13
Army-Air Force: Video compression picture is clearing PN 96 May 25
Awacs: NATO approval nears PN 90 May 11
Europe's consortium concept helps competition with the U.S.: missiles, satellites and warplanes production PN 90 Aug 31
GAO urges Congress to push for more NATO weapons standardization WN 57 Feb 2
Grumman's signal detector uses an optical memory ER 41 Mar 30
Navy: costs double on Lamps antisub helicopter WN 57 Mar 16
Navy: Submarine hunters sought for ASW mobility WN 55 Mar 2
Navy: Updates add to P-3C capabilities PN 90 June 8
Canadian way with the P-3C PN 92 June 8
NATO to jump EW, ASW outlays in 5-year plan WN 59 June 8
PAVE PAWS opposed by Cape Cod environmentalists as health peril - microwave radiation EN 35 Apr 13, ER 48 Apr 27, NU 8 Dec 7
Signal processor, P²E, from Saunders goes programmable ER 42 Mar 2
- CRYSTALS**
Great Britain: Digital compensation technique in crystals yields ultrastability EI 67 Sept 14
Liquid crystals see **Displays**
Quartz crystals: Understanding precision crystal time bases 114 Aug 17
- DATA COMMUNICATIONS**
AT&T's Advanced Communications Service (ACS)
AT&T asks FCC for ruling so it can use its digital facilities for data service ER 41 July 20
AT&T selling data processing illegally, says IBM... Justice eyes AT&T software sales WN 57 July 20
Let's not rush to answer the phone ED 12 Aug 3
AT&T bid for switched digital service (ACS) jars industry PN 79 Aug 3
AT&T's ACS plan is stirring queries ER 53 Aug 31
FCC hears support for ACS concept from large users WN 59 Aug 31
Top IBM scientist asks for unregulated ACS service EN 33 Sept 14
AT&T's reply to FCC's request for data PN 83 Dec 7
AT&T vs IBM: Pitting AT&T against IBM called harmful to industry WN 57 Mar 16
Burrheads readies mainframe networking entry EN 34 Aug 31, ER 42 Oct 12
Buying power consolidated by GSA WN 57 Dec 7
Communications chip (ACE) interfaces with most microprocessors 123 Mar 16
CompCon 78: Computer producers unveil designs for data communications ER 41 Sept 28
Telecommunications policies clash ER 41 Sept 28
Comsat, IBM seek to expand satellite data tests ER 48 Mar 16
Conferences offer update on data communications EN 124 Aug 17
Data-link control chips: bringing order to data protocols 104 June 8
Data communications abbreviations 105 June 8
- Letter 6 Aug 3
Digital signals grow stronger for communication systems PN 88 July 20
- Letter 6 Sept 14
DIP delay lines: Easy impedance matching opens the digital door 114 Mar 2
Making connections 116 Mar 2
Fiber optics see **Optoelectronics**
France: Switchable modem sends and receives low and high IN 67 Aug 31
GaAs the answer to data traffic jams? PN 94 Nov 23
Great Britain's Teletext see **Communications**
Japan: Hi-fi cassette gets new hearing in data recorders NPI (5E) Dec 7
Japan: NEC and Toshiba aim minicomputers at industrial control, data networks IN (66) Feb 16
Modems: Automatic system monitors network performance NP 206 June 22
Modems: Motorola's multiplexer makes a better-balanced modem EN 148 Aug 31
Multiplexing liquid-crystal displays 113 May 25
Navy: Monitor sorts targets EI 71 July 6