THE INTEGRATED OFFICE

**HARDWARE**
- IBM PS/2 Model 60
- Amstrad PC-1640
- Sinclair’s Z-88

**SOFTWARE**
- Gem DTP
- DOS helpers

**FEATURES**
- The Cray 2
The secret of Borland's success is "Quality, Speed, Power, & Price"

We're one of the biggest software companies in the world—and we got that way by making "Quality, Speed, Power, & Price" essential characteristics of every Borland software program. Look for Borland software—then look no further.

**SideKick**
*Instant Desktop Management!*

Powerful desktop management program and the #1 best seller for the IBM PC. SideKick includes notepad, calendar, calculator, appointment scheduler, telephone directory, autoswitch, and ASCII table. It's RAM-resident—which means SideKick is always there ready to react when you need to do something, call someone, or find out something in a hurry. And it does all this while you run other programs. Minimum memory: 128K.

**Traveling SideKick**

It's the electronic organizer for this electronic age. Neither you nor your secretary need to take 1987 with old-fashioned 1887 diaries. Traveling SideKick has everything they have—and a lot more. (Unlike dusty old diaries, Traveling SideKick doesn't "expire" at the end of '87, because it's electronic and good for '88, '89, '90 and on and on and on.) It's a professional binder, a software program, and a report generator—a modern business tool that prints your ever-changing appointments in daily/weekly/monthly/yearly form. (If your schedule changes hourly: Traveling SideKick handles the changes instantly.) Whether you use your own personal computer or have someone's help with that, Traveling SideKick is the smart new way to take your computer with you—without taking your computer with you. Minimum memory: 256K.

**Turbo Lightning**
*Solves All Your Spelling Problems!*

While you use SideKick, Reflex, Lotus 1-2-3, and most popular programs, Turbo Lightning proofreads as you write! If you misspell a word, Turbo Lightning will beep at you instantly, and suggest a correction for the word you just misspelled. Press one key, and the misspelled word is immediately replaced by the correct word. And if you're ever stuck for a word, Turbo Lightning's thesaurus is there with instant alternatives. Minimum memory: 256K.

**Lightning Word Wizard**
*Technical Reference Manual For Turbo Lightning!*

An important addition to Turbo Lightning, Lightning Word Wizard includes fascinating and challenging word games like "Akua" (try reading that backward), "That's Rite," "CodeCracker," "CrossSolver," "MixUp," and "FixUp," to name some of them. Lightning Word Wizard introduces you to the "nuts and bolts" of Turbo Lightning technology, and gives you more than 20 different-calls to the Lightning engine. Minimum memory: 256K.

**Turbo Prolog**

Our new Turbo Prolog has drawn rave reviews—which we think are well deserved—because Turbo Prolog brings 5th-generation language and supercomputer power to your IBM PC and compatibles. Turbo Prolog is a high-speed compiler for the artificial intelligence language, Prolog, which is probably one of the most powerful programming languages ever conceived. We made a worldwide impact with Turbo Pascal, and you can expect the same results and revolution from Turbo Prolog, the natural language of Artificial Intelligence. Minimum memory: 384K.

**Reflex**

No matter what business you're in, if you use Lotus 1-2-3 or dBASE you need Reflex and the new Reflex Workshop to give you all the tools and views to see what your numbers mean. The new Reflex 1.1 with expanded memory support allows you to manage huge databases of up to 8 megabytes of RAM, 32,000 records, and 250 fields per record with "Reflex Lightning Speed." The Reflex Workshop gives you a wide range of analytical tools written for specific applications like Finance/Accounting, Administration, Sales and Marketing, and Production and Operations. You can use the tools "as is" or modify them to suit your business needs. Minimum memory: 384K.

**SuperKey**
*TURNS 1000 KEYSTROKES INTO 1!*

If you use SideKick, you need SuperKey. They're designed to work together—and work for you. SuperKey's an amazing keyboard enhancer for your IBM PC and compatibles. With easy-to-write macros, you and Superkey can turn 1000 keystrokes into 1. Minimum memory: 128K.

**Turbo Pascal**

Turbo Pascal, the worldwide standard in high-speed compilers, and Family.

**Turbo Database Toolbox**

A perfect complement to Turbo Pascal, because it contains a complete library of Pascal procedures that allows you to search and sort data and build powerful database applications. It comes with source code for a free sample database—right on disk. Minimum memory: 128K.

**Turbo Editor Toolbox**

Recently released, we call our new Turbo Editor Toolbox a "construction set to write your own word processor." Source code is included, and we also include MicroStar, a full-blown text editor with pull-down menus and windowing. It interfaces directly with Turbo Lightning to let you spell-check your MicroStar files. Minimum memory: 192K.

**Turbo GameWorks**

Turbo GameWorks is what you think it is: "Games" and "Works." Games you can play right away (like Chess, Bridge and Go-Moku), plus the Works—which is how computer games work. All the secrets and strategies of game theory are there for you to learn. You can play the games "as is" or modify them any which way you want. Source code is included to let you do that. Minimum memory: 192K.

**Turbo Tutor 2.0**

The new Turbo Tutor can take you from "What's a computer?" through complex data structures, assembly languages, trees, tips on writing long programs in Turbo Pascal, and a high level of expertise. Source code for everything is included. New split screens allow you to put source text in the bottom half of the screen and run the examples in the top half. There are quizzes that ask you, show you, tell you, teach you. Minimum memory: 192K.

**Turbo Graphix Toolbox**

Includes a library of graphics routines for Turbo Pascal programs. Lets even beginning programmers create high-resolution graphics with an IBM Hercules, or compatible graphics adapter. Our Turbo Graphix Toolbox includes all the tools you'll ever need for complex busines graphics, easy windowing, and storing screen images to disk. It comes complete with source code, ready to compile. Minimum memory: 192K.
Turbo C: The fastest, most efficient and easy-to-use C compiler at any price.

Turbo C: The C compiler for amateurs and professionals.

If you're just beginning and you've always wanted to learn C, now's your chance to do it the easy way. Like Turbo Pascal, Turbo C's got everything to get you going.

If you're already programming in C, switching to Turbo C will considerably increase your productivity and help make your programs both smaller and faster. Actually, writing in Turbo C is a highly productive and effective method - and we speak from experience. Eureka: The Solver and our new generation of object code size, Compile and link time, Compile time, Object code size

Sieve benchmark (25 iterations)

<table>
<thead>
<tr>
<th>Turbo C</th>
<th>Microsoft PC</th>
<th>Lattice C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compile time</td>
<td>3.89</td>
<td>16.37</td>
</tr>
<tr>
<td>Compile and link time</td>
<td>9.94</td>
<td>29.06</td>
</tr>
<tr>
<td>Execution time</td>
<td>5.77</td>
<td>9.51</td>
</tr>
<tr>
<td>Object code size</td>
<td>274</td>
<td>297</td>
</tr>
</tbody>
</table>

Benchmark run on a 8 MHz IBM AT using Turbo C version 1.0 and the Turbo Linker version 1.0. Also includes MS-DOS version 3.1 and the MS object linker version 3.05. Power and Price.

55 Turbo C: The fastest, most efficient and easy-to-use C compiler at any price.
Our prices are so consistently competitive that we've usually undercut them by the time they appear in print - so why quote them at all? 'Phone us direct and we'll give you the best prices on the day.

We guarantee:

★ Competitive prices  
★ Wide range of Hardware & Software  
★ Full pre-delivery inspection  
★ Huge stocks  
★ Rapid delivery  
★ 24-Hour Answering Service.

★ A Number One service from the Number One company.

SPECIAL OFFERS

olivetti

Fantastic prices on BRAND NEW OLIVETTI systems with full manufacturers warranty. These are guaranteed 100% genuine Olivetti units with no hidden third-party components and the price we quote includes keyboard, monitor and DOS.

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>M24</td>
<td>£1405.20</td>
<td>(640k RAM 360k + 20Mb Disk)</td>
</tr>
<tr>
<td>M24SP</td>
<td>£1502.40</td>
<td>(640k RAM 360k + 20Mb Disk)</td>
</tr>
<tr>
<td>M28</td>
<td>£2040.60</td>
<td>(512k RAM 1.2Mb 20Mb Disk B.s.Con.)</td>
</tr>
</tbody>
</table>

New and ex-demonstration equipment available: -

COMPUTERS
IBM  
Olivetti  
Compaq  
Toshiba

PRINTERS
NEC  
Epson  
Toshiba  
HP

SOFTWARE
Database  
Spreadsheet  
Word Processing  
Graphics

Modems, Tap Backup, Monitors, Hardcards & Consumables

Service just a telephone call away!

Please ring for an immediate response and today's prices

Prices exclude VAT & Delivery. All orders are subject to C.W.O.

-- circle 135 on enquiry card --
## THE INTEGRATED OFFICE

The micro is no longer alone in the electronic office. Fax and telex are becoming intelligent, telephones are growing up with ISDN, and optical storage is replacing filing cabinets. We look at how it will all fit together in the office of the future.

### AMSTRAD PC-1640
An upgraded PC-1512 with EGA-compatible display and more memory. Glyn Moody assesses its chances in the corporate market.

### IBM PS/2 MODEL 60
The Model 50 and 60 form the backbone of IBM's new business micro range. Ian Stobie puts the first Micro Channel machine through its paces.

### LOW-COST 386s
How good are machines costing half the price of a Compaq 386? We test 80386-based clones from Mission and the highly successful US mail-order company Dell Computer Corporation.

### Z-88
Sir Clive Sinclair returns with a characteristically idiosyncratic product—a sleek, battery-powered portable.

### PRINTER STANDS
Everybody uses printers, but do you need a printer stand? Carol Hammond tries several models for size.

### GEM APPLICATIONS
Susan Curran tests two applications that run in the Gem environment: a word processor and a mid-range desktop publishing package.

### ADOBE ILLUSTRATOR
From the company which devised the Postscript language, a drawing package for the Macintosh.

### DOS HELPERS
No matter how sophisticated programs get, you are usually stuck with the supremely unhelpful DOS. Carol Hammond examines some programs that make it easier to use.

### ALVEY'S ACHIEVEMENTS
The Alvey programme was meant to put Britain back in the forefront of computing. Mary Fagan traces its origins, aims and achievements.

### CRAY 2
Probably the fastest supercomputer around. Carol Hammond takes a guided tour.

### DEFECTIVE SOFTWARE
Anne Staines explains how new legislation could have a significant effect on who is liable for damages arising from defective packages.

### COMPUTER LANGUAGES
We survey the vices and virtues of the 10 leading micro languages for business.

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- **386 AT clones** The Mission (above), Dell (below) — page 40.
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DAZZLING REPERTOIRE.

A Canon Laser Beam Printer paper cassette has a capacity of 200 sheets. So you waste less time re-loading. It can handle varying weights from 60 to 135 gsm, plus envelopes, and there are face-up and face-down modes for easy collating.

A Canon Laser Beam Printer can mix 32 different fonts and 64 shading patterns on a single page. It has eight resident fonts. But, if you want to be more creative, there is an expanding library of slot-in cartridges which will soon give you access to more than 100 type styles and point sizes.

A Canon Laser Beam Printer has a built-in memory of 512K for better graphics and font downloading. For full page graphics the memory is expandable to 1.5 MB.

A Canon Laser Beam Printer has the ability to emulate just about any of the most popular printer brands currently in service. And that means it can use the software they use.

A Canon Laser Beam Printer will go on running for 300,000 pages before it needs a major service. And its unique maintenance-free toner cartridge will print 4,000 pages before it has to be replaced. A simple 30-sec job.

Dazzling enough?

STUNNING PERFORMANCE.

A Canon Laser Beam Printer gives you typesetting and graphics perfectly reproduced on the paper of your choice. So silently, you hardly know it's working. At a speed of 8 pages a minute. Real printing you used to have to go outside for.

Stunning enough?
(If not, you'll be knocked out by the price: just £2,195)
They become obsessed with perfection where before they were the enthusiasts. Given their own shining new micro, they take to it with such alacrity that it becomes a distraction. Luddites are few and far between these days; far more dangerous are the digital faith. If it is a real problem — and it seems to be — it needs explaining, or else disillusioned companies are going to turn away from technology altogether.

The benefits from the introduction of the older computer technology were real and quantifiable. Mainframes and departmental minis were usually brought in to automate a pre-existing function. Often those functions were labour-intensive, slow and prone to error. An automated version of essentially mechanical tasks is relatively straightforward to implement and produces very clear gains in terms of increased speed, efficiency and reduced staffing levels.

Compare the equivalent situation for the micro. As its name suggests, the personal computer is by its very nature a tool for individuals. The tasks it supports tend to be far more multifarious than those found on mainframes and minis, which means that it is harder to translate across from the manual to the micro system. Since micros are normally introduced on a large scale, compromises must be made in the provision of software. Unlike the bespoke mainframe software, which is written with the intention of mapping the old tasks on to the new technology, off-the-shelf packages like dBase or 1-2-3 may be poor substitutes for personal filing or budgeting systems which have been honed over the years. This is not a reflection on the quality of such micro software but of the simple fact that you cannot be all things to all people.

Even where a company has contracted a seemingly thorough costing exercise on the introduction of micros, with positive apparent benefits, it may find that in practice things do not quite work out as intended. Again, this flows directly from the very nature of the personal computer, which is decentralised and ultimately uncontrollable.

For a start, people may get carried away by the technology. Luddites are few and far between these days; far more dangerous are the enthusiasts. Given their own shining new micro, they take to it with such alacrity that it becomes a distraction. They become obsessed with perfection where before they would have made do with bare working solutions. They get sidetracked into exploring interesting but ultimately irrelevant avenues of the micro world. None of this happens with the mainframe or mini. Nothing could be more dull than the terminal, nothing so restrictive as the software which lets you do one thing only — the job in hand.

Allied to this dissipation of time, with its resultant lowering of efficiency, the over-keen adoption of technology can have knock-on effects, all of them bad for the bottom line. Once you use a micro, you find you soon need more memory or disc storage or better graphics or perhaps a faster machine altogether. Since many of these purchases are relatively small-scale, they may well be within the budget of individual managers who can authorise them without reference to higher, more sceptical powers. Taken across a company, such creeping upgrades can cost worryingly large sums.

And yet most of us are sure micros are good for you — and for the company. So what is it that they offer if cost-saving is doubtful at best? The answer has already been hinted at. The enthusiasm which people often manifest, and their willingness to experiment with ideas, is perhaps the most valuable benefit of PCs, though the least obvious and quantifiable.

To justify large-scale computerisation at the personal level, companies must learn to sustain and harness that enthusiasm, and to be alert to the brilliant ideas when they appear. In the end, micros turn out to be all about serendipity — the happy chance discovery. The great new challenge for business is not just working with new technology, which is relatively straightforward but learning to cope with the disconcertingly open-ended type of creativity it engenders.

5 YEARS AGO...

Top Apple people were in London recently for a series of briefings to prepare the way for what they term their Fourth Generation machines.

Rumour has it that the new Apple IV will be a 68000-based 16-bit machine, clearly aimed well up-market for Apple. It comes with 1Mbyte of RAM and 1.5 Mbyte of built-in floppy storage.

The most interesting thing about it is that Apple is aiming to be in the operating system, which is not the ubiquitous Unix but a special Apple-written product. The user interface resembles that of the cult language Smalltalk, developed at Xerox's Palo Alto Research Centre.

The very high-resolution graphics are not in colour. But the Apple printer will be able to dump the 400-by-800 resolution graphics directly to paper, which may be more important to professional users.

The system is likely to come with a considerable body of software included in the price; this probably means word processing, spreadsheets, communications and some accounting applications, as well as software development aids. Apple believes that fourth-generation machines will only sell on the back of good software.
The data protector.

(A SOFTWARE LOCK ON YOUR MICRO OR NETWORK)

Is 'personal' data on your micro secured in accordance with the Data Protection Act?

Is sensitive data secure on your micro?

If the answer to either of these questions is NO then you need CLAM from MICROFT TECHNOLOGY. CLAM, as the name implies, provides a software 'shell' around your computer to prevent unauthorised access to programs and data. It can be used to protect either individual files or subdirectories or both. Each copy of CLAM includes a copy of Microsoft's popular menu generator MENUMGEN, so that users, if required, can be presented with a friendly menu interface.

On starting the computer users are asked for a password. They will then be presented either with a menu or the normal DOS prompt. In either case they will only be able to access those files and subdirectories for which they have authority.

Files are protected using 'Dynamic File Encryption'. Under this technique the files are held on disk in a permanently encrypted form. When an authorised user reads the file the data is automatically decrypted by CLAM after it is read from the disk but before it is given to the user. The time taken is imperceptible. When a file is updated the data from the user is automatically encrypted before it is written. This is the only failsafe way to secure data.

CLAM is available for most micros with PC/MS DOS version 2.0 or later. These include the IBM PC and all compatibles. CLAM costs £148 + VAT for a single user licence. Site and corporate licences are available. Existing MENUMGEN users may upgrade to CLAM for £110 + VAT.

CLAMNET, the network version will run on all PC/MS DOS based networks. The cost is £580 + VAT per ten or part of ten workstations on the network.

CLAM may be purchased from MICROFT TECHNOLOGY LTD, The Old Powerhouse, Kew Gardens Station, Kew, Surrey TW9 3PS or from most dealers. To order or obtain further information telephone 01-948 8255.

MAIN FEATURES

1. All data held on a hard or floppy disk or a network can be kept secure from unauthorised access.
2. Security is by default and is failsafe. Once CLAM has been set up the user does not have to take any positive action to secure data.
3. Access to all activities can be controlled via user defined menus within CLAM.
4. Each user is given a user name and password. These determine which menu options the user will see and which files he or she may use. Each user needs to remember only one password.
5. Protected files are kept in a permanently encrypted form on the disk. Even if there is a power or hardware failure the data will never be readable by an unauthorised user.
6. The algorithm that encrypts all files and subdirectories uses the individual CLAM serial number in its key. One copy of CLAM cannot therefore access files or subdirectories encrypted by another copy.

- circle 121 on enquiry card -

THE DATA PROTECTOR

There are now over 10,000 users of Microsoft products worldwide.
How to make sure your Printer doesn't slow your PC down.

Without a Megabuffer your Printer can slow down the rate your PC outputs to the rate your Printer prints. Turning a 5 minute print file into half-an-hour. Which means that the PC can be out of action for long periods. Merely outputting. With a Megabuffer the PC outputs at its top speed into the Megabuffer memory, the PC is then released for further work, and the Printer prints at its own rate from the Megabuffer memory.

- Allows you to use your PC more
- Can emulate special plotter handshake protocols
- Compatible with most computers, printers and plotters: IBM & compatibles, AMSTRAD, HP, ACT, SHARP, EPSON, CALCOMP and many more
- Can cut PC output time to one sixth or less
- Software independent
- Data Buffer and interface converter
- Pause, 'reprint page' and multiple copy facilities
- Full range of memory sizes for every application: 64K £180, 128K £216, 256K £270, 512K £388, 1MB £558

Flexible Interfacing that keeps them all talking

Eliminate miles of spaghetti and all those ‘T’ and ‘X’ switches with a simple Megabuffer which allows your PC to instantly connect to a selection of printers and plotters.

MEGASWITCH AS — Serial Data Selector
- Single unit multiplexer and demultiplexer + 2K data buffer
- RS-332 and RS-422 versions
- Can operate as RS-332/RS-422 converter
- Diagnostic output
- Megabuffer compatible
- Multiplexer — Ideal for printer sharing, 4 inputs and 2 outputs
- Can automatically select any channel supplying data
- Demultiplexer — Ideal for driving several different printers from a PC, 2 inputs and 4 outputs
- Software and manual selection
- LED indication of data flow
- Use it with a Megabuffer for additional time saving
- £189

MEGASWITCH S — RS232 Serial Selector
- Connects any of 5 inputs to either of 2 outputs
- Universally compatible — works with all baud rates and handshake arrangements
- LED indication of data flow
- Use it with a Megabuffer for additional time saving
- £99

MEGASWITCH AP — Parallel Data Selector
- Connects any of 4 inputs to either of 2 outputs
- Can automatically switch to any channel supplying data
- Ideal for laser printer sharing
- Universally compatible — works with all standard centronics, computer and printer interfaces
- Use it with a Megabuffer for additional time saving
- £189

Removable discs are old hat, but Tandon has come up with a new variant: removable hard-disc units. Is this just a gimmick, or a real boon for people who need to take large chunks of data from place to place? We also take a look at some of the new large screens that are becoming available.

Word Perfect seems to be going great guns. The latest in the range is Word Perfect Executive, an all-in-one package which offers word-processing, a spreadsheet, and a cardbox plus other features. Is it the one we have been waiting for?

There is a new breed of micros around — the work stations. We look at the principal players and the likely spillover into the mainstream market. Plus an introduction to the intelligent building.

Computers have led to a proliferation of data. The trick lies in turning it into information. The burgeoning CD-ROM industry could provide the answer. And beyond information lies knowledge: we find out how far expert systems are along the road.

Comms are all the rage so we pick out 10 of the best communications add-ons.

Don't miss the October issue of 'PRACTICAL COMPUTING On Sale at W H Smith and all good newsagents after 16 September.

Contents may vary due to circumstances beyond our control and are subject to change without notice.
Apricot upgrade

APRICOT COMPUTERS has announced a special £999 upgrade for purchasers of its 80286-based Xen and Xen-i machines. For machines bought after 15 June and until 31 August, upgrades to the standard of the new Xen-i 386 machine will be available for £999.

The upgrade will be to the nearest equivalent: for example, the 20Mbyte 80286 system will go to the 30Mbyte 386. Although the 386 machines do not usually offer mono display circuitry as standard, a mono adaptor card can be added for an extra £199 when upgrading the machine.

For full details contact Apricot Computers, Apricot House, 111 Hagley Road, Edgbaston, Birmingham B16 8LB. Telephone: 021-456 1234

AMSTRAD PCW-9512

AMSTRAD has announced that it will be launching an upgraded version of the PCW-8512 word processor in September, both in the UK and the US. No UK prices have yet been released, but in America the price will be $799.

The main points that distinguish the new product from the old are a daisywheel printer and a white screen. Both are intended to endear it to secretaries and other office staff. A newly styled keyboard takes advantage of some of the new features of the Locoscript word-processing program.

The daisywheel is rated at 20 cps, and has a 15in. platen, allowing it to handle paper up to 15.5in. wide. The parallel interface allows other printers to be connected; printer drivers for the Epson FX-80 and Diablo printers are supplied. The machine comes with 512K memory as standard, and one 1Mbyte disc, with a second optional drive.

Locoscript II has a number of new features. There is now a 78,000-word spelling checker and user-definable dictionary. A mail-merge program called Locomail is supplied with Locoscript II.

The PCW-9512 will be launched at the PCW Show at Olympia on 23 September. For more details contact Amstrad, Brentwood House, 169 King's Road, Brentwood, Essex CM14 1EF. Telephone: (0277) 228888.

Hercules for PS/2

HERCULES COMPUTER TECHNOLOGY, the manufacturer of the Hercules graphics card, has announced that it will be producing a version for the PS/2 system. Unlike many other manufacturers who have announced cards for the new system, Hercules has a tricky task since the Hercules graphics must work with the new VGA standard without impairing it. No details have been given of price, availability is from this autumn.

More information from Hercules Computer Technology, 2550 Ninth Street, Berkeley, CA 94710, USA. Telephone: (US area code 415) 540 6000.

Sirton PC Mirror

SIRTON COMPUTER SYSTEMS have launched PC Mirror, a device which allows video images to be captured and stored. The board interfaces with standard CCTV equipment. It digitises images in real time, displaying them on a standard monitor. At any instant images can be frozen and filed. Each image requires 64K, and is resolved into 256 grey levels. PC Mirror comes with software enabling images to be modified in various ways. The cost is £775. Details from Sirton Computer Systems, 7 Greenlea Park, Prince George's Road, London SW19 2PT. Telephone: 01-640 6931.

New modems from Hayes

HAYES has launched a new modem and cut the price on its current models. The Smartmodem 1200 now offers V-21 300 baud, full-duplex, V-22 1,200 baud, and V-23 1,200/75 baud. The last option is an addition designed to allow users to log on to viewdata services. The external version of the 1200 costs £499, not including software. The internal card version, the 1200B, costs £440.

A new comms software package, Smartcom III, can be supplied with the modems and operated using either menus or commands. There is also a simple communications programming environment (Scope), which allows repetitive and unattended operations to be automated by writing a script which is stored for future use.

Following this launch, Hayes' older models have been reduced in price. The external and internal versions of the V-22 Smartmodem 1200 cost £449 and £399 respectively. The upgrade to Smartcom III from Smartcom II costs £20 until the end of the year, and £50 after that.

For more information contact Hayes Microcomputer Products, 1 Roundwood Avenue, Stockley Park, Uxbridge, Middlesex UB11 1AE. Telephone: 01-848 1858.

Low-cost network card

MICRO PERIPHERALS has announced an eight-bit token-ring adapter card for £399. It uses the Texas TNS-380 chip set, which was jointly developed with IBM, and operates at a data speed of 4Mbit/s. There is also a multi-access unit (MAU) which can support eight adapter cards, and has the ability to daisy-chain with other MAUs. The price is £499.

For more information contact Micro Peripherals, Intec Unit 3, Hasocks Wood, Wade Road, Basingstoke, Hampshire RG24 0NE. Telephone: (0256) 473232.

Hardware Shorts

• DEC has reduced the price of its Vaxmate product. The basic system is down 24 percent to £2,315, while the hard-disc add-on unit is down 18 percent to £1,113. Details on (0734) 866711.

• The Taxan Multivision 770+ will work with the new IBM VGA adaptors and the Mac II. The cost is £699. Details on (0707) 2177-44.

• Compaq has announced that disc caching will be standard on all its 80286-based models as well as its 80386 machines. Details on 01-940 8860.

• Computers Unlimited is offering 2Mbyte RAM Simms for the Mac II family for £499 and 4Mbyte Simms for £999. Details on 021-349 2395.

• Mekom Computer Products has cut the price of the Kyocera F-1010 laser printer from £2,775 to £2,495. Details on 021-454 2288.

• The Viglen family is another group of low-cost clones. Prices start at £499 for a PC and £2,995 for an 80386.

More on 01-843 9903.

Apple Telex

APPLE has introduced a telex facility for the Macintosh. Called Apple Telex, the system consists of Vixtel software from AM Technology, and a hardware telex manager from Trend Communications. Apple Telex uses the standard pull-down menu approach to control the programs.

The cost is £1,995 for the single-user version, and £2,995 for a multi-user system. Full details from Apple Computer, Epsom Way, Hemel Hempstead, Hertfordshire HP2 7HQ. Telephone: (0442) 60244.

Kudos cards 30

KUDOS SYSTEMS has launched a 30Mbyte hard disc on a card for £299. It is claimed to fit into one expansion slot on most compatibles without encroaching on the space above the slot next door.

Another product from the same company is the Stradcom V-21/V-22 modem offering Hayes compatibility. It is BT approved and costs £159.

More information on these products can be obtained from Kudos Systems, Capitol House, Capitol Way, London NW9 0EQ. Telephone: 01-200 6511.
New additions for Lotus 1-2-3

THE NUMBER of add-ons aimed at Lotus 1-2-3 spreadsheet users continues to grow. Scemore lets you cram more information on your screen in a variety of compressed display formats. You can thus see double, triple or quadruple the number of 1-2-3 cells displayed on your screen. The £85 utility requires no special hardware and works with CGA, EGA and Hercules adapters on old-style IBM-compatible machines, as well as with the VGA graphics of the PS/2.

Contact: In Touch, Fairfield House, Brynhysyd, Caerphilly, Mid-Glamorgan CF8 2QQ. Telephone: (0222) 882334.

Deja is a pop-up that gives 1-2-3 users access to dBase III Plus files without leaving their worksheet. It lets you transfer data both ways and gives you 11 new 1-2-3 functions that allow you to reference dBase information from within a cell formula. Deja costs £100 from Softsel dealers.

More information is available from Softsel, Softsel House, Syon Gate Way, Great West Road, Brentford, Middlesex TW8 9DD. Telephone: 01-568 8666.

Low-cost DTP

WITH a UK price of £59.95, Newssetter is one of the cheapest desktop publishing packages on the market.

Newsetter supports over 170 different matrix and laser printers, and fonts with 34 built-in typefaces and its own library of over 280 pre-drawn images. Designed mainly for producing newsletters and notices, it can cope with layouts of up to 10 columns. You can import existing ASCII text into the package, but it also has its own text editor built-in.

More details from Polyrom, 2A Davis Road, Poole, Dorset BH12 2BA. Telephone: (0202) 673777.

Meanwhile, Fontasy, an established low-end DTP product, has been enhanced. The bare program still sells for £70, but you can now buy add-ons which provide extra features, more fonts, integrated image library or let you use EMS extended memory effectively.

Details from Cyril Alt Deli, 44 Brownbaker Court, Neath Hill, Milton Keynes, MK14 6JH. Telephone: (0908) 867259.

EASIER WAYS TO DEAL WITH SECURITY

TWO NEW encryption packages and a backup system all attempt to make the business of making things secure less irksome.

Secret Disk works by setting up a part of your hard disc as a security area; you then access it as drive D or whatever in the normal way. You can put programs as well as data on your secure disc and run them from there.

The advantage of this approach is that everything in the secure area is encrypted, including programs and temporary files. Without the right password no access is permitted. Secret Disk was developed by Lattice Inc of Lattice C fame, and is available in the UK for £85 from Roundhill Computer Systems, Axholme, London Road, Marlborough, Wiltshire SN8 1LR. Telephone: (0672) 54675.

MS/CRYPT also adopts a memory-resident approach. It will automatically encrypt and decrypt designated files as you access them. In addition to its security function MS/CRYPT provides several other utilities, including the ability to compress files, to search through your sub-directories for a particular file, and to display your directory tree structure on screen. MS/CRYPT costs £195 from Javelin Systems, 29 Bell Street, Sawbridgeworth, Hertfordshire CM21 9AR. Telephone: (0727) 726525.

Easyback is not designed for encryption, but instead enhances security by encouraging you to take backups regularly. The £140 package consists of a software utility and a box of colour-coded discs to go with it. You can get Easyback in a PC version with 360K discs, in AT version with 1.2Mbyte discs or in PS/2 format with 3.5in. discs.

You set the backup software up in various ways. For example, you can choose only to back up files that have been changed since the last use. On-screen prompts guide you through the procedure.

Easyback is available from RPS, High Street, Houghton Regis, Bedfordshire LU5 5QI. Telephone: (0582) 867222.

Pagemaker upgrade

ALDUS has announced a major new release of its Pagemaker DTP software for the Mac. Along with new features like kerning, automatic hyphenation and support for facing pages, Pagemaker 2.0a offers file compatibility with the PC version of Pagemaker. In companies with mixed hardware setups you will also be able to transfer pre-formatted text files from IBM word processors like Word Perfect and WordStar across to the Pagemaker 2.0a running on a Mac.

Pagemaker 2.0a costs £450 and is available now. Contact Aldus UK, Craigrook Castle, Craigrook Road, Edinburgh EH4 3UH.

SOFTWARE SHORTS

• Xenix System V for the IBM PS/2 Model 50 and 60 will begin shipping in the third quarter of this year, according to the Santa Cruz Operation. For further information contact the Santa Cruz Operation on 01-439 2911.

• Smart-pad is a £49 desk accessory which is a kind of souped up version of the Mac's existing notepad with fast search and retrieve facilities. You can store 22,000 characters on each page and copy, cut and paste text to and from other applications. For more details contact Blyth Software on (0728) 3011.

• Microsoft is offering users of all other word-processing packages a chance to move over to Microsoft Word 3.1 for £200 — which is £250 less than the normal price. For details telephone Microsoft on (0734) 500741.

• In Touch has produced a specialist catalogue containing around 150 different add-on products for dBase III plus. It is free from In Touch, telephone: (0222) 882334.

• Supadupadir works just like the MS-DOS Dir command but it keeps a master list of all your files on your hard disc; it costs £10 from S&S Enterprises. Telephone: (02403) 28095.

• PC Blast II is a £195 comms program which emulates most standard terminals. It claims to be particularly good at transferring files across bad telephone lines or satellite links. Further details available from Software Ltd. Telephone 01-278 2377.

Stronger rival for dBase

ASHTON-TATE's dBase III Plus application generator and database is likely to run into renewed competition from Foxbase Plus with the release of new versions of the clone product. The high-performance version for 80386 machines, priced at £595, runs with the processor in Protected mode.

SCO Foxbase is a new multi-user implementation running under Xenix; it costs £795. For ordinary MS-DOS users the new £395 Foxbase 2.00 has several enhancements, including a claimed doubling in speed.

Contact: In Touch, Fairfield House, Brynhysyd, Caerphilly, Mid-Glamorgan CF8 2QQ. Telephone: (0222) 882334.
**PC USER SHOW**

**Sharp is the sharpest**

ONE OF the best showings of new equipment was made by Sharp on a stand that was rather tucked away to the side. In addition to old machines, new versions and new products, there were also several future peripherals being shown for the first time in this country. Perhaps the most exciting was the MZ-1V0I image-processing terminal which could function as a fax machine, image scanner and copier — see page 91 for more details.

Another exotic beast was the JX-450 colour scanner with a resolution of 300 dots per inch. Each RGB element can recognise 64 shade variations, and the colour tone capacity is over 260,000 shades. The price is expected to be about £5,000.

The QA-25 is an LCD projection device, similar to the Kodak Data-show reviewed in the June issue of Practical Computing. It weighs 6lb. and is just over 12in. square. The cost is around £750.

Sharp also showed its new portable, the PC-4501. This compact unit uses the standard flip-up LCD, supported rather precariously on one side only. The LCD is back-lit, and there is one 3.5in floppy and up to 640K of RAM. The V-40 processor runs at 7.16MHz. Parallel and serial interfaces come as standard. The twin-floppy version will be available later this year, while the 20Mbyte hard-disc version will not be around until early 1988.

Finally, an upgrade to the PC-7000 series was launched. Called the PC-7200, it is an AT compatible with a 20Mbyte hard disc. The internal expansion slot will take full-size PC or AT cards. It weighs 21lb. and costs £2,995.

For details on all Sharp products at the show contact: Sharp Electronics, Sharp House, Thorp Road, Manchester M10 9BE. Telephone: 061-205 2353.

**PC-based typography**

**ALONG with 80386-based machines, desk-top publishing (DTP) dominated the show. This was apparent not only from the software exhibited, but the hardware too — particularly high-resolution monitors. One indicator of how seriously the printing industry is taking DTP was the presence of a typesetting company, Itek Graphix, at the exhibition.**

Itek announced an enhanced version of its Personal Typesetting Workstation (PTW) software package for the IBM PC and compatibles. PTW is a capable of composing text at speeds of up to 6,000 characters per second. It offers menus, prompts and over 100 help screens, which together with a tabbing capability designed to simulate an electric typewriter, are aimed to make the program simple enough for those not experienced in typesetting to use it.

PTW costs £35,000. It includes over 100 typefaces on-line with the ability to mix 128 faces in any job. A 50,000-word dictionary contains data for hyphenation and spell checking. It is also available with the PTW laser printer which uses the same type library as the Digitek typesetter.

For details contact Itek Graphix, Westlink House, 981 Great West Road, Brentford, Middlesex TW8 9DN. Telephone: 01-568 9297.

**PS/2 Model 60 for hire**

CCA MICRO RENTALS was exhibiting an IBM Personal System/2 Model 60 at the show. The company will be renting the machine, with options ranging from one day to a year.

The marketing director at CCA, Graham Hallett, claimed that the Model 60 had attracted a vast amount of speculation in the industry about its capabilities and the impact it is likely to have on the market. CCA’s rental option scheme for the Model 60 is designed to allow users to test its capabilities before purchasing.

The Model 60 will be available at a rental price of £220 per week or £500 per month. The rates for the Model 30 are £140 per week or £350 per month. The Model 30 is also available at £95 per week or £225 per month. Similar rental options will be offered for the PS/2 Model 80 when it appears.

For further details contact CCA Micro Rentals, Unis 7/8, Imperial Studios, Imperial Road, London SW6 2AG. Telephone: 01-731 4310.

**Taxan LCD printer**

ALSO tucked away was a new printer on the Taxan stand. It looks like a laser but uses LCD technology instead. The CrystalJet has a speed of eight pages per minute, and can emulate nine other printers. The resolution is 300 dots per inch and it comes with 2Mbyte of RAM. The cost will be less than £3,000, and the launch date will probably be in the autumn.

For further details contact Taxan (U.K.) Ltd, Taxan House, Cookham Road, Bracknell, Berkshire RG12 1RB. Telephone: (0344) 484646.

**Autoscan monitor**

MICROVITEC launched an auto-scanning monitor and a range of graphics system at the show. The 14in. Autoscan colour monitor can adjust automatically to different scan rates. This means that users can upgrade to better graphics standards or to one of the PS/2 micros without buying a new monitor.

The Autoscan handles CGA, EGA and PGC graphics standards as well as the MCGA and VGA standards used by IBM’s PS/2 range. It costs £600. For further information contact Microvitec, Futures Way, Bolling Road, Bradford, West Yorkshire BD4 7TU. Telephone: (0274) 390011.

**Ellinor’s Voicekey**

ELLINOR PERIPHERALS launched a voice-recognition package called Voicekey. It is designed to enable IBM PC and compatibles to recognize words and convert them into keystrokes.

The system consists of an expansion board, a floppy disc and a microphone. Ellinor claims that Voicekey’s one-pass entry system allows users to train and have the system recognise words by repeating them only once. The system can also recognise and edit voice commands without exiting the current applications. This means that users can enter and edit new commands while in an application program. Voice key costs £995.

For more information contact Ellinor Peripherals, Arkwright Road, Reading, Berkshire RG2 0LS. Telephone: (0734) 865417.
Train your computer to deliver the mail

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All you need is a Miracle modem and your PC becomes a postman. A Miracle modem may look unremarkable - just a small, black box beside your computer. But it lets you do some astonishing things. Take electronic mail...

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It’s cheaper too. Each message can cost less than a second-class stamp.

And with Miracle, you also get modem features like ‘auto-dial’ and ‘auto-answer’, so you can send and receive messages when it suits you.

That’s really just the beginning. There’s also software for telex, file transfer and access to Prestel and over 200 independent databases. (All this, because Miracle modems support Hayes protocols, the industry standard.)

Perhaps most remarkable of all is the price. You can have a Miracle modem complete with software for as little as £226. And if you buy now, we’ll give you a year’s subscription to an electronic mail service absolutely free.

To demonstrate exactly what Miracle modems can do, we’ve produced a booklet: ‘70 new tricks to teach your computer’.

For your complimentary copy, complete and mail the coupon. It’ll be with you as quickly as the post office allows.

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Apollo
Hewlett-Packard
ICL
Sun
Digital
Who would you prefer?

Over the years the Apple name has become synonymous with intuitive, easy to use computers.

So, when it's Apple that introduce the ultimate power PC, it has to be the perfect combination.

The Macintosh II has both the power and flexibility to suit even the most voracious user, while still retaining Apple's famed point-and-click simplicity.

At its core is the new 32-bit Motorola 68020 microprocessor.

The beauty of selecting the 68000 series for Macintosh really pays off in the Macintosh II. The upward compatibility of this series means that over 2000 current Macintosh applications can already take advantage of the Macintosh II's power.

The Motorola 68020 allows you to run virtually every Macintosh program at four times the speed of a Macintosh Plus, while a new co-processor enables you to perform mathematical calculations at a staggering 200 times the speed.

But speed is only part of the story.

The Macintosh II also offers incredible flexibility.

Like all Macintosh products it has a built-in LAN which allows information exchange and resource sharing. With its open architecture and 6 expansion slots you can customise it to serve virtually any purpose you can imagine. Both now and in the future.

Because it's not constrained by today's technology, your investment in a Macintosh II is an investment in the future.

You don't even have to limit yourself to one operating system as the Macintosh II can run all three industry standard microcomputer operating systems, Macintosh, MS-DOS and UNIX, off one workstation.

There is also the choice of memory options - up to 16 megabytes of RAM. And, although our 40 megabyte hard drive is probably sufficient storage for most users you can employ an internal drive of up to 80 megabytes.

Add to all that its superb colour graphics, its high resolution bit-mapped screen and its vast palette of over 16 million colours and you have the ultimate PC.

You may not have expected a computer this powerful to have come from the Apple family, but try it out and we think you'll be glad it has.

Please send me more information about the Macintosh II.
Post to: Apple Computer (UK) Limited, FREEPOST, Information Centre, Eastman Way, Hemel Hempstead, Hertfordshire HP2 4BR or Dial 100 and ask for Freephone Apple.

NAME

TITLE

COMPANY

ADDRESS

PC/9

Apple: The power to succeed.

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SOFTWARE SALES BY TYPE
U.K. all channels, by number of units

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word processing</td>
<td>26%</td>
</tr>
<tr>
<td>Spreadsheet</td>
<td>26%</td>
</tr>
<tr>
<td>Database</td>
<td>17%</td>
</tr>
<tr>
<td>Graphics</td>
<td>4%</td>
</tr>
<tr>
<td>Desktop publishing</td>
<td>4%</td>
</tr>
<tr>
<td>Integrated</td>
<td>11%</td>
</tr>
</tbody>
</table>

Source: Romtec

BRITAIN’s TOP-SELLING SOFTWARE

WORD PROCESSORS and spreadsheets still dominate the PC software market, making up half the non-accounting packages sold in the UK, according to Romtec’s latest figures. Word Perfect is the leading high-end word processor, with WordStar 1512 taking the low-end Amstrad market. Lotus 1-2-3 continues to dominate the spreadsheet scene, although Computer Associates’ Supercalc also makes a strong showing.

Desk-top publishing packages now represent nine percent by value of non-accounting software sales, although only five percent of the unit sales. Aldus Pagemaker and Ventura Publisher hold the number 1 and 2 positions respectively, way out in front of anything else.

Romtec’s figures refer to sales made in the month of May, and cover all the main distribution channels. They exclude the highly fragmented accounting market, where a large number of vendors continue to offer products, often through highly specialised channels.

SOFTWARE BRAND LEADERS
U.K. all channels, unit sales for May ‘87

<table>
<thead>
<tr>
<th>Brand</th>
<th>Top seller</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word Perfect</td>
<td>WordStar1512</td>
</tr>
<tr>
<td>Multimate</td>
<td>Lotus 123</td>
</tr>
<tr>
<td>Word</td>
<td>dBase III+</td>
</tr>
<tr>
<td>Displaywrite</td>
<td>Symphony</td>
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<tr>
<td>Wordstar2000</td>
<td>Pagemaker</td>
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<tr>
<td>Wordstar Pro</td>
<td>Freelance</td>
</tr>
<tr>
<td></td>
<td>Chit-Chat</td>
</tr>
</tbody>
</table>

Source: Romtec

In all categories the top-selling package by volume also leads in terms of value, except in the case of word processing, where WordStar 1512 sells more copies than anything else but cannot match the revenue raised by the more up-market products.

More details about the UK’s favourite word processors are provided by another market-research company, Context. Monitoring sales through 700 UK outlets, Context confirms that WordStar 1512 is the top-selling product. Word Perfect is in the number 2 slot by units sold but has a far greater share in value terms.

Context’s figures, which are collected on a quarterly basis, show that Word Perfect’s position is improving. It was number 4 in value terms in the last quarter of 1986, but moved to number 1 in the first quarter of this year.

While the low-end WordStar 1512 sells well, it is not its publisher’s biggest earner. It is too cheap to generate as much revenue as Micropro’s more expensive products such as WordStar 2000 and WordStar Professional, the current incarnation of traditional WordStar. But even these Micropro products are only at positions 5 and 6 in the earnings league. Word Perfect, Ashton-Tate’s Multiplan, Microsoft Word and IBM’s Displaywrite 3 all take more of the purchasers’ money.

SPREADSHEET SKILLS
RESEARCH conducted jointly by Lotus and the temp agency Manpower suggests that substantial numbers of secretaries now use spreadsheets. Over half of the 92 organisations contacted needed temporary secretaries who could use Lotus 1-2-3, and just under 10 percent hired them frequently. According to Lilian Bennett of Manpower, in most cases the temporary is only expected to be able to enter information into a model that someone else has built, but 10 percent of the firms surveyed expected the temporary worker to be able to design the model as well.

HARD DISCS
AT LEAST 80 percent of the PCs going into UK corporates have a hard disc, according to Wharton Information Systems. The average disc size is 260Mbyte and the PCs typically have 640K of memory. Around 40 percent are AT-level machines. The PS/2 has not yet shown up in Wharton’s figures, but the company thinks the strong trend already evident among users towards more powerful machines is likely to continue.

NEC COLOUR MONITORS
NEC now commands 40 percent of the UK market for 14in. colour monitors according to Romtec, not 14 percent as we incorrectly stated last month.

Charts this month prepared with the new Harvard Presentation Graphics. It costs £279 from Softsel; telephone 01-588 8866.
RITA SOFTWARE PRODUCT AWARDS

PARAGodox and Direct Technology's PC Automator. To determine this year's winners needs input from you. While the judges make the final decision, it is based on a range of software companies which can be nominated by anyone. Practical Computing therefore invites you to submit the name of either an entirely new software package or one which is a substantial improvement to an established product and which was in use in the UK during 1986/87. Entry is free.

In addition to the name of the nominated product, you should give brief details of why you feel it should win the software Rita award. Also give your own name and company, as well as your address and telephone number.

All nominations must reach us by 30 September 1987. They should be sent to Practical Computing, Room L309, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Envelopes should be marked 'Rita' in the top left-hand corner.

More Telecom Gold facilities

TELECOM GOLD has added Kompass Online to its range of on-line databases. An electronic business directory containing information on 110,000 UK companies, it is compiled from directories such as Kompass, Kellys, Directory of Directors, Dial Industry, British Exports and UK Traded Names. Kompass Online provides access to marketing and sales leads, product and service availability, and the contact names of agents and representatives. The information can be searched by company name, product, county or number of employers. The service currently offers 45,000 product categories. It allows mailing lists to be created which may be stored on a Telecom Gold text file.

Telecom Gold has also announced that Italy has joined the Dialkom stable, and is contactable via Telecom Gold. Finland will be joining in the autumn.

For more details contact Telecom Gold, 60-68 St. Thomas Street, London SE1 3QU. Telephone: 01-403 6777.

World agreement on piracy

A STATEMENT from the World Computing Services Industry Forum held in Munich has been signed by 15 nations. The main thrust of the statement is simply that international copyright laws should form the basis for protecting software, which in itself is hardly earth-shattering. It does, nonetheless, represent something of an achievement, since Japan is one of the signatories. Japan has in the past been rather sceptical of pushing copyright as the panacea for piracy, but it has now fallen into line with the rest of the world.

The countries taking part were West Germany, United Kingdom, Switzerland, Denmark, Belgium, Sweden, Spain, France, Finland, Austria, United States, Australia, Canada, Japan and Taiwan.

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**PRACTICAL COMPUTING** September 1987
**WHAT FUTURE FOR TELECOM EMAIL?**

**O**nly a month or so ago I was happy about the future of email. Telecom Gold had celebrated its fifth birthday, improved all its documentation and was growing strongly. Gateways had been opened up to Kompass Online, and to allow Micronet users on Prestel direct access to the Gold computers, promising to enlarge the user base still further. File transfer was nearly here. The X-400 message-handling software was being installed to allow the public email system to be linked to private ones, like DEC Vax networks and Data General CEOs.

In the more mature US market, the Source was taken over by venture capitalists with big ideas. MCI Mail linked up to CompuServe, British Telecom moved its Dialcom subsidiary to new headquarters, had a royal opening and looked to be doing well. Internationally, Japan and Italy started to get their Dialcom services together. Masterterm was used during the Venice summit in June — while Finland signed up for the network.

If you can connect the major public email systems together, link in the big corporations, and make a few international connections over the X-25 packet switched network then suddenly the global village is in sight. What could possibly go wrong?

Well, plenty. In the UK, Telecom Gold's new boss, Phil Madden, dropped a bombshell by shifting to a character-based charging system from 1 August. I did a bit of crude arithmetic on my 1,200/1,200 baud access and found that the worst-case increase was some 570 percent. Even though Gold argues that average increases will be nothing like this, I face the horror of a monthly bill, like this, I face the horror of a monthly bill, literally in the form of a document known as the Bill of Quantities.

Well, what goes up must come down. Which brings us to the other aspect of the new billing policy. If you think Gold's charges are bad, just wait. The FCC has ruled that equipment providers must also pick up the tab. In my experience, confusion about the cost of any particular session, something that is easy to do with a time-based charge. In my experience, confusion about the cost of using a service is not good for business. Suppose Telecom Gold's new charges put its growth into reverse? The recent rescue of One to One — which I never found of any use when I had a box on it — the gingering up of Easylink under its new Mercurylink 7500 label, the management buyout of Israel and other market activity may mean that the UK email battle is not over yet, as Gold's effective monopoly had led me to think. In the US, the email market is much more balanced between different players — see table below. In addition, I believe The Source has over 60,000 mailboxes, though it is mainly used by individuals rather than businesses.

With a number of strongly competing services, and firms that have no compunction about switching from one to another, the customer must benefit. However, in this case, the financial fly in the ointment also comes from outside. It comes literally in the form of a document known as Interstate Access Charges Exemption for Enhanced Service Providers CC Docket 87-208, from the US Federal Communications Commission (FCC). The FCC plans to stick around $5 an hour on top of data users' bills as from 1 January next year. If you are on-line for, say, 20 minutes a day or 10 hours a month, this will mean finding an extra $50 a month or $600 a year.

The FCC originally introduced such charges on long-distance phone traffic in 1982. Data services were excluded at the time because it was feared that rate shock would stunt the growth of national data networks and important value-added services like databases and electronic mail. Now, however, the FCC says that since data goes down the same twisted-wire cable as voice, data users must also pick up the tab.

The FCC argues that the extra charges go mainly to the Bell Operating Companies to cover their fixed network costs. This will enable overall charges to be brought down in the long run — and indeed, another drop in long-distance call rates is already scheduled for next July.

Nevertheless, there is going to be a rate shock when the extra charges are introduced. This will mean that some email and data users will drop out of the market, and some service providers will suffer. In particular, the little companies and individuals will get hurt most, since no charges are applied to the private lines used by the big corporations. As GTE Telenet's Philip Walker put it, "Large companies and information providers are exempted, while those not able to afford their own networks get banded on."

Walker points out that value-added network service (VANS) providers buy ordinary phone lines at standard business rates, "typically $30 a month; it's an all-you-can-eat type arrangement". The FCC's access charges will have a staggering effect on them, making many services uneconomic.

Whatever the arguments, it is certain that providing VANS, electronic mail and database services has not proved to be a surefire bet. In particular, it's an all-you-can-eat type arrangement". The FCC's access charges will have a staggering effect on them, making many services uneconomic.

This means there is an argument for a sort of enlightened national self-interest. Information industries are the key to the future, so countries ought to encourage the growth of a computer-literatere, data-friendly, network-using population. In France they take this idea seriously enough to lend out millions of free Minitel terminals. The vast amount of data traffic this now creates means that from the operator's point of view the terminals probably pay for themselves.

Neither the Bell companies in the US nor British Telecom in the UK are exactly on the breadline. Indeed, BT turned in over £2 billion in profits this summer. The extra cash that might temporarily be generated by network access charges in the US, and the character-based charges on Telecom Gold, is going to be invisible on that scale of fee. If Telecom Gold users drop out in droves, or defect to the much cheaper Mercurylink 7500, BT will soon find itself with lots of expensive, newly upgraded Prime minis and a reducing revenue to pay for them. And that won't be much fun at all.
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<td>AT 8MHz motherboard 0K</td>
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PARALLEL WORLDS

ONLY BY ADOPTING COMPLETELY NEW METHODS FOR HANDLING DATA WILL IT BE POSSIBLE TO BREAK OUT OF THE LIMITATIONS OF TODAY'S MACHINES.

W e all think a lot of our PCs — well, most of us anyway — and we are always impressed by the seemingly endless stream of innovations which bring wider words, more storage and higher operating speeds. Such were the thoughts that came to me recently when I visited a travel agent to enquire about some cheap airline tickets. During the interminable delays while the helpful assistant endeavoured to access the often unobtainable databases, I had time to ponder on the state of the art in data-processing technology.

I forced myself to be objective, and to imagine what a visitor from another planet or another time might think of the tortuous procedures to which we humans willingly submit ourselves in order to obtain the most basic kinds of information and services. I quickly decided that despite our Worm drives and our high-resolution graphics we are really still in the paleolithic stage of data-processing development. There has to be a better way.

At present our horizons only extend as far as improved versions of basically the same machine architectures and programming tools that we have been using for the last 40 years. While this limited thinking persists, improvements will be incremental and unspectacular. So I decided to take a look beyond the limits of current technology and practice to see if the future can indeed be made to work.

The most obvious route to data-processing utopia is already being explored by chip designers. Microprocessors perform calculations faster, memories get bigger and faster, and there seems to be no end in sight to the improvements being brought by the shrinking geometries laid down on the silicon wafers. Physical limits do exist, however, and already there are signs of a slowdown in the breakneck pace of size reduction and speed increase.

Another route is provided by parallel processing. Replacing a big, expensive microprocessor with teams of simple, inexpensive ones working together sounds like a great idea until the problems of coordination are considered. Using conventional microprocessors in this way is possible so long as the problem can be structured to suit, but few systems exist which can use more than a dozen or so devices effectively, and the costs of interfacing are high.

Alternatively, perhaps the answer to my prayer will come not from the hardware designers but from the software technologists. Artificial-intelligence techniques appear to promise a lot of the things I seek, and AI programs could even be run directly on my own— or the travel agent's — PC.

Taking the three routes in turn, there is some minor cause for celebration. As speed improvements arising from feature-size reduction on the silicon chip start to falter in the next few years, a new semiconductor technology will be waiting to pick up the speed challenge.

Already with us are logic arrays and even whole processors fabricated not in silicon but in gallium arsenide (GaAs). Carrier mobility is higher in the GaAs material, which means that things happen more quickly. A typical chip using the same 1 micron design rules currently used for silicon devices offers gate delays of only 100 picoseconds, a 10-fold improvement.

Experimental GaAs processor chips running at 200 million instructions per second have already been produced in the US. Such processors, linked by optical rather than wired connections, may provide the ultimate in processing capability for current architectures. Unfortunately, GaAs is currently an expensive and power-hungry technology, and the production and packaging problems may never be overcome in a way that is economical.

Perhaps the final word on speed will be provided by the room-temperature superconductor materials now being widely sought. For many years IBM pioneered work on a high-speed superconducting logic element called a Josephson junction, only giving up when they could see no economical means of routinely cooling their creation to liquid-helium temperatures. Room-temperature superconductors could change our whole world — not just our computers — but there is a long way to go before the technology is usable.

Parallel processing has already been made feasible by the amazing Inmos Transputer, which features an architecture directly supporting the concept of concurrent processing. All the interfacing hardware is provided on the chip so that large arrays of interconnected Transputers can be built up at low cost.

Systems using up to 100 of the Inmos devices have been produced, and performance has been mind boggling. Unfortunately, the problem of writing practical code for such a system remains formidable despite the concurrency support provided by the Inmos Oecam language. On the artificial-intelligence front, languages like Prolog, Lisp and Smalltalk represent the first filtering steps along a new path to smarter non-numerical applications.

Put it all together and you have a high-speed, parallel-connected, artificial-intelligence machine — the fifth generation in fact — which should make its debut in the early 1990s. While it is not the complete answer to my quest for truly user-friendly systems, such a machine would certainly be a vast improvement, equivalent, perhaps, to the Neolithic stage in the development of human society.

Anyone wishing to sample the delights to come can already start writing their own programs in Lisp or Prolog. The problem is that current conventional processors are better suited to number crunching than they are to the manipulation of the incomplete symbolic information which the true AI machine — like we humans — must face.

Before long, however, it could be possible to buy a plug-in PC peripheral card which will bring a real taste of AI potential to everyday applications. An American startup company called Symbolics has unveiled its plans to market a microprocessor-like device which will be optimised for AI programming. The new chip, code-named Ivory, will use a 40-bit word length which includes a 32-bit address and data field and an eight-bit tag field for Lisp data types. Included on the chip will be a ROM array containing a standard Lisp interpreter so that it will run AI source programs directly.

The company is aptly named, because artificial intelligence is all about the manipulation of symbolic data in the form of lists or images, rather than the numeric data which is the basic diet of conventional machines. Input data and program structure can be described in terms which are already familiar to the programmer. It will no longer be necessary to reformat the data and the problem into the numerical arrays and arithmetic solutions necessary to produce conventional processors into high-speed action.

Initially, chips like Ivory will act as peripherals to conventional processors. But as operating systems and applications programs are developed, the tables will be turned. AI processors are potentially well suited to providing the core of future systems while numeric processors provide the specialist number-crunching capability.

The Symbolics Ivory chip will not become available commercially until mid-1988, although prototypes are already running. Whether it will revolutionise my travel agent I cannot say, but it should provide a useful bridge to the fifth generation.
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THE SURVIVAL OF THE OLDEST
WHY IS IT THAT WORDSTAR, DESPITE ITS MANY FAULTS, REFUSES TO DIE?

O ne of the most difficult questions that anyone can be asked is to recommend a good word-processing package for company use. It is not that there is a shortage of good software. On the contrary, between Multimate, Microsoft Word, Word Perfect and a few others there are plenty of excellent products to choose from. The problem is to select a package that a company can standardise on without vast expenditure on training. Having to send every new operator on, say, a Word Perfect course can be a very costly business. None of this will be news to most WordStar users as it is the main argument for continuing to soldier on with this ancient package.

Now I know there is plenty to be said against WordStar; I say quite a lot against it myself. It is a product of the late 1970s that never quite made it to the 1980s. But it does have one overwhelming advantage: it is well known. When secretarial agencies offer their staff free WP training they give free WordStar training. Ask your agency for a temp who is an experienced word-processing operator and you will get an experienced WordStar operator. Advertise for a audio typist with 12 months' WordStar experience and you will probably receive an excellent response. Advertise for someone with Word Perfect experience and your phone will not ring.

It was therefore with some enthusiasm that 1 read about WordStar 4 earlier this year. Would this new version allow a company to capitalise on the pool of WordStar experience, and at the same time deliver the power of heavyweight products like Word Perfect and Multimate? I ordered a copy, used it for several weeks, and concluded that the answer is no.

It is not that WordStar 4 lacks improvements. At long last, you can store margin and tab settings within a document; get at and from non-documents; go straight to a layout; and no need to save the file to disc. Topsideker nearly meets these needs, but its lack of printer support rules it out. One answer might be Topcopy. This is an inexpensive word processor aimed at individual users and small businesses. You can use it as an ordinary program or as a memory-resident pop-up. It lacks high-powered features, but it does have all the basics like cut and paste, find and replace, headers and footers, reasonable printer support, and word counting.

Topcopy is window-based. You can have up to six documents open at a time, either display. And there is still no windowing, which means that you can only work on one document at a time; one of WordStar's main drawbacks has always been the constraints needed to copy a paragraph from one letter to another.

There was also a problem with speed. One of the customisation options is to remove the annoying screen flicker or snow that you get with some monitors, but this is done at the cost of slower screen updating. With the snow suppressed the screen display on my Olivetti M-24 ran very slowly. The old WordStar was faster, and snow was never a problem.

If you already use WordStar 3, the £95 needed to upgrade to version 4 is worth paying. But for those just starting a WP department the new release leaves all the old problems unresolved.

Small outfits and individual users do not have to contend with the same problems of training and compatibility. Personally, I have found no difficulty in choosing a word processor for long documents like articles and reports. But how I wish I could find something suitable for knocking off one-page letters and file notes.

My ideal would be a program that I could load quickly - preferably a pop-up. It would let me simply type a page, print it, and forget it. No menus, a default page layout, and no need to save the file to disc. Sidekick nearly meets these needs, but its lack of printer support rules it out.

One answer might be Topcopy. This is an inexpensive word processor aimed at individual users and small businesses. You can use it as an ordinary program or as a memory-resident pop-up. It lacks high-powered features, but it does have all the basics like cut and paste, find and replace, headers and footers, reasonable printer support, and word counting.

Topcopy is window-based. You can have up to six documents open at a time, either on your own screens or in windows. Copying text from one file to another is a lot easier than in WordStar. There is also a mail-merge option plus a separate program for maintaining mailing lists. This side of things is rudimentary, but would be adequate for occasional producers of mail shots.

The snag is that Topcopy refuses to run on my Olivetti M-24. I have tried it on Amstrad, Victor and Tandon machines, and it works fine on them all. But the M-24 defeats it, which is a pity because this is my main machine at present. Steve Brimley, who wrote Topcopy, has promised to try to find the bug. I hope he succeeds.

Another product I will use regularly is the Palomar Utilities. It contains the sort of little programs that everyone needs from time to time - things that should have been built into the operating system but were not. You can name a floppy after it has been formatted, move files between directories without copying them and much more. Several firms sell utilities like these for a few pounds each, or you can pick them up for nothing from a user group.

Palomar's approach is to bundle the programs into collections that they sell at £19.95 a time. My favourite is a utility called Index in the Disc Collection. All it does is print the names of all the files on your disc, in alphabetical order, showing the complete directory paths. It might not sound much, but it is a terrific help when it comes to cleaning up the hard disc. It has certainly been worth £20 of my money.

Finally, things seem to be heating up in the market for keyboard macros. A few years ago I was singing the praises of Smartkey, a utility that redefines the keyboard and attaches sequences of keystrokes to single keys. Then Borland's Superkey came out: it does the same job, but with lots of extra features. Superkey has the big advantage of being controlled entirely from menus that pop up over your main application, while many of Smartkey's features were only available from the DOS prompt.

Now Smartkey is back in a new and improved version. It too is now a full pop-up, and it has nearly all the features of the Borland product as well as a few new ones of its own. It can, for example, format discs and copy files while another application is running. It also supports nearly twice as many redefineable keys as Superkey. If you already make heavy use of Superkey you could be better off sticking with your existing macros. But for anyone thinking of buying a macro program for the first time, the new Smartkey is well worth a look.

SUPPLIERS

Palomar Utilities Palomar Systems, 84 Cedar Road, Bolton, Oxford OX2 9ED. Telephone: (0865) 723392

Smartkey NewStar Software, 200 North Service Drive, Brentwood, Essex CM14 45G. Telephone: (0277) 220573

Topcopy Innova Software, 8 Gloucester Row, Watton-under-Edge, Gloucestershire GL12 7DX. Telephone: (0453) 835379

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MANAGING SUB-DIRECTORIES WITH WORDSTAR

I have used WordStar for some time for word processing, and Correctstar for checking spelling on an IBM XT. WordStar is fine, except that it does not understand sub-directories on the hard disc, and I have to keep copies of all three WordStar files in each sub-directory that I use. Is there any way round this?

S STEVENS

A We too use plain old WordStar more than any other program. We agree that it is a pity that most versions of the program do not recognise sub-directories, since this is important if you have a hard disc, but there are ways round this. Version 4 of WordStar does handle sub-directories properly and without any fuss. You can turn in your master discs and get the latest version for £99.

WordStar 3.4 and earlier versions require that three files — W.S.Com, WSovlyr.Ovr and WSmsgs.Ovr — are all in the directory you are using. The DOS command Path sets a search path so that you can find WC.Com in another sub-directory named in the Path command. Thus if you put

```
PATH C:\WS
```

in your Autoexec.bat file you can access WS.Com from the sub-directory WS on drive C when you are working in any drive or sub-directory. Unfortunately the Path command will only find executable files — that is those with extensions Com, Exe or Bat. It will not find the Ovr files.

There are two ways round this. If you have MS-DOS version 3.2 you can use a command called Append. It works like the Path command in that it defines a search path with the difference that it operates on data files, including those Ovr. You simply put the command

```
APPEND C:\WS
```

in your Autoexec.bat file, and when a data file is requested, the computer will look for it first in the current directory, and then in C:\WS.

If you are using a version of DOS before 3.2, you will not have the Append command, but you can overcome the problem by copying the three WordStar files into a RAM disk, that you designate drive D, as part of your Autoexec.bat file. You then change to drive D and load WordStar.

If you want to edit a file in a sub-directory on drive C you first use the CD command to change to the sub-directory on the hard disc that contains the file you wish to edit, then change to drive D if you are using the RAM drive method, load WordStar, and finally change the logged-in directory to C, which will in this case put you back into the sub-directory with the file you want to edit.


I am having difficulty transferring WordStar files using Kermit. Basic files stored in ASCII will transfer, but WordStar files will not. I think that the problem may be control characters in the file, but I do not know what to do about it.

M JOHNS

A The ASCII character set comprises 128 characters, which include the alphabet in both upper case and lower case, the numbers 0 to 9, and a few extra symbols such as punctuation marks, +, -, *, / and so on. Each of these characters can be represented using seven binary bits. A Basic program stored as ASCII characters uses one byte to store each character, but only seven bits are actually used. The eighth bit is frequently wasted, but on some systems it may be used to make the parity odd or even as required by a particular machine.

Though WordStar files are mostly text that can be represented by seven-bit ASCII codes, the program sets the eighth bit for special purposes such as marking bold or underlined text. If you are using micro-justification, the end of each word also has its eighth bit set, so the program knows where it can add extra micro-spaces.

To transmit a WordStar file to another machine you can strip and discard the eighth bit, so that you are transmitting a pure ASCII file. WordStar version 3.4 includes a program called WScrvt that will strip any eighth bits that have been set, leaving you with an ASCII file that is transferable.

Another way to obtain an ASCII file is to make WordStar print the file required, but instead of sending the output to a printer, send it to a disc file. Both methods will remove print enhancements such as bold, underlining, superscripts and subscripts, as well as micro-spacing.

If you really want to preserve these attributes — for example, when transferring WordStar files produced on a CP/M system to an IBM PC where you may want to do further editing under WordStar — then you must preserve all eight bits. This means that you must instruct Kermit to send all eight bits, as for a binary file, rather than the text-file default of sending seven bits.

Exactly how to do this depends on what machine you are using, and you may need to consult the manual. If you are using Kermit-MS on the IBM PC or one of the clones, after loading Kermit type

```
SET EOF=CTRL Z
```

On a CP/M machine using Kermit-80 you type

```
SET FILE-TYPE BINARY
```

and on a Honeywell mainframe type

```
SET TEXT OFF
```

It is best to set both machines to eight-bit transmission, before using the Send and Receive commands as usual. We commonly move WordStar files in this way.

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The Bromcom QC is also an ideal file server for IBM, Olivetti, Ericsson and a host of other PCs.

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The unpleasant colour screen of the old PC-1512 been replaced by an EGA-compatible display, but will this be enough to give Amstrad its sought-after success in the business market?
One thing you have to grant Alan Sugar: he certainly seems responsive to customers' demands. First he added what he himself claimed was a completely superfluous fan to the PC-1512 following widespread worries about possible overheating. Now, not only has he come out with an upgraded version of the same machine, the PC-1640, but he has even brought it out in the UK well before he had originally intended — all apparently because potential customers had asked him to.

This is hardly altruism, though. Sugar has admitted that corporate sales of the PC-1512 have been disappointing; he has failed to breach the Big Blue citadel. The latest model is an attempt to address some of the criticisms which the earlier machine attracted, and in the process make it into the business-micro big time.

Those criticisms centred around the display. Amstrad chose to put the power supply for the whole PC-1512 system in the monitor. This means that you cannot upgrade to the higher-resolution screens made by other manufacturers. In particular, it acted as a considerable obstacle to those who wanted to install an EGA card, which in any case is incompatible with the original system. This has proved unfortunate for Amstrad, since many companies have standardised on the EGA display. Compatibility problems apart, the PC-1512's graphics look ropey in comparison.

The PC-1640 has solved this at a stroke by offering enhanced colour graphics that Amstrad claims are fully EGA compatible. This has been achieved by buying in a design from Paradise, a firm that makes graphics boards, and incorporating the new circuitry on the main board. At the same time the on-board memory has been increased to a full 640K. Prices are pitched at around £150 more than comparable PC-1512 machines, and the top-of-the-range 20Mbyte hard-disc colour system now costs £1,199. No monochrome versions will be available.

Essentially the new micro is very similar to its predecessor. The only noticeable changes over the old PC-1512 are some extra ventilation holes in the system box and a row of DIP switches at the back. The new holes are there to allow the fan to function. And to forestall any possible worries about the high-resolution monitor overheating there is even a fan in the VDU.

The DIP switches allow the video resolution to be swapped between EGA and IBM-standard CGA graphics and the same effect can also be achieved using the Display utility that is supplied on one of the discs accompanying the machine. Swapping between different resolutions is easy from the DOS prompt, but he simply type DISPLAYEGA to obtain EGA-compatible graphics. More than a dozen different display options can be selected in a similar way.

Apart from incorporating Paradise's BIOS for the enhanced graphics, the basic ROS — Amstrad's name for the ROM operating system — remains unchanged, bar some tidying up. There are four expansion slots, one of which is occupied by the hard-disc controller. Digital Research's DOS Plus operating system, which was bundled with the PC-1512, is no longer included but Gem Desktop and Gem Paint are still being supplied.

In operation the PC-1640 is almost identical to its older sibling, though the two fans are slightly more intrusive. Running the Basic Benchmarks produced a figure of 7.0 seconds, practically the same as we found for the PC-1512. The floppy disc also turned in a comparable figure, though it did seem much more noisy: one person in Practical Computing's office compared it to the sound of knives being sharpened.

When reviewing the PC-1512 we were unable to test the hard disc. On the PC-1640 supplied this time there was a 20Mbyte hard disc from Tandon. It turned in a very acceptable time of 97 seconds running the Bagshaw Benchmarks, almost as fast as the hard disc on the new IBM PS/2 Model 30. The Amstrad is bound to be seen as one of the Model 30's main competitors, though on all but the most irrational grounds there is precious little reason to consider buying IBM's non-machine.

The main difference between the two generations of Amstrad machines is in the graphics, and here the Paradise technology does Amstrad proud. The image shows no sign of wavering, and text and graphics are sharp and displayed in bright colours. When the PC-1512 was launched it was available at prices that were previously unheard-of. The down side was that the overall standard of construction was inevitably less than first class. For the personal user, this is not likely to be too much of a problem: after all, if you pay out your hard-earned money on a piece of kit, you are likely to look after it. But it is a sad fact of working life that people in large companies show precious little respect or consideration for institutional machines.

Company micros need to have a higher standard of construction to withstand daily wear and tear. The PC-1640 is certainly a successful upgrade as far as the display is concerned, making it an excellent-value budget machine. But there are no new concessions to basic company needs in the area of build quality. As a result, it cannot be recommended as a workhorse business micro unless the usage will be relatively light.

These worries about reliability are put in an interesting light by persistent rumours that Amstrad will bring out an AT compatible in the not too distant future, possibly 80386 based. The AT is well established as the standard business micro, and it could be here that Alan Sugar's chance to hit the corporate market really lies. The PC-1640 is not sufficiently differentiated from the PC-1512: both are best suited for personal use. But a rather more stastically made AT compatible, combined with the same aggressive pricing shown on the existing machines, could be a winner.

If it seems implausible that a company should bring out a machine which effectively supersedes a model launched only a few months previously, bear in mind that Amstrad did exactly that in the home market. So if you are tempted by the PC-1640, hang on a few months to see if the Amstrad AT materialises.

If you must buy an Amstrad now, by all means get the PC-1640. It is well worth the price difference over the PC-1512. Despite the company's protestations to the contrary, it is hard to see the PC-1512 still being in existence at the end of the year.

**CONCLUSIONS**

- The Amstrad PC-1640 is an upgraded version of the PC-1512 with EGA-compatible colour graphics and 640K of RAM.
- The colour graphics are superb. Otherwise, the performance remains unchanged.
- The biggest problem with Amstrad PCs remains their relatively low level of production quality; in the rough and tumble of company use they cannot compete with the more sturdy built machines.
- The PC-1640 seems almost certain to replace the PC-1512, which it thoroughly surpasses for little extra cost.
AHEAD OF ITS TIME

IBM PS/2 MODEL 60

By Ian Stobie

IBM PS/2 MODEL 60

PO VERDICT

Performance | Poor | Average | Good | Excellent
---|---|---|---|---
Ease of use | | | | |
Documentation | | | | |
Value for money | | | | |

Possibly destined to be a top-selling office machine, but with few practical advantages over present cost for both A or a cheaper clone.

IBM has not preserved full compatibility with its previous character set. Loading up PFS Professional Write we noticed vertical stripes running down the opening screen. It emerges that this problem is caused by a small change in the graphics character set. Somewhere to be found is a characteristic "grey" ring to it, which we did not like.

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The VGA display chip inside the Model 60 takes over the functions of the EGA or CGA display card used on previous IBM systems. IBM offers a range of new monitors to go with it. We had the SV12, at £505 the cheapest of the new colour monitors IBM is offering.

The VGA standard has had a good press, but we were disappointed with it. The characters seem very upright on the display, and you get little distinction between letters like m and n. The screen also had a kind of grey tinge to it, which we did not like.

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One day the Model 60 could become the standard business micro, but as yet it does not do much more than an ordinary PC/AT.

In April of this year IBM announced Personal System/2, the new machines on which its continued dominance of the business PC market depends. The Model 60 is one of the key members of the range, a kind of up-market replacement for the IBM PC/AT. It has just gone on sale in Britain, priced at between £4,500 and £5,000 for a typical working system.

The Model 60 is very similar to another PS/2 machine, the Model 50 which is about £1,000 cheaper and of conventional desk-top design. The Model 60 is meant to be used propped up on its side in a vertical position; feet fold out from the main system box's base so you can stand it on the floor. It is about two feet high so it will fit under most desks, though not unfortunately the ones we were using.

Both machines have sufficient power to run the new OS/2 operating system when it becomes available at the start of next year. At present IBM is shipping the machines with PC-DOS 3.3. Both also use IBM's new Micro Channel expansion system; this means they will take cards conforming to the new standard but not old PC or AT ones.

It is much easier to get all the PS/2 models apart than previous IBM machines. You can remove the whole side panel of the Model 60 by merely twisting off two large screws with a coin. For security there is also a lock on the panel which you undo with a key. Inside, the Model 60 has twice as many expansion slots as the Model 50: eight instead of four. They are the 16-bit version of the full 32-bit Micro Channel offered on the top-of-the-range Model 80. For all but specialist users 16-bit cards are likely to be the norm for the next few years.

On the PS/2 series graphics, comms and printer support are supplied on the main board, so you only lose one slot for the hard-disc controller. If you want a mouse, the IBM offering, which costs under £60, plugs into a socket on the back of the machine, so you do not need a slot for this function either.

We had the base Model 60 machine, which comes with a 44Mbyte hard disc and one 1.44Mbyte double-sided 3.5in. floppy drive. There is room for an extra hard disc inside the box, and another 3.5in. floppy drive or resort to the RS-232 serial ports and an ordinary IBM printer cable to connect up to the printer port on another PS/2 machine. The VGA display chip inside the Model 60 takes over the functions of the EGA or CGA display card used on previous IBM systems. IBM offers a range of new monitors to go with it. With our system we had the SV12, at £505 the cheapest of the new colour monitors IBM is offering.

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IBM has not preserved full compatibility with its previous character set. Loading up PFS Professional Write we noticed vertical stripes running down the opening screen. It emerges that this problem is caused by a small change in the graphics character set. Some of the grey-scale characters are one pixel narrower, hence the stripes. This problem does not appear to affect solid or line characters, and the program itself still worked quite happily. But it is irritating, as it is a completely unnecessary source of incompatibility which must be laid at the door of IBM itself.

Where the new display standard does come into its own is in graphic applications, particularly those especially written for it. We had a PS/2 demo version of a drawing package called Dr Halo, and the effects available were impressive. While the VGA maximum resolution of 640 by 480 is not that much of an advance on the EGA, what makes the difference is the range of colours you can choose from: up to 16 at a time at top resolution or 256 at 320 by 200 dots. The active colours can be selected from a palette of over quarter of a million hues.

The Model 60 keyboard is the new standard IBM type, with 12 function keys arrayed horizontally along the top and a separate set of cursor keys in addition to its numeric keypad. The layout is therefore identical with recent AT keyboards. Following normal IBM practice the keyboard is not lumped in the price, so you could buy a third-party product instead.

With the PS/2 range IBM has now fully embraced the 3.5in. floppy-disc format. IBM provides two ways of transferring data from the 5.25in. format. The first option is the obvious one — a second external floppy disc for the PS/2 machines in 5.25in. format. IBM currently only offers a 360K version, so you cannot transfer data from 1.2Mbyte AT floppies in this way.

More elegant and also much cheaper is the grandly named data migration facility. It costs £24 and consists of a small box-like adaptor that you plug into the parallel printer port on the back of the PS/2. You then use an ordinary IBM printer cable to connect up to the printer port on another PC. This system lets you transfer files from 1.2Mbyte floppies, 360K floppy discs or the hard disc.

We had no trouble getting both programs and data across in this way from our AT to the Model 60. It was quick too. The only problem with the migration facility is that it is purely one way. PS/2 machines have a bidirectional printer port, but most other machines and third-party printer cards can only send. If you want to send files both ways you would need to use the external drive or resort to the RS-232 serial ports and a conventional comms package.

Software is beginning to arrive now in 3.5in. format, though most of it is standard
Above: Good colour graphics are the Model 60's main claim to fame.
Below: The data-migration facility.

PC-DOS stuff. Many publishers are following the lead of Microsoft and putting both discs inside the box when they sell retail packages. To get some kind of feel for how the Model 60 might look when OS/2 applications are run on it we tried out Guide, a newly written hypertext program which runs under Microsoft Windows and makes extensive use of the mouse and the PS/2's graphics. The combination had a remarkably Macintosh-like feel to it.

The documentation that IBM supplied with our copy of PC-DOS 3.3 was pretty feeble. As with the earlier PC-DOS supplied with the AT you get an introductory user's guide full of patronising pictures of parrots. But instead of the full DOS reference manual you only get an abridged version about a quarter the size. Apart from a slim manual for the monitor, we received no other documentation with the Model 60, although a DOS technical reference manual is available if you pay extra for it.

Perhaps the key distinction between the main members of the PS/2 range and earlier IBM systems is the Micro Channel expansion bus. The first cards will mainly be from IBM itself: the company has announced network adaptor cards, 3270 terminal emulation, and an optical-disc interface. So far third-party suppliers have mainly announced memory products. At the moment this shortage of expansion cards puts all the PS/2 machines above the Model 30 at a severe disadvantage compared to a conventional AT or clone. The Model 60 suffers particularly on this point, as its whole rationale is that it has more Micro Channel slots than the cheaper Model 50.

CONCLUSIONS

- The Model 60 is a well-made system broadly comparable in power to the existing IBM PC/AT. Its key distinguishing features are its use of the VGA graphics standard, the Micro Channel expansion system, and its floor-standing design.
- For graphics work there may be some point in standardising on the new VGA graphics standard — the colour in particular is very good — but for ordinary text work it offers little.
- The Model 60's main claim to fame is its seven free Micro Channel slots. But until more cards are available to put in them the Model 60 is at quite a severe disadvantage compared to a conventional AT or clone.
- The Model 60 is really a machine for the future. For the time being, anything that runs MS-DOS software and contains an 80286 chip can do most tasks equally well.
Though 80386-based PCs have been around for less than a year, it is already low price rather than technical specification on which newcomers to the market stake their claim.

With the lower end of the PC market now going through a relatively calm period as far as both technology and pricing are concerned, the cut-throat battles have moved to the more lucrative arena of the power-user market. First to be hit were the conventional AT compatibles. Prices tumbled from an initial £5,000-plus to the current low of around £1,200 for a fully equipped unit. Now machines using the Intel 80386 processor have been drawn into the war zone, and the prices being asked by the big names like Compaq, IBM and Zenith are already beginning to look rather silly.

But before parting with any cash for a budget clone it is worth asking some searching questions. This is especially the case when the hardware involved is so advanced as to be years ahead of its applications and operating-systems software base. Hardware and software standards to support the powerful 32-bit processor are still emerging, and there are no guarantees that the smaller manufacturer will still be around to maintain the development of their particular implementations of the standard.

The two machines reviewed here are just the first salvo from the price-cutters to be aimed at the big boys precisely where it hurts them most — at their corporate and power-user base. The Dell 386 is the brainchild of 22-year-old American entrepreneur Michael Dell. In just three years he has expanded his US mail-order PC business from $1,000 start-up capital to a turnover of almost $70 million. He now plans to tackle Europe with the same mail-order techniques and is starting with the UK from his Bracknell headquarters. The machines will not be available through dealers but must instead be ordered by phone, to be delivered by courier to your door in around a week. The Dell range also includes conventional 80286-based AT compatibles.

Mission is a company that made its name in esoteric hi-fi. In recent years it has diversified into PC networking, and now offers a range of PCs. The Mission 386, which is the subject of this review, is designed and manufactured by Advanced Data Logic, an American company, but it will be fully supported in the UK by Mission from its Huntingdon base. This powerful machine
took the recent PC User Show by storm as it sported a sub-£2,000 price tag. Quite who would be interested in such a high-performance machine without a hard disc is hard to imagine, but hats off to Mission for a great publicity stunt.

Both the Dell and the Mission machines follow the bulky three-box approach and are of a similar size and weight to IBM’s PC/AT. There is no evidence of design elegance in either model, but the Mission does have a useful stand which will allow you to get the monster system box off the top of a crowded desk and on to the floor.

The Dell 386 has a 1.2Mbyte 5.25in. floppy drive mounted on its front panel above a blanking plate where a second floppy can be fitted. Alongside the conventional AT keylock is the most eye-catching feature of the Dell: a four-digit green LED indicator panel that the company has christened Smartvu. It bursts into life as soon as the machine is switched on, and can therefore be used to display messages before the screen has warmed up. In normal use it displays information about hard-disc activity or confirms the current processor operating speed, but its most useful role will be for diagnostics. In truth it is a gimmick, but one that has some beneficial spinoffs.

The Mission, on the other hand, has no flashing lights to alleviate the tedium of the standard AT design. Once again a 1.2Mbyte 5.25in. floppy is a standard fitment, but in this case there are apertures for a further two half-height drives.

As you would expect from machines aimed at the power user there is a wide variety of mass-storage options. The Dell is sold with either 40Mbyte, 70Mbyte or 150Mbyte units. The first two have an excellent 28ms. average access time, and the last an even better 16ms. access time. The base-model Mission has no hard disc at all, but serious users will be relieved to hear that 40Mbyte, 80Mbyte and 150Mbyte units are available with access times of 28ms., 23ms., and 19ms. respectively.

With the covers taken off the boxes it is the Dell that once again attracts attention. The distinguishing feature this time is the small motherboard, a result mainly of the Dell’s remarkably low chip count. The Mission machine uses a more conventional approach, but in terms of performance it loses nothing in the process.

Both machines run their Intel 80386 processors at 16MHz, a clock speed which has become the norm for 80386-based computers. The one notable exception is IBM’s PS/2 Model 80, one version of which runs at 20MHz. To ensure compatibility with existing IBM packages the Dell’s processor can be made to emulate the PC/AT running at 12MHz or the IBM PC running at 4.77MHz. Hardware compatibility with PC/AT expansion cards is assisted by the ability to switch the expansion bus, which normally runs at 12MHz, down to a more AT-like 8MHz.

The Dell 386 contains 1Mbyte of RAM on a special memory board that plugs into its 32-bit expansion bus. The bus runs at the full 16MHz, and to maximise its speed advantage over the competition Dell has fitted static RAM, which does not require a refresh cycle to maintain its contents. Since the Dell’s static RAM chips are manufactured using CMOS technology they also use less power and as a result produce less heat than normal dynamic RAM (DRAM) chips. Static RAM is more expensive to fit in the first place, and is more expensive than DRAM to expand, but it does give an edge to the Dell’s performance. The standard memory board just has 1Mbyte, but memory can be expanded to an impressive 6Mbyte by plugging in additional strips, each containing nine 256K CMOS chips.

Mission’s approach is more conventional, utilising high-speed 80ns. 16-bit memory chips. All machines sold with hard discs are fitted with 2Mbyte of memory as standard. There are two full-speed 32-bit slots, so users can expand memory to 8Mbyte without occupying any PC or AT slots.

Both machines have the basic features of battery-backed clock/calendar as well as serial and parallel ports — two of each in the
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case of the Dell. Display-adaptor options confirm the feeling in the industry that the CGA standard is no longer acceptable. The Dell offers just two types: a Hercules-compatible monochrome system and an EGA system based on the Video 7 adaptor card. Mission has yet to finalise its display options, but the review machine was supplied with an ADC EGA card driving the superb but pricey Taxan 770 colour monitor. In a welcome move, Dell is making the system unit available without keyboard and mouse in AT layout. Mission users on the other hand get a full 102-key ATE unit, which is both better made than the Dell keyboard and has a more satisfying key action.

It is not surprising that both these capacious machines perform well as card cages. In most cases memory will be placed in the 32-bit slots leaving the remaining eight-bit and 16-bit slots free. The Dell starts with one 32-bit, five 16-bit and two eight-bit slots; with all the necessary support boards in place three 16-bit and one-eight bit slot are left vacant. Mission's bare 386 board has two 32-bit slots, four 16-bit slots and two eight-bit slots, and ends up with one 32-bit, one-eight and two 16-bit slots available to the user.

Both machines also offer good mass-storage expansion potential. A further three half-height devices can be fitted to either machine. But while the Mission allows front access to two of them, the Dell gives you access to only one.

It has long been obvious that machines as powerful as these desperately need an alternative operating system to the MS-DOS that currently encumbers them. The memory-management capability of the 80386 chip is in excess of the 8Mbyte maximum that the machines currently offer. Yet there seems little point in going even this far when MS-DOS can only cope with a meagre 640K. Dell and Mission both promise that their machines will come into their own when Microsoft's OS/2 becomes available, but only Mission has bundled in software that can exploit advanced memory-addressing capability. It is when you come to processor-intensive tasks that the 80386-based machines really score over even the fastest 80286-based AT compatibles. In the Basic Benchmarks tests the Dell came in at 1.66 seconds and the Mission at 2.07 seconds. It seems that Dell's efforts in providing high-speed RAM have paid off, as it now ranks as the fastest machine we have tested. But even the Mission is well within the range that is normal for 80386-based AT clones. The Kaypro 386 manages 2.03 seconds in the same test, and the Zenith Z-386 1.86-seconds timing. The current record holder is the Apricot Xen-i 386, which turned in a timing of 1.75 seconds.

The speedy processor performance also comes through loud and clear when the machines are actually being used for day-to-day applications. Tasks that otherwise take a second or two, such as searching a spelling-checker dictionary, are completed more or less instantly, and complex spreadsheets no longer take an age to recalculate.

Running the Bagshw Disc Benchmarks, the Dell's hard disc achieved a total timing of 27.2 seconds, marginally faster than the Mission's Priam unit which managed 28.8 seconds. The difference is so small as to be imperceptible in practice, and both are fast.
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Compromises are inevitable when you set out to build a cheap battery-powered computer that is small and light enough to be used anywhere.

The Z-88 is Clive Sinclair’s first offering under the name of Cambridge Computer. Any micro from the man whose previous company, Sinclair Research, spearheaded the home-computer boom with the ZX-80, ZX-81 and ZX-Spectrum would be interesting. What makes the Z-88 worthy of note is that it is a lap portable, complete with software, which costs about £250. If the machine fulfils Cambridge Computer’s claim to have produced “the first portable with full personal-computer facilities” then it will certainly have proved to be a price breakthrough.

The Z-88 comes in a grey carrying case which looks as though it is made of plastic-coated cardboard and has a black plastic handle. Flimsy though it is, you could use the case to carry the Z-88 around in as the machine is very light. However, the case does not look as if it would last very long, nor does it fit in with an executive image. Most people will probably just pop the Z-88 into a briefcase.

One of the advantages of the Z-88 is that it is truly portable. It is light — weighing just under 2lb. — slim, and takes up about as much space as an A4 pad. The casing is made of black plastic and has a built-in screen in the top face. Below the screen lies a stick-on panel which lists the most commonly used key combinations, and below that is the keyboard.

On the right-hand side there is an RS-232 serial port and a plastic panel that pulls out to reveal the Z-80 expansion bus. On the left is a mains adaptor port, a dial to adjust brightness, and a small hole which houses the Reset button. To reset the machine you poke a piece of wire or a paper clip into the hole and jab twice.

On the front edge there is a clear plastic window covering a row of three cartridge slots. You flip out the window to insert RAM or EPROM cartridges. On the bottom face of the machine is another plastic panel which you can pull out, enabling you to rest the Z-88 at an angle of 12.5 degrees. Below this is a smaller panel that covers the battery compartment.

The Epson-built LCD screen is clearly legible. The background is a sage-green colour and text appears in purple. Unfortunately, you can only display eight lines of data at a time. This is a common problem with lap portables, and one that Cambridge Computer has been unable to solve. There is plenty of space underneath the existing dis-
play to house a larger one, should that become a possibility. Nevertheless, the Z-88 can display a full 80-character line, which is a lot for the price and its size. Though the characters are of necessity small, I had no problem reading them.

The keyboard is said to have been especially designed to be silent. In fact it is a membrane keyboard of the same ilk as that found on the ZX-Spectrum. The keyboard has 57 alphanumeric keys and a space bar, as well as Esc, Tab, Shift, Del, Enter and Caps Lock keys. It also has two Shift keys, four cursor keys, Index, Menu, Help, Square and Diamond keys. The keyboard on the machine supplied to us was different to that exhibited at the Which Computer? Show last February. The show machine had a Topic key instead of an Index key, and some of the keys have moved around. Cambridge Computer says the Diamond key has been moved to make it easier for touch-typists to reach, and that Topic was felt to describe that key’s function more clearly than Index.

The stick-on label on the Z-88 we had was different to the one that appeared on the original version, with different key combinations for commands. This is an indication that the software has changed since it was first shown. Cambridge Computer says that it is delays in developing the software that account for the late appearance of the.

(continued on page 49)
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Z-88. It was originally intended to be shipped in April, and at a lower price than that now being asked.

The ROM and EPROM cartridges that slot into the front of the machine are a similar size and shape to the Sinclair QL’s Microdrives, measuring about two inches square and a quarter of an inch high. They slot into place easily. Any programs written for the Z-88 — apart from those already built-in — will be supplied in cartridge form. The EPROM cartridges are the nearest the Z-88 gets to a conventional mass-storage device. EPROMs store text and other data semi-permanently. They are available in 32K and 128K cartridges — our machine had a 128K EPROM — up to three of which can be plugged in at once. Cambridge Computer says that 1Mbyte EPROM cartridges should be available in September. Also available is an ultraviolet EPROM eraser that wipes existing data, allowing a cartridge to be used again.

**BATTERY-BACKED RAM**

The Z-88 comes with 32K of RAM, of which 10K to 15K can be used for data. Additional RAM is available — our machine had 128K of extra RAM — and once again this comes in 32K and 128K cartridges with a 1Mbyte version due in September. Data is erased from the RAM cartridges when they are removed, or if the machine is deprived of power. Normally the machine goes into Sleep mode when you turn it off, and all the data in the resident RAM cartridges remains intact.

But problems arise when you change batteries. The Z-88 uses four AA batteries which are meant to be enough for approximately 20 hours normal use, or about a year when the micro is turned off. To conserve battery power the Z-88 will automatically turn itself off and go into Sleep mode if the keys have not been depressed for a given amount of time — you can choose how long. Turning the machine on again returns you to your application at exactly the point where you left it.

When you change batteries it is advisable to safeguard data in RAM by temporarily connecting the Z-88 to the mains; an adaptor is supplied at extra cost by Cambridge Computer. Otherwise you are going to have to be pretty nifty when changing batteries. The manual includes a table showing how much time you have, depending on the number of RAM cards fitted. With one 128K RAM card you have four minutes to change your batteries; with three fitted you have a mere 60 seconds.

Of course, it should not take that long to change six or eight batteries, but you could be in trouble if your power ran out unexpectedly while you were stuck in the middle of nowhere with no spares to hand. The Z-88 gives a warning on-screen when the batteries are low, to help you avoid such accidents. On one occasion we could not get the Z-88 to switch off by the normal means of pressing both Shift keys simultaneously. Rather than waste a new set of batteries by leaving it overnight we removed them and wiped out the data being held in RAM.

The Z-88 is not meant to be opened up by users, and there should not normally be any reason for doing so. We managed to get at the inside by undoing 11 screws. The display lies a plastic battery housing and L-shaped board. The board curves around the box for the cartridges, which is held in place by a long strip of brass.

Your large chips are mounted on the board. From left to right they are an NEC 1Mbit EPROM, a 256Kbit static RAM, a logic array, and the main processor — a Zilog CMOS Z-80. Below them and to the left is a small loudspeaker. The substantial logic array helps to keep the component count low, but there is still a surprisingly large number of discrete components in the form of transistors and resistors. Cambridge Computer was unable to supply a printer cable in time for us to try out the Z-88’s printing capability. The Z-88 uses an RS-232 serial port for printing, which is also slightly worrying. Cambridge Computer claims that it can be used with most popular printers, though the cheapest models usually have a parallel port as standard. To convert a printer to serial operation could cost you about £30, possibly adding a hidden cost to buying a Z-88.

The documentation was fairly helpful, though it is not without errors. One tutorial instructs you to press the Square and Down Arrow rather than the Diamond and Down Arrow when using the Calendar, which confused me for a while.

The Z-88 is said to be aimed at business, professional and educational users. Its closest rival is probably the Tandy 102, which costs £299. The Tandy machine displays fewer characters on-screen and has slightly less memory but it does have a full-travel keyboard, and parallel and serial printer ports. It also has a built-in modem — though it is not approved for use with the UK phone network — along with a separate modem port. Software in the form of a text processor, Basic, and address and scheduler programs is also standard. The Multiplan spreadsheet is available at extra cost. For business users it could well prove a more appealing option than the Z-88.

**CONCLUSIONS**

On paper the Z-88 looks good value for money. Its spec is impressive, especially the built-in software; it is light and easy to carry around, and has a clear display. But it is让我们先来看看键盘。它有一个标准的QWERTY布局，虽然它并不完美，但对于打字，打字的益处还是能让人接受的。当评估这台机器时，我们更看重它的性价比。Z-88的打印能力是个吸引人的选择，而非Z-88。虽然Z-88没有正式上市，但是其价格可能会更低，因为这台机器的市场定位是商业、专业和教育用户。它的竞争对手是Tandy 102，价格为£299。Tandy机器在屏幕上显示的字符较少，但它的内存更少，但它确实有一个全行程的键盘，以及并行和串行打印机接口。它还有一个内置的调制解调器，尽管它还没有被批准用于英国的电话网络——以及一个附加的串行口。软件，软件，软件，包括文本处理器，Basic，地址和调度程序，也是标准的。Multiplan电子表格是额外收费的。对于商业用户，它肯定能证明是更吸引人的选择，而不是Z-88。
PRINTER STANDS
HIGH-TECH ORANGE BOXES
By Carol Hammond

Continuous stationery is cheap and convenient but for one problem — what to do with the stream of printout spewing forth from your machine. Printer stands are designed to keep the problem under control with printer, paperstack and printout supported on one neat unit.

Lasers printers solve one of the awkward problems of using a printer: where to put the paper. They store the paper to be used and come with a tray to catch the printed output. However, for those using more humble printers, paper handling still presents a problem that many people look to printer stands to solve.

If you use continuous stationery you need to position your printer so that there is a clear path for feeding paper into it, and somewhere for the resulting output to go, where it can be nearly folded. Otherwise you may find that the printout gets crumpled, or that it starts feeding itself back into the printer mechanism. To avoid this you may have to rig up your printer in a way that takes up quite a lot of room. Even then you may feel that it is necessary to stand over it while it is in action, in case any paper gets caught.

People buy printer stands to overcome these annoyances. Stands cost anything from £10 to £300, so it seems there must be many different ways of solving the problem. We looked at a variety of stands, from the cheap to the expensive, which adopt different ways of housing printers and paper.

The first one we looked at was the Universal PC Printer Stand; at £12.75 it was also the cheapest. The Universal consists of five pieces of smoked plastic, complete with slots, which you put together yourself. It is quite easy to assemble. A diagram is provided, and each section of the stand has letters embossed on it so you know to connect each piece to another with the matching letter.

One piece sits horizontally, and two other pieces are placed vertically at either end of it. The horizontal piece has four slots; the two outer ones are for housing a 132-column printer, and the two inner ones for an 80-column printer. You test your printer on this horizontal base. There is another piece which acts as a lip to prevent your printer from sliding off, since it will be lying at an angle, sloping towards the front. The remaining piece is the paper guide, which slots in at the back. It has two cut-out shapes at either side of it to feed printer cables through. The Universal is meant to have stick-on rubber feet but ours arrived without them.

Although the Universal stand looks flimsy, it proved to be quite sturdy. Unfortunately, it did not seem to be of much use. You can put your paper underneath the stand in order to save space, and you can feed it through the paper guide to the printer and then out quite easily so that it does not get creased. But the stand has no mechanism to fold the paper or catch it, so it is still free to go awry.

The Amaray stand consists of one piece of smoked plastic suitable for an 80-column printer. The stand has three sides to it, the largest having a hole in it to feed paper through for bottom-feed printers. The stand we used had a crack in the front, so it obviously did not travel well through the postal system and must have been quite brittle. With the Amaray stand, again, you just put your printer on top and your paper beneath, so you save some space and make a clear path to feed paper into the printer.

The Datasafe Printer Carrier comes in 80-column or 132-column models. Both are made up of two pieces of plastic: the main stand and a catcher tray. The 132-column model can be used with bottom-feed printers. One piece is box shaped but with two side pieces missing. One of the remaining side pieces has a hole in it from which a panel pokes out to form a paper guide. The top edge of this side of the stand does not join to the piece of plastic above it, but it has a rubber edge. Paper is stored inside the stand and feeds through this open edge to the printer, which rests on top of the stand. The output falls into a catcher tray which fits on to the back of the stand below the paper guide.

CURLED PAPER
Although the Datasafe stand makes some attempt at catching the paper and keeping it in one piece, when we used it the paper started to curl around itself and did not fold up neatly. A carefully positioned cardboard box with a hole in one side would have been just as efficient. There is the advantage, however, that as you move the stand you can move the paper stored inside it.

At this point we began to feel that printer stands were largely a waste of time and money. Unless the printer stand actually folded the paper coming out of it, there seems little point in having one. On all the models we tested up to this point the paper could still get creased, and we would not have been happy to leave the printer to its own devices during a long printing session.

The Micro Fold stand, however, has a paper-folding compartment which worked successfully when we tried it. The Micro Fold stand costs almost £60, but it works so efficiently it is probably worth the expense if you do a lot of printing. It is certainly one we would use in our office.

The Micro Fold is supplied in eight separate pieces plus a bag of screws. It looked as though assembly might be a complex and frustrating task, but in fact very clear instructions are provided and we were able to put the Micro Fold together in about 15 minutes. The small piece of plastic that was left over when we had finished proved to be a clip to hold the printer cable in place.

RECUMBENT V
Once assembled, the Micro Fold looks like a V lying on its side. Your printer rests at an angle on the raised part of the V shape. Underneath the printer lies a wire tray where your printout is refolded. Beneath this tray there is room for an input stack about 1.5in. thick. If you want to do a print run that requires more paper you can feed it in from a bigger stack at the front of the Micro Fold.

A metal plate at the back of the stand separates the incoming paper from the printout. It can be adjusted according to the type of paper or printer used to ensure the paper feeds through at the right tension. A helpful diagram of how to feed in paper is stuck on to the stand. The Micro Fold can be used with bottom-feed printers too.

Encouraged by this, we moved on to use the Imac Desk saver, which employs a similar vertical arrangement to store and fold paper. It is supplied as three separate pieces of plastic which, once assembled, are claimed to form a printer stand with a smaller footprint than the printer itself.

The largest piece resembles a four-sided box. You place one piece at the bottom of the box to form a tray for the stack of new paper, while the last piece hooks over the edges of the large box to form a deep tray to (continued on page 52).
## PRINTER STANDS

<table>
<thead>
<tr>
<th>Printer Stand</th>
<th>Printer Width</th>
<th>Dimensions (mm.)</th>
<th>Material</th>
<th>Supplier</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal PC Printer Stand</td>
<td>132 col</td>
<td>450 x 475 x 110</td>
<td>plastic</td>
<td>PAS</td>
<td>£12.75</td>
</tr>
<tr>
<td>Amaray Printer Stand</td>
<td>80 col</td>
<td>400 x 349 x 108</td>
<td>plastic</td>
<td>PAS</td>
<td>£15.65</td>
</tr>
<tr>
<td>Space Maker</td>
<td>80 col</td>
<td>400 x 300 x 115</td>
<td>metal</td>
<td>Inmac</td>
<td>£29</td>
</tr>
<tr>
<td>Datasafe Printer Carrier</td>
<td>80 col</td>
<td>381 x 450 x 140</td>
<td>plastic</td>
<td>PAS</td>
<td>£66.80</td>
</tr>
<tr>
<td>Misco Micro Fold</td>
<td>80 col</td>
<td>415 x 460 x 380</td>
<td>metal</td>
<td>Misco</td>
<td>£59</td>
</tr>
<tr>
<td>Datasafe Printer Carrier</td>
<td>132 col</td>
<td>597 x 450 x 140</td>
<td>plastic</td>
<td>PAS</td>
<td>£61.80</td>
</tr>
<tr>
<td>Desk saver</td>
<td>80 col</td>
<td>280 x 571 x 365</td>
<td>plastic</td>
<td>Inmac</td>
<td>£65</td>
</tr>
<tr>
<td>Ergo Lowstand</td>
<td>132 col</td>
<td>600 x 800 x 410</td>
<td>metal</td>
<td>Inmac</td>
<td>£139</td>
</tr>
<tr>
<td>Autofold</td>
<td>132 col</td>
<td>680 x 800 x 720</td>
<td>metal</td>
<td>Inmac</td>
<td>£269</td>
</tr>
</tbody>
</table>

Dimensions are quoted as width x depth x height.

**SUPPLIERS**

Inmac 16 Silver Road, London W12 7SD. Telephone: 01-740 9540

Misco Computer Supplies 4 The Western Centre, Western Road, Bracknell, Berkshire RG12 1RW. Telephone: (0344) 482121

PAS Computer Products Datasafe House, Unit 4, Central Trading Estate, Staines, Middlesex TW18 4UP. Telephone: (0784) 62781
every time you use it, you would also have to
positioned where passers-by cannot bump
ever,
and in folding the output. It also had the
factorily - both as regards feeding paper in
found that the Spacemaker performed satis-
slotted into position to accept printout. We
your desk - but it can be pulled up and
second wire tray, connected to the first, nor-
the printer rests. Underneath it lie two metal
trays for the paper stack and the printout.
The sheet of instructions supplied was
parts were heavy and awkward to position.
Assembling it was straightforward,
but it took two people because many of the
parts were heavy and awkward to position.
The sheet of instructions supplied was
reasonably helpful, but did not show clearly
how to position the wire divider tray. Once
screwed together, using the tools provided,
it certainly looked built to last. We fitted
castors because it would otherwise have been
far too difficult to move around.
The Autofold has three levels. The top is a
flat, plastic-covered surface on which the
printer rests. Underneath it lie two metal
trails for the paper stack and the printout.
The trays can be positioned at six different
heights according to the amount of paper
you need to accommodate.
In use, the Autofold did not quite live up
to its impressive appearance. We found our
printout did not fold very easily, and there
seems to be little reason to pay so much
money for a stand unless you do a great deal
of long-run printing. It might also be
appropriate if you use a very large or heavy
printer and want to be able to wheel it round
the office.
The Ergo Lowstand, the second most
expensive stand we tried, looked like a cut-
down version of the Autofold. Like the
Autofold it is robustly built, but it has only
two levels: the upper houses the printer and
the lower the paper. A wire tray protruding
from underneath the top level can be ex-
tended to take printout. The stand worked
well when we put it to the test, folding up
paper without any difficulty. It is more
expensive than the Misco stand, but has the
advantage that it can be wheeled around on
castors and is very well built.
If you have decided on a particular printer
stand, try to see it in use before you buy it —
photographs may paint a flattering image of
a particular model’s capabilities. If you buy
from a catalogue, check that you can get a
full refund if you are not satisfied. Finally,
keep an eye open for empty crates or card-
board boxes. With a little bit of time and
ingenuity you might even be able to set up a
suitable arrangement of your own.

CONCLUSIONS
Overall we were disappointed by the printer
stands we tried.
Price seems to bear little relationship to the
functionality of the product; if anything it
depends on the material from which the stand
is constructed.
If you are buying a stand, go for a model
that will fold up your printer.
Avoid the temptation to overspecify: some
of the more expensive models are so soundly
built that they will still be as good as new long
after your last continuous-stationery printer
has been replaced by a laser.
Prospero Software is dedicated to languages and to customer support. For an opinion ask a colleague; for information call 01-741 8531 or write to Prospero Software Ltd, 190 Castelnau, London SW13 9DH, England.
Digital Research's mouse-driven front end has so far not found much favour with the writers of applications software, but some home-grown programs have now arrived to fill the gap.

If Digital Research's Gem front end is ever to play a major role in the PC market it will have to be well supported with application packages. Of course, any run-of-the-mill PC applications can be called up from the Gem front end, but what are needed are proper Gem-style applications with mouse support, windows, slide bars, pull-down menus and the rest. Not many independent software suppliers have produced the goods, and it seems that Digital Research has cottoned on to the fact that it will have to produce some of these packages itself, if only to get things started.

The results of this thinking are Gem Desktop Publisher and Gem 1st Word Plus, a word processor. Desktop Publisher is a low-end product as desk-top publishing (DTP) packages go and was developed by Digital Research itself. The word processor was bought in and adapted. Both have the Gem format. They interrelate with Gem graphics packages and are very competitively priced. It is essential to have graphics capability in order to use these programs, and colour is desirable. It is also more or less essential to have a mouse: though keyboard alternatives to the mouse commands are provided, they are fail-safes and do not add up to a true alternative interface.

Gem 1st Word Plus has been packaged by Digital Research with the Gem Desktop itself, including the usual range of output drivers. You also get Gem Paint, a pleasant little painting program. Amstrad owners are presumed already to have Desktop and Paint, and can buy 1st Word Plus alone at a lower price. Separate discs and manuals for all three come together in a hard slip case.

The standard Gem manual style is soft-covered and spiral bound. The cover graphics are pretty and the reference material is reasonable, though the writing style is rather leaden. More seriously, the authors seem to have no idea of what constitutes a proper tutorial. 1st Word Plus comes on two unprotected floppy discs. One holds the main program and the spelling checker, while the other is for the mail-merge package. Using the usual Gem procedures it is easily installed on a hard-disc machine; it would be very hard work to use Gem applications with floppies alone.

The program opens with a document-selector screen, which then leads to an editing screen. Gem applications can never be clean-screen programs as all the usual mouse-and-windows clutter has to be displayed. In 1st Word Plus there is also a note of function-key assignments at the bottom of the screen, totally hemming in a little text window, though you can pull down the text window to hide it if you wish. The key-assignment strip indicates whether boldface, underline and the like are toggled on or off, but it is less useful than it might be because it displays only unshifted key assignments. The program uses shifted function keys as well, but no Alt or Control combinations. Most function-key assignments are in any case duplicates of the menu functions.

There is no automatic context-sensitive help, but among the pull-down menus there is a help menu which provides a list of topics. On the start-up screen there is a fount table which provides very easy access to non-keyboard characters; it is also accessible from the main screen if you shift the text windows. There is also a key box which allows you to click with the mouse instead of pressing Space, Return, Delete and various other keys. To keep it on-screen while typing, though, would mean losing a hefty chunk of text space.

1st Word Plus works by default in an insert mode, without automatic reformatting. It displays italics, boldface and the like, and justifies your text on-screen. Although the program handles a small range of fount sizes, this is not reflected in the display. It is painfully slow in responding to key presses: it is not difficult for a moderately fast typist to race several words ahead of the text on-screen.

The spelling checker has an in-built contextual spelling facility. It displays a list of words that it judges to be possible alternatives to the word in context, after a lengthy wait.

Digital Research's mouse-driven front end has so far not found much favour with the writers of applications software, but some home-grown programs have now arrived to fill the gap.
You can also superimpose text or other pictures over a picture. The program has a Top's Snapshot feature. Pictures can be defined wherever you like and you can combine them with other pictures as if they were in a notebook, moving them around and changing their size. Once your rectangle is in place, you can define and place a rectangle on the blank space. Apart from the clock and other little goodies it is a one-window program, and a toolkit along the left-hand side; the Gem-type screen, with menus along the top and a toolkit can be suppressed to give more screen space.

The program comes up with a standard Gem-type screen, with menus along the top and a toolkit along the left-hand side; the toolkit can be suppressed to give more screen space. Apart from the clock and other little goodies it is a one-window program, but it does allow you to switch between a number of views of the document. For example, you can view two adjoining pages or one full page with normal-size text rendered illegible, or you can select any part of the page to be displayed at either actual size or twice actual size.

For laying out pages, Gem Desktop Publisher works with the basic concept of a rectangle, the same thing is known as a frame in the parlance of some other packages. You can use the mouse pointer to define and place a rectangle on the blank page. All text and graphics — even the page numbers — are enclosed within rectangles. You can locate as many rectangles as you need, overlapping them as necessary. Once your rectangle is in place, you can grab the contents from a suitable file to be repositioned within it. Rectangles are defined in the usual Gem way: you set the mouse pointer at one corner, and then stretch the box out. It is possible to display grid co-ordinates on-screen to ensure accurate positioning, a feature which is more or less essential, since Gem Desktop Publisher cannot define page sizes.

All the indications are that the final documentation will be just as pretty as the 1st Word Plus manual, and equally heavy going for the reader. This program itself did not have an output module, though there is no reason to suppose that there will be any reliability problems, and in one morning session I crashed the program nearly 20 times. Its idiot-proofing will, I hope, be improved by the time it is released to the public.

By DTP standards, Gem Desktop Publisher is a compact program. It uses just two floppies, though of course it also relies on the printer drivers and the like that are included in Gem Desktop. Gem Desktop Publisher has no graphics or word-processing facilities of its own, so you have to use it in conjunction with a separate word processor and graphics package.

Gem Desktop Publisher supports word-processed files from WordStar, Word Perfect, Multimate and Displaywrite, as well as from the Gem word-processing packages 1st Word Plus and Write. Documents from these sources can be imported in their normal formats, though they are stripped of their bold, underline and other display codes. You can also import ASCII documents from any other program capable of producing them.

COLOUR CAPABILITY

The only graphics programs that are supported are the Gem packages Paint, Draw Plus and Graph. Gem Desktop Publisher will handle colour, but it does not translate colour into shades of grey on monochrome machines.

The program comes up with a standard Gem-type screen, with menus along the top and a toolkit along the left-hand side; the toolkit can be suppressed to give more screen space. Apart from the clock and other little Gem goodies it is a one-window program, but it does allow you to switch between a number of views of the document. For example, you can view two adjoining pages or one full page with normal-size text rendered illegible, or you can select any part of the page to be displayed at either actual size or twice actual size.

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(continued on next page)
margins in any other way. Rectangles and text will normally be positioned precisely as defined, but you can also arrange for them to snap to the nearest grid section. The size of the grid is adaptable.

Each rectangle has to be either a graphics rectangle or a text rectangle: which type it is, is determined by the nature of the file you read into it. A rectangle cannot be filled with matter from more than one file, but the contents of a single file can spill across several rectangles if necessary. This is not quite as restrictive as it sounds, since graphics rectangles can include text that has been generated as part of an illustration, and rectangles can be superimposed to combine text and graphics.

The real problem is that it is only possible to designate a rectangle for graphics or text by reading in a file. If you leave a rectangle as an empty phantom you cannot locate the cursor in it to type in any fresh text. Nor is it possible to paste text cut from a text rectangle into an empty rectangle; there has to be some text there first, even if it is subsequently deleted.

Of course, most of the time you will be importing chunks of text that have been prepared using a word processor. But most DTP users still need to add an occasional headline to an existing piece of text, and will not take kindly to having to call up their word processor in order to do so. Gem Desktop Publisher makes this simple operation — and several others — seem like hard work.

Rectangle attributes are defined from a pull-down menu of options, one of which is column layout. Rectangles can have from one to four columns of text, and the space between them can be selected. Each column has to be of the same width, and you have to define a separate rectangle for a heading that is intended to spread across the head of two or more columns of text. This causes some problems if you want to include text from several different files on a single page. Each slab of text has to be fed into a separate rectangle, so you have to do all the columnar calculations by hand.

NO GRAPHICS

The background inside a rectangle can be set to appear in any one of eight colours and nine patterns, including plain; it can be either opaque or transparent to underlying rectangles. There is no built-in facility for setting borders around rectangles. If you want a border you have to import one from a graphics program or superimpose rectangles of slightly different sizes. There is a command for setting vertical lines between columns, but otherwise there are absolutely no built-in graphics capabilities.

Only as much text is read into the rectangle as will fit; the overflow is ignored. If the rectangle or the sheet in it is realized, the contents are adjusted automatically and the flow to subsequent rectangles is automatically corrected.

Text is invariably chained from one rectangle to the next in a straight sequential way, depending upon its position on the page; you cannot override this ordering. To some extent this is handy, but I did find it difficult to adjust my rectangles to the right size so that only the headings of a file appeared in a heading rectangle. Gem Desktop Publisher did not seem particularly helpful here: time and again I got a "word too long for rectangle" error message when I did not want the word in question to appear in the rectangle anyway. And when I picked too large a fount size for my heading, the program seemed very reluctant to give me a chance to choose again. I would also have liked a clearer way of indicating whether — and when — there was overflow from a rectangle. It has no automatic method for positioning from one section of a file to the next.

A good feature of Gem Desktop Publisher is its handling of illustrations. You do not have to define spaces for illustrations before reading in text: you can do this at any point. If you define a graphics rectangle in the midst of a spread of text, the space for it will be cleared automatically and the text flowed around it. Flowing takes place automatically in a simple newspaper-column format so that text will not read right across the illustration even if it is placed in mid-column or within single-column text.

As well as defining rectangle attributes, you can define attributes for sections of text within a rectangle. These blocks can be existing paragraphs or a section of text that you have defined with the cursor. Paragraph attributes include the Swiss and Dutch fount styles and sizes from 7 point to 72 point. You can also specify various indents and spaces along with ink colour and text alignment; range-left, range-right and centred styles are all available. You give each set of paragraph attributes a name of your choice, and save the set of names used within a document as a style sheet.

Individual character attributes are applied to defined blocks of text, and are limited to the basic set of bold, underline, italic and normal. You can also mix paragraph and character attributes into your original text files. The command

```
@subsection
```

for example, will set the rest of the paragraph into sub-heading style, assuming one exists in the style sheet being used. This is a very handy feature which greatly simplifies and speeds the design of long documents.

Gem Desktop Publisher's general facilities for handling multi-page documents are at least adequate. Some attempts are made to carry forward the initial layout to subsequent pages, and it is possible to insert and delete pages at any point.

Though text cannot be entered from scratch, it can be edited within the program, and there is a facility for assigning the editing keys so as to mimic those of your originating word processor. I found the text-editing cursor to be a clumsy beast, which rarely located itself exactly where I expected.

Gem Desktop Publisher lacks automatic hyphenation facilities, so if you want to insert soft hyphens you have to do so manually. It also lacks any kerning facility, so you cannot adjust the spacing of characters to improve the look of the type. I also found that supposedly justified text sometimes falls short.

Headers, footers and even simple page numbering are handled as graphics files. The advantage of this approach is that it allows you to incorporate a logo, but it does make adding simple headers an unnecessarily complex business. A basic selection is provided, to simplify the task.

Gem Desktop Publisher's file handling is complex since the program cannot save all your text and images in a single file. In order to produce or reproduce a document you need a bewildering variety of files on disk, including various versions of the text files, graphics files, style sheets and the special files that the program itself generates. All of them must be present on the same disk. Though this arrangement is economical on disc space, it does make it a major chore to do simple tasks like reproduce a document on a floppy in order to carry it to a typesetting printer. The program does make a small attempt to simplify this procedure.

CONCLUSIONS

- Gem 1st Word Plus and Gem Desktop Publisher are decent attempts to exploit Gem's very pretty front-end. Both programs implement the Gem features well.
- Both programs are not unique to low-end programs with a relatively limited range of features, and both are very competitively priced.
- Though both programs are perfectly competent, neither is exceptional as to provide an overwhelming reason for choosing Gem as a front end.
Finally there is a productivity software package that perfectly fits your executive management style. Carefully tailored to enhance executive productivity, WordPerfect Executive is easy-to-use business software that lives up to its name.

WordPerfect Executive skilfully weaves the elements of word processing, spreadsheet analysis, calendaring and information management into one compact package. It is ideally suited for laptop PCs, with the entire program on one 3½" diskette, yet it covers the many business computing needs of executive computer users.

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Get the productivity software tailored for top management: WordPerfect Executive. For more information, telephone or write to Sentinel Software.

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ADOBE ILLUSTRATOR
TRACING WITH POSTSCRIPT
By Carol Hammond

While most drawing programs force you to start with a blank screen, this Macintosh package is designed specifically for those who want to adapt existing images.

As its name suggests, Adobe Illustrator is a drawing package. Like others of its kind it can be used to create images, but it really comes into its own as a tracing tool to modify existing artwork. It is intended primarily as a tool for graphic artists, technical illustrators and suchlike. Its tracing facility also allows the less artistic to produce reasonable looking artwork.

Adobe Illustrator comes from Adobe System, the company which originated the Postscript page-description language. As you would expect from a program with such a lineage, Illustrator takes advantage of Postscript. Rumour has it that Illustrator is a development of an in-house tool originally used by Adobe to create Postscript fonts.

Unlike painting programs such as Macpaint, Adobe Illustrator is object orientated. When you use Macpaint to create an image, the image is specified as the dots or pixels that appear on the screen. But artwork created with Illustrator is automatically specified as a collection of lines and curves, each of which has its own mathematical definition. The definitions that make up a piece of Illustrator artwork comprise a Postscript program, which is executed every time you print the artwork. It is in this that makes it possible for Illustrator to create high-quality artwork.

You can use Illustrator to generate images or to alter existing images created with Macpaint, Macdraw or any other software that creates Macdraw Pict or Macpaint documents. You can also modify scanned images stored in Macpaint or Macdraw Pict format. They could be existing images like a photograph, map, cartoon or technical drawing, or a drawing you have done yourself on paper and scanned in.

Where you want to use an existing image as artwork, Illustrator imports it as a template and displays it on-screen as a bit map. What you see is a copy of the scanned image. You then trace around whatever area of the image you like to form a new Illustrator document. For example, you could scan in a photograph of a man beside a tree in a field and just trace around the silhouette of the tree. You could then outline the tree, fill it with a tint, add some text and use it as a company logo.

On-screen Illustrator initially appears like other Mac drawing packages. There is a window complete with a drawing area, scroll bars and a tool box down the left-hand side. Some of the 15 tools are familiar ones: an arrow is used to select objects, a hand tool moves objects, and a magnifying glass zooms in on objects.

But the spray can, paint pot, eraser and pencil icons found in Macpaint are missing from Illustrator. Instead there is a pen tool which you use to draw and trace around artwork, plus several others which allow you to add type, draw rectangles and squares, draw circles and ovals, split paths, transform objects by scaling, rotating, reflecting and shearing them, and finally subdivide the drawing area into pages for printing. These tools show where the strength of Illustrator lies: in manipulating images.

To trace round an object you select the pen tool and place it at the point where you want to start. You then negotiate your way round it by building up a series of lines or curves, as appropriate. You do not use a mouse to draw lines; instead you set up a sequence of curves and lines by specifying points which Illustrator then connects. It is rather like the drawings children construct by joining numbered dots. For the novice, the process of tracing is rather fiddly, but with practise you can build up a very precise copy of the object you are tracing.

To draw straight lines you click on the pen tool to bring a pointer up on the screen. You move the pointer to one end of the line and click again. A solid black square called an anchor point appears. You then move to the other end of the line and click again to draw the line and set another anchor point, from which you can carry on to draw another line. Squares, rectangles, circles or ellipses can be drawn from scratch by selecting the square and circle tools from the toolbox.

To trace a curved line round an object you first establish an anchor point as before. Using the mouse to drag the pointer causes the anchor point to become a small hollow square with two lines sprouting from it in opposite directions. As you drag, the lines change orientation to indicate what the tangent to the curve will be if you stop dragging and release the mouse button to establish the second anchor point.

With the second point fixed you can start dragging again. This time the directions of the pointer lines at the two fixed points change, while the curve adjusts itself to remain tangential to them. In this way you can make sure that any curved line will fit snugly to its template. The whole process is like using an infinitely variable French curve, and is correspondingly hard for the beginner to learn.

The difficulty of drawing curved lines is my main grouse against Illustrator. Nifty (continued on next page)
fingerwork is also required to use the Shift, Option and Command keys and the space bar in combination with the various drawing tools to vary their effect. This gives you a lot of options, but the assignments are hard to remember. Somehow Illustrator does not have the intuitive feel that makes many other Mac packages so pleasant to use.

Once you have traced round or drawn an object you can zoom in on it to make any fine adjustments, or add type to it. You can also transform objects by rescaling, rotating, duplicating, reflecting or shearing. You can also paint objects with tints, and apply continuous or dashed outlines of varying weights. If you are running Illustrator on a Mac II you can allot colour as well.

To look at what you have created you select Preview from the View menu. You can preview what you are doing as you go along by dividing your screen into two windows, and set one aside as a Preview window and one as an Artwork and Template window. This is still not entirely satisfactory, as you lose half your drawing area. You can, of course, print out as you go along to an Imagewriter to get an idea of what your finished artwork will look like.

You can save Illustrator documents in three formats: Postscript Only, Encapsulated Postscript (Macintosh) or Encapsulated Postscript (IBM PC). While the code of a Postscript Only document is accessible to the user and can be edited, this cannot be done with the others. They are designed to be used with page-composition systems that support the Aldus/Altsy/Adobe Encapsulated Postscript file format for IBM and Mac products. Systems that support this format display the previewed image on-screen for positioning, scaling and cropping, and send the transformed Postscript to the printer. A PC version of Illustrator is expected next year.

Illustrator’s documentation includes a video tape in addition to the conventional manual. The tape takes the form of a tutorial led by the president of Adobe Systems, Charles Geschke. It is rather like a sales demonstration, in that it fills the viewer with enthusiasm about the capabilities of the package. Alas, as in a demonstration, users are left to find out that using Illustrator is not as easy as it looks. But the video does serve the purpose of giving you a comprehensive grounding in what the package can do and how to use it.

The manual tries very hard to explain how to use what is a fiddly package, and comes complete with copious diagrams. I found I had to reread passages over and over again before I understood them. But this is probably an inevitable result of the complexity of the package.

CONCLUSIONS

Adobe Illustrator will be useful to graphic artists who routinely tinker with existing images.

The facility for tracing over artwork will endanger it to those who are less artistic.

Illustrator is fiddly to use. It is not something for the casual user; even tracing over existing artwork is not easy.

You will need to contemplate heavy use of the package to justify the cost of such a specialised graphics tool — and the time and effort to become adept at using it.
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The new Qume LaserTEN Plus arrives with all you need for instant action
Now with 512k memory as standard and simple plug-in emulation the new configuration Qume LaserTEN Plus printer gives you flexibility with simplicity

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Leader pedigree

Leading the second generation of laser printers in clarity of type, the LaserTEN range is now successfully into its second year of service in many of Britain's most selective companies.

So if you want the quiet, ten-page-a-minute performance of a laser and the simplicity and type quality of the world's leading daisy-wheel supplier, there's only one printer with the real pedigree. The LaserTEN Plus from Qume. At your nearest authorised dealer.

Qume

QUME Quality. Simplicity is just part of it.

Postscript** compatibility now available on the new SCRIPTEN

* Hewlett Packard is the registered trade mark of the Hewlett Packard corporation.
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A dozen steps to the right decision.

When you've seen one printer you really haven't seen them all. That's why, when you're trying to choose your first or your next, you really need all the help you can get. Here are a few steps to get you started.

1 Compatibility. You needn't worry about matching any of our printers with your present system. A simple slot-in interface means that any Star printer can be used with virtually any terminal or PC set up. And, equally important, the software command sets are switchable.

2 Value. Getting more doesn't mean you have to pay more. All our printers are proof of that. Whatever your budget, the Star 9-Pin printers start well below £300 while prices for the Letter Quality Star 24-Pin printers begin at less than £600.

3 Simplicity. The Front Control Panel on all Star business printers gives you total control at the touch of a button. Selecting a typestyle, draft or one of the Letter Quality options, print pitch, margins and paper control are sheer simplicity. No mess, no fuss and no more fiddly DIP switches for all your usual daily needs. All our machines have semi-automatic single sheet feeding too. Simply drop your page into the top, press a lever, and the printer advances it to the correct position ready for printing.

4 Choice. The Star range features models with both 9-pin and 24-pin print heads. (The more pins you have, the better the print quality.) So if you need a printer for simple statements and invoices and don't need the ultimate in Letter Quality printing, you can save money by opting for any of the high speed draft machines in the 9-pin range. For more important documents, where Letter Quality print is essential, any of the three 24-pin printers offer the ultimate in razor sharp Letter Quality print.

5 Print Quality. The Near Letter Quality of the NL-10 through to the NR-15 is extremely crisp and perfect for everyday office use. The NB24-10, NB24-15 and the NB-15—all 24-pin printers—produce the ultimate in Letter Quality print that's ideal for the discerning professional who has previously been limited to a daisywheel printer.
Paper Width. The suffix 10 or 15 in each printer’s name indicates its carriage size. So the NL-10 and the NB24-10 can accept paper widths of up to 10 inches wide (80 col), while the ND-15 and NB-15 for example can accept paper up to 15 inches wide (136 col).

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Optional Upgrades. Each Star printer has a host of facilities to widen its use. The machines have a selection of plug-in interfaces for compatibility, plug-in font cartridges (on our 24-Pin models) and expandable buffer memories.

Paper Handling. A built-in push feed tractor unit gives the paper saving advantage of short form tear off. Paper feeding can either be continuous or single sheets and all our printers have the option of a low cost, totally automatic sheet feeder—just clip it on and it’s ready to work without any additional hardware or software selection.

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Support. When you buy a Star printer you buy superb back-up too. We’ve a national three-level support system which operates through all our Star dealers backed by the finest distributors in the country.

The Star printers for business

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THE TRUTH ABOUT
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YOU’D GET
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And clarity (remarkable clarity: its 24-wire printhead produces diamond-sharp printouts).

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It also comes with a smooth and effortless paper handling system (featuring a built-in rear-feed tractor unit), instant hardware compatibility with just about any name brand computer on the market, heart-warming reliability, and a shocking price.

Shocking?

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Japan's No. 1 computer maker

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☐ DL2600 (24-wire dot matrix)  Title: 
☐ DL2600 Color (24-wire dot matrix)  Company: 
☐ DL2400 (24-wire dot matrix)  Address: 
☐ DL2400 Color (24-wire dot matrix)  City:  Country: 
☐ DX2200 (9-wire dot matrix)  Phone:  Fax: 
☐ DX2100 (9-wire dot matrix)

Send to: Fujitsu Europe Ltd. 2 Longwalk Road, Stockley Park, Uxbridge, Middleses, UB11 1AB, England. Phone: 01-573 4444

- circle 102 on enquiry card -
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Now available T1000 & T1200 at special low prices.

T3100/20MB available now

The portable that thinks it's a desktop PC!

T1100 PLUS specification.

- MS-DOS 3.2
- 8088 running at 7.16 MHz or 4.77 MHz
- 640K
- Two 3.5" 720KB offering 1.4MB total storage
- Supertwist technology
- 80 characters x 25 lines
- 9.1 x 4.7 inches
- 640 x 200 pixels
- Position adjustable a full 90°
- 81 keys, full size
- RGB colour monitor
- Monochrome composite monitor
- IBM compatible parallel printer
- 5.25 disk drive
- RS-232C serial communications
- I/O bus for Expansion Box

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<tr>
<th>Feature</th>
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<tbody>
<tr>
<td>Dimensions</td>
<td>12.1&quot; wide, 2.6&quot; high, 12&quot; deep</td>
</tr>
<tr>
<td>Weight</td>
<td>Less than 10lbs</td>
</tr>
<tr>
<td>Power</td>
<td>Built-in rechargeable NiCad batteries</td>
</tr>
<tr>
<td>Included accessories</td>
<td>240VAC adapter for recharging and mains power operation</td>
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<td></td>
<td>Owner's manual</td>
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<tr>
<td></td>
<td>Carrycase with grip handle and shoulder strap</td>
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<tr>
<td>Options</td>
<td>Internal V21, V22, V23 Hayes compatible modems (BABT approved)</td>
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<td></td>
<td>External 5.25&quot; floppy disk drive</td>
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<tr>
<td></td>
<td>Universal Floppy Link to desktop PC disk drive</td>
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<td></td>
<td>Car cigarette lighter power adaptor/charger</td>
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<td></td>
<td>Expansion Box with five IBM compatible slots</td>
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<td></td>
<td>Bi-Synchronous Communications Adapter</td>
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Features

- Enormous processing power – this is the main feature of the T3100.
- The basic version of the T3100 comes with 640 KB of main memory which can be expanded to 2.6 MB.
- The T3100 also has a built-in 3½" drive with 720 KB storage capacity for exchanging data and programs with other computers.
- The hard disk – a standard feature of the T3100 – provides even greater storage capacity than the diskettes.
- The enormous storage capacity, the hard disk offers two other important advantages: considerably faster access to stored data, which means much faster response time for the computer, and greater data security.

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Communications Software for IBM PCs and compatibles

Prestel and Telecom Gold
You will have heard of Contact and will know that it gives simple and trouble free access to the world of information and data communication. Contact allows access to Prestel, Telecom Gold, and many other electronic mail systems, as well as providing a micro to mainframe link. However, you may not be aware of just how powerful and easy to use it is. So here are a few of its features in more detail:

Automatic Sequences
With Contact we provide powerful Automatic Sequences to enable your computer to automatically login to Telecom Gold (or One to One, Link7500 etc.) collect your mail and logoff. It can then print the mail out, properly paginated, at any time of the day or night you choose. Of course you can easily write your own sequences too.

VT100 and Viewdata
Contact offers both a high quality VT100 emulation and a full screen Viewdata display. For those with Amstrad PC1512s or IBM PCs with an EGA card the display is in full colour. The VT100 emulation is extensive. With VT100 you can move away from scrolling screens - giving much faster screen update. Files can be captured to disk with all the escape sequences removed so you get a text file that really can be edited by your word processor or fed into your database.

Programmable Function Keys
The menus can be pulled down with a mouse or by pressing function keys. In addition you can program each of the 10 function keys with a sequence of commands. For example you could set F5 to contain "Mail Scan Unread" or, for Prestel, F5 could contain *72195# to take you straight into "Datasearch". Not only can each function key contain up to 80 characters but all 10 can be automatically set up for each of the unlimited number of different services you may want to contact.

And the price?
£79.95
Contact costs £79.95 and is available in two versions: one for the IBM PC and compatibles and the other for the Amstrad PC1512. To place your order or request more information please complete the coupon below and return it to:

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Pract. 3
The forbidding facade that MS-DOS presents to the world discourages most users from using many of its functions. These programs set out to make them more accessible.

The DOS operating system does not provide the easiest of interfaces, particularly for first-time users. With this in mind, a number of software houses have started producing DOS helpers — programs which set out to help you use MS-DOS and PC-DOS. They adopt a variety of approaches. Some simply provide a disc-based tutorial, while others augment the standard operating system to make it easier or quicker to use.

A program called Using the IBM Personal Computer Disk System is in the first category. It comes from Science Research Associates (SRA), the educational subsidiary of IBM, which has a long history of publishing educational materials. This pedigree shows in the product, which is both useful and easy to use.

The package is made up of two 5.25in. discs, one 3.5in. disc and a leaflet telling you how to insert the discs and what kit you need to run the program. It is no more than a gesture towards documentation, but you do not need any more than this because the program is designed to be completely self-documenting.

To run the SRA program you switch on or reboot the machine with the disc in place. From then on you simply read the text which it displays and answer the multiple-choice questions that it poses at appropriate points. I found simplicity itself to use, and comprehensive paper documentation would have been superfluous.

The program covers the most basic concepts of computing, from what hardware and software is, to what an operating system is and what different DOS commands do. It also covers topics like what a virtual disc does and why you might want to use it. Beginners will find it extremely helpful as an introduction to DOS.

Experienced users may well benefit from it too as it allows you to learn about the operating system's many powerful commands in an interesting and structured way. For many people, their introduction to DOS comes from reading the manual, which can be boring and time consuming. There must be plenty who have given up not much after Dir in the alphabetical command list.

The Q-DOS directory map.

The main menu of the Q-DOS.

Others just learn how to cope with DOS as they go along.

Anyone who has never sat down and learned how to use DOS in a systematic way is likely to remain unaware of handy commands like TREE /F which lists the directory paths of all the directories on the current drive, together with the names of the files they contain. Obviously the program does not totally replace a DOS manual, but it is certainly a valuable supplement to it.

The program is divided into chapters, each of which covers a distinct area. The treatment of separate topics within each area concludes with a set of exercises. For example, the section explaining PC hardware is followed by an interactive question and answer session in which you are told whether your answers are right or wrong. I found completing the exercises helped me remember what different commands did and what syntax to use. It is more effective then just reading about them in a manual.

The sessions are never dull, since the form they take varies. Sometimes they are multiple-choice exercises in which you fill in the right word in a sentence, for example. In others your answers are used to build up a comparison between two items: the session on the advantages and disadvantages of hard and floppy discs is one example. At the end of each exercise you are given a tally of how many questions you have answered successfully, with or without help.

The screen is divided into three areas. The chapter and exercise number are flagged at the top while text and diagrams appear in the middle, which is also where you put your answers. The area at the bottom is used to display help information and the response to your answers. If you get an answer wrong you are told why it is wrong and the program makes suggestions to put you on the right track. You use the function keys to get help, display the solution, skip a question, re-display a question, return to the index, end a session or access a glossary of terms.

The only serious problem with the program is that it is copy protected, so you (continued on next page)
SOFTWARE REVIEW

(continued from previous page)

cannot make backups or install it on the hard disc of more than one machine. It is also not cheap, and some people may be unwilling to pay £80 for a glorified manual-tutorial, however useful it may be.

The Q-DOS program, also known as Quick DOS, is a file manager for DOS users. It aims to help novices by enabling them to understand disc organisation, and experienced users by performing DOS functions more quickly than can be done by addressing DOS directly. It does this by cutting down on the typing you need to carry out different functions, and presenting a less inscrutable face to the world than does DOS itself.

Q-DOS comes on a single unprotected floppy disc with an installation program that copies all the relevant files to a separate directory on your hard disc. You then run the program in the conventional way. You can also run Q-DOS direct from the floppy drive, but if you want access to its help information you have to keep the Q-DOS disc present in the drive.

Q-DOS

VERDICT

Performance
Ease of use
Documentation
Value for money

[ ] Poor [ ] Average [ ] Good [ ] Excellent

[ ] Will help veterans and novices to use DOS wisely. Its directory map is a boon.

Operations are carried out from Q-DOS main menu. Listed at the top are the main commands: Directory, Tag, View, Copy, Move, Find, Erase, Rename, Space, Attribute and Execute. Commands can be selected by pressing the first letter of the command or by highlighting it with the command cursor — which you move by using the left and right arrow keys — and pressing Return. Beneath the command list lies the path name from the root directory. Many of the commands perform functions broadly similar to their like-sounding DOS equivalents.

The body of the main menu screen lists files and directories vertically, giving filename and file size, plus the date and time it was created. To copy, erase, rename or move a file you have to tag it first. This is done by selecting a file, using the cursor keys, and then pressing the space bar. If you tag more than one file the operation can be performed on the whole group.

To the left of the screen are five boxes which show the number of files in the directory, the total size of those files, the number of sub-directories, the number of tagged files in the directory and the total size of the tagged files in the directory and the total size of the tagged files. Function keys and their assignments are shown below the boxes. If you run a program which takes over the function keys for some other purpose you should still be able to execute the Q-DOS functions by holding down the Alt, Shift or Ctrl key and pressing the desired function key.

The on-screen help that forms part of the program is a useful addition that will be helpful to DOS novices. Having the commands listed on-screen also means there is less to remember in the way of what commands there are and what syntax to use, so you do not have to type so much.

Q-DOS's Directory command is particularly useful. When you select Directory the program asks you to specify a drive. Pressing Return then displays a directory map of the disc in the specified drive. This consists of directories sorted alphabetically and connected by lines showing their hierarchical relationship, and immediately makes clear the tree-like structure of DOS. You can move around the directory map using the cursor keys. This feature will help novices understand the concept of a hierarchical file structure, and perhaps encourage experienced users to organise their files more efficiently than they otherwise might.

You can also perform various functions on the directory map. For example, using the Make command you can make a new directory just by highlighting the directory you have chosen as its parent and keying in an input box appears, you enter a DOS filename, press Return and Q-DOS will update and display the directory map. You can also copy files to other directories, copy directories to other drives, and move files around

Above: I-DIR shows how much memory is available.

Below: Window DOS shows path name of directory viewed.
from one directory to another on the same disc with the help of the directory map. It does not take long to get familiar with Q-DOS and the documentation is helpful in explaining how the program is used. Its descriptions are clear for beginners, while explaining how the program is used. It has a screen saver facility which sets the disc with the help of the directory map.

For example, with 1-Dir you have a choice of modes: Basic and Expert. If you choose Basic mode the program asks you to verify any command you enter before it executes it, which is handy for new users to the program and for DOS novices generally. It also has a screen saver facility which sets the length of time the screen is displayed after your last keystroke. You can even use it to reprogram existing menus or create new ones to meet your requirements.

Features like the menu builder reveal the true colours of this program: it is not really intended for novice users. The real targets for 1-Dir are confident users who would like to customise DOS to suit their special needs, and at the same time maybe make it easier and quicker to use.

The price you pay for the wealth of features provided by 1-Dir is that it is not particularly easy to get used to. It comes with an extensive A5 manual, and there are a large number of key combinations that you need to remember to use it effectively. If you want to add hub caps and go-faster wheels to your operating system, 1-Dir will probably repay the effort you have to expend to get to know it. The danger with any program of this type is that you could end up replacing one difficult environment with another that is equally complex. I did not find Window DOS 2.0 quite as easy to use as Q-DOS, and it has a profusion of key combinations that you have to know before you can make use of its functions. It has a number of endearing features, particularly its screen-saver facility, password protection and Tree window. Its documentation is brief and comes complete with diagrams.

The Tree window is like Q-DOS's directory map, though not quite as graphic or as versatile. It lists the sub-directories of a drive, with the root first at the left edge of the window and each following letter of subordination indented two spaces to the right. When the cursor is over a sub-directory the number of files and bytes of storage space occupied by the files in that sub-directory are displayed on the second line of the Tree window.

CONCLUSIONS

- As an aid to getting to know how to use DOS, for the beginner, or as a refresher in how to use DOS more efficiently, SRA's Using the IBM Personal Computer Disk Operating System is certainly worth a look. I wish I had seen it long ago. Shame about the copy protection.
- Q-DOS is easy to use, making DOS more approachable for the novice and helping veterans use DOS more quickly and wisely. Its directory map is a particularly helpful feature.
- For more experienced users who want to customise DOS, 1-Dir could be a real asset. Less confident users may find getting to grips with all its features as much of a burden as acquiring a thorough knowledge of DOS itself.
- Window DOS does not have the plethora of sophisticated features provided by 1-Dir, nor is it as easy to use as Q-DOS, but may provide the right mix for some users.

How you make your micro easier to use is a very personal matter, analogous to deciding what maps, diary or paraphernalia to put in your Filofax. It is worth looking around at DOS helpers before you buy one: different levels of expertise and requirements will influence your choice substantially.
ALVEY’S ACHIEVEMENTS

With the Alvey programme due to come to an end next year, the direction of IT research in Britain is once again coming under scrutiny.

Mary Fagan looks at what has been accomplished by the existing programme, and what is likely to replace it.

Since it began in 1984, the Alvey programme has been at the centre of Britain’s research effort in information technology (IT). Collaboration between industry and academic workers has been one of the key features of the programme. Joint project teams are drawn from industry and from academic institutions.

The academics receive full government funding, while industry pays for half its involvement. The programme has cost £350 million, £200 million of which has come from various government departments. The remaining £150 million has been provided by the IT industry. Most of the money has been allocated to some 200 collaborative projects.

The idea was that all the projects should be based on pre-competitive research. The difficulties of getting companies to cooperate with each other and with academics were considered too great for more market-oriented projects to be considered. In spite of this, many of the individual companies involved have already exploited work carried out under the Alvey scheme as marketable products and service.

The programme has been divided into several smaller units, each dealing with a different kind of enabling technology. The aim is that work from one project should be able to feed into others. The individual areas include very large-scale integrated circuits (VLSI), software engineering, intelligent knowledge-based systems (IKBS), architectures and the so-called man-machine interface (MMI). To focus the work and integrate the results, a series of large-scale demonstrator projects has been set up to bring together research from all the areas.

One of the most important demonstrator projects is an effort led by ICL to develop a decision-support system for the Department of Health and Social Security (DHSS). The task of encapsulating in software the legislation, case histories and procedures that rule how the DHSS works is immense. The aim is to help decision making by DHSS staff, freeing them for more direct contact with clients.

An equally important goal is a very easy-to-use computer to help clients fill in the department’s daunting claim forms. It is hoped that clients will eventually be able to use a machine rather like an arcade game to find out what their entitlements are. The first version, called the Forms Helper, has already been demonstrated. A more advanced product will guide people through an electronic form on the screen. Trials will begin next year to see how DHSS clients react to using a machine instead of wrestling with paper.

Further up the ladder, systems are being developed to provide clerks with a database of the legislation and case histories they need. For policy makers, the aim is to help them to keep abreast of the continually shifting legal framework, identify problems with existing rules, and evaluate hypothetical alternatives.

All these schemes will need to draw on the IKBS and software-engineering research going on in individual Alvey projects. But even more important will be the MMI issues.

A sophisticated support system will be useless unless the decision makers take it on board.

Equally ambitious, and infinitely more glamorous, are the efforts at Edinburgh University to build a speech-driven word processor. It has as its objective the development of a word processor that recognises connected speech in real time, and with a reasonable error rate. Imperial College and the Husat centre at Loughborough University are also involved in the work but the original industrial partner, Plessey, has dropped out.

The first prototype was built last year. It consisted of a series of software modules running on Masscomp and Xerox computers. Phoneme recognition rates reached 92 percent on a limited test set, and rose from 46 percent to 76 percent on a larger set. A 46 percent recognition on phonemes corresponds to only 10 percent on words, but the team’s goal is to understand 20,000 words of continuous speech. The system should also be speaker adaptive so that it can be used by more than one person.

The eventual aim is to get things right first time 50 percent of the time, and a further 30 to 35 percent right after some interaction with the user. Unrestricted automatic speech recognition would mean that the machine would have to understand rather than just recognise the speech. This is out of reach for the moment so something has to

The VLSI project has brought feature sizes below one micron, as in this mask.
go. It is full automation that has been sacrificed, but with an interactive system it is possible to get away with less than perfect performance.

The project on mobile information systems demonstrates how work begun under Alvey can be converted into something of practical use. The overall objective is to bring the benefits of IT to the mobile user. In practice this means the development of a cellular phone that can go anywhere in Europe to transmit and receive both speech and data.

Chips for the high frequencies used by cellular phones are being made by Ferranti. They are the result of the one micron CDI process which Ferranti developed as part of a separate Alvey project. Other sub-projects feeding into the mobile-systems work include a traffic-information collator, a fault diagnosis IKBS and a secure electronic mail network for mobile phones, known as Locator.

At present it is easy for anyone to listen in to cellular radio, and the problem will be exacerbated when data is added to voice transmissions. The Locator represents an attempt to devise the architecture and encryption techniques for secure X-400 electronic mail. Racal's partners in the project are Hewlett-Packard, Ferranti, Cambridge and Sussex Universities, and Thames Polytechnic. In a parallel project, Husat in Loughborough is trying to assess the needs of users of this type of system.

The demonstrators also include a hybrid, called Ansa, which in some ways could be the most far-reaching of all; the name stands for advanced network systems architecture. Ansa is unusual in two respects: it has a large foreign input and, instead of being spread around, all the work takes place in Cambridge, at a single site. Ansa's project manager, Andrew Herbert, believes it is the first attempt to develop a generic standard for open distributed processing (ODP) in which applications can talk to each other without intervention from the user.

The distributed system can be different computers in different locations, different chips in a single box, or different functions on a single chip, all working towards completing a common job. The Ansa project takes a global approach, and is even being taken as the basis of a working group on ODP systems within the International Standards Organisation (ISO). Herbert is confident that Ansa will become the basis of an ISO standard.

The final Alvey demonstrator applies artificial-intelligence techniques to designing, manufacturing and selling products. The project, called Design to Product, addresses an entire product life-cycle from design through process control to after-sales service. It will assess how design changes can affect manufacturing, assembly or sales, for example. The project will culminate in a computer-integrated manufacturing (CIM) demonstration at a factory owned by Lucas that makes parts for diesel fuel pumps. But it should be possible to exploit the results in any short-run manufacturing that relies for its success on a fast response to changing customer needs.

The large demonstrators give a global view of the aims of the Alvey project, but there have also been many smaller successes along the way. Much work has been done to develop whole processes for manufacturing VLSI components with sub-micron feature sizes. STC is producing very high-speed random-access memories with 1.25 micron geometries, the result of a process developed with British Aerospace. Racal and the University of Leuven in Belgium. Ferranti is well advanced with work on one-micron reticles for producing very fast gate arrays, and Plessey is in pilot production with a 1.5 micron CMOS line at its new Roborough plant.

One major success story is Ella, a computer-aided hardware-design language which originated at the Royal Signals Research Establishment. A firm called Praxis took up the development and is now taking it to European and American markets. Less well known are products such as the generic associative memory (GAM) chip for know-ledge processing, developed at Strathclyde. The chip is now to be commercialised by Deductive Systems, a small Glasgow firm. A common thread running through the schemes is the application of expert systems. One of the great achievements of Alvey is that it has increased the pool of skills in artificial intelligence (AI) in the UK and has done a lot to bring AI out of the academic world and into industry and commerce. According to Brian Oakley, who heads the Alvey Directorate, "The academic teams have been overwhelmed by demand from industry, and it is most encouraging to see that this co-operation has led to the widespread establishment of teams in the major firms."

Mary Fagan is Technology News Editor on New Scientist.
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The Cray 2 has become a byword for computing power. Carol Hammond reports on her tour of inspection of the machine.

To look at the Cray 2 is like being beamed up to the bridge of the Starship Enterprise. The horseshoe-shaped main unit stands nearly four feet high and is more than four feet in diameter. At its outer edge can be seen row upon row of silver- and gold-coloured circuit boards stacked several layers high. Viewed from its inner edge it appears to be crammed full of blue and white wiring. Closer inspection reveals that the whole unit is full of a gently bubbling clear liquid, giving the impression of a high-tech cauldron.

The Cray 2 is a product of Cray Research Inc. The company was founded in 1972 by Seymour Cray, and by 1986 it had gained a 64 percent share of the supercomputer market. Over 10 percent of all Cray machines are installed in the UK — nearly twice as many as in any other country apart from the US.

The machine we saw was installed in March of this year at the Harwell Laboratory of the UK Atomic Energy Authority. It is valued at £13 million. Crays are not new to Harwell. It bought a Cray 1 in 1981, and upgraded it to a Cray 1S in 1982. This was followed by a Cray X-MP in 1986 and finally the Cray 2 in 1987.

The Cray 2’s main unit is accompanied by two free-standing support cabinets for the power-supply control unit and a cooling unit, along with a number of Perspex standpipe towers down which liquid coolant cascades. The towers of the Harwell machine are bathed in blue light, further enhancing the futuristic look.

If you want to run a Cray 2 you do not simply plug it into the mains. The machine consumes several hundred kilowatts of electrical power, and motor generators are needed to provide it with the 400Hz supply that it requires. Apparently the higher frequency is necessary to give sufficiently smooth d.c. supply.

The Cray 2 at Harwell has 12 DD-49 disc drives. Each one provides 1,200Mbyte of storage, giving a total of 14.4Gbyte. It is possible to have up to 36 disc drives on a Cray 2 though as yet no one does — even Nasa restricts itself to 34. The drives run at a sustained rate of 9.6Mbyte per second. A modified AT&T PC serves as an elaborate on/off switch, acting as a system-control console to stop and start the main machine.

The main unit of the Cray 2 is built up from 14 columns like slices of a pie. The upper part of each column contains a stack of circuit-board modules, while the lower part contains power supplies for each column. Up to 320 circuit-board modules can be accommodated. Each one contains about 750 integrated circuits to give the Cray 2 a total of around 240,000 components, of which 75,000 are memory chips. Each module is made up of eight circuit boards. The chips on the modules we saw were Japanese, but Cray Research now has its own chip-making facility at Chippewa Falls, Wisconsin, where all the hardware is assembled.

Circuit interconnections are made in all three dimensions within the module. In a supercomputer, component packing is important because one of the main constraints on speed is the time required for signals to pass from point to point within the machine. It takes about a nanosecond for electrical pulses to travel 10cm. through ordinary wiring. The distance that electrical signals have to travel along the data path is therefore crucial to the performance of the machine. The longest wire in a Cray 2 is 25in., with 10in. being the average length. About 36,000 pairs of wires are hand wired into the machine.

The problem with such a compact design is that the power consumption of the machine is huge in relation to its size. The Cray 2 is rated at 195kW, which is of the order of 1,000 times the power consumption of a PC. Nearly all of this energy ends up as heat, which is carried away by the 200 gallons of coolant that bathes the machine’s components.

The coolant used is a colourless, non-toxic, non-flammable fluorocarbon liquid called Fluorinert, made by 3M. It is a good electrical insulator, has high thermal stability and good heat-transfer properties. It circulates up one column of the main unit and then down the next in direct contact with the integrated-circuit boards and power-supply components.

Placing the coolant in direct contact with the components to be cooled helps to stabilise the operating temperature, and improves the reliability of the system by preventing chips getting hot. The liquid enters the main unit at a temperature of around 70°F and leaves at about 80°F.

If a module fails, diagnostic software isolates the problem to the failing module or, in the worst case, to two or three modules. Indicator panels on the top of the machine display information about the status of key components. Before defective modules are removed the coolant must be pumped up into the standpipe towers, and then pumped back into the machine after a replacement module has been fitted. Cray claims that the operation only takes a few minutes.

Faulty modules are diagnosed and repaired by on-site maintenance staff. Where a fault can be pinned down to a particular chip it is removed from the board, repaired or replaced and then soldered back on. In its preventive-maintenance scheme Cray Research stresses the machine outside its normal operating limits to expose any incipient faults.
Above: The Cray 2's main unit, with the standpipes for the coolant visible in the background. Below: Each module contains eight circuit boards and around 750 ICs.

To achieve its high processing rates the Cray 2 uses scalar and vector processing and a large common memory in a multi-processing environment. The scalar processing used by conventional computers handles information sequentially. Supercomputers attain their increased speeds by handling data which has been assembled in vectors or arrays. Vectors are expressed in a computer as a string of 64-bit numbers that can be processed in parallel as a single entity. A special set of instructions is used to process vectors, and only one instruction need be issued to carry out the processing of the entire vector.

Each Cray 2 has four identical CPUs which run at 1,700 million floating-point operations (1.7Gflops) per second. The common memory holds 256 million 64-bit words and there is an integral I/O controller and a maintenance control console. Each of the four CPUs contains registers and functional units to perform vector and scalar operations. The I/O controller controls I/O devices like disc drives and the front-end interfaces. The large size of the common memory allows users to run programs that would be too large to run on other systems, and it allows several jobs to reside concurrently in memory.

The Cray 2 comes with an operating system called Unicos, based on AT&T Unix System V. Fortran is the main language used, though Cray also offers an automatic vectorising Fortran compiler and a C compiler. A large number of applications packages are available from third-party suppliers.

The Cray 2 at Harwell is connected to IBM and DEC machines as well as various work stations, including Sun and Apollo units. The IBM's are linked via a front-end interface which acts as a channel-to-channel connector and sorts out the differences between Cray and IBM channels. The Vaxes are linked via a Network Systems Corporation Hyperchannel, which also links to one of the work stations and an IBM. The work stations also use one of the Vaxes as an Ethernet gateway.

The high cost and small market for supercomputers has meant they have hitherto been the domain of government, research and military establishments. But their number-crunching prowess and real-time computing ability has taken them into other fields. Harwell's Cray 2 is used for applications in aerospace, computational physics and structural analysis.

Harwell hires out time on the Cray 2 at around £1,000 per hour. If this seems expensive it is worth bearing in mind that a problem which could be solved in an hour on the Cray 2 would take something like a month on a DEC Vax 11/780. Put another way, 10 days' worth of calculation on an IBM PC would be completed in just one minute on the Cray.
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DEFECTIVE SOFTWARE

It seems likely that anyone sold defective software will now have a stronger case for claiming damages, but it still all depends on whether software is properly classified as goods or services. Anne Staines explains how the law relating to this area is still in a muddle.

CONFUSED?
YOU WILL BE

Somewhere in the gathering dusk, a voice is heard to whimper: "Well how should I know why all the missiles suddenly launched like that? There must be a fault in the system." This is hardly an original scenario; in fact it is one so hackneyed it could even lie at the root of an act of Parliament, as indeed it does. It is an extreme but feasible example of the risks inherent in modern technological production.

The EEC Council addressed its directive on product liability in 1985 to these risks. The directive ordered all EEC member states to implement national laws giving effect to the principle that, irrespective of fault, producers shall be liable for damage caused by a defect in their products. The deadline for such laws to come into effect was July 1988.

In the UK, the directive was implemented on 15 May 1987 by means of the Consumer Protection Act 1987, which turns the former product liability law on its head. Before, a person claiming damages in respect of injuries caused by a defective product had to prove that it was more likely than not that the defect resulted from negligent manufacture. The deadline for such laws to come into effect was July 1988.

The opening words make it clear that Part I is intended to comply with the EEC product liability directive. The directive, referring specifically to the problem of increasing technicality in industrial production, clearly covers computer software, either as a product itself or as a component part. Whether or not the UK law does is less clear.

The problem lies in the definition of

(continued on next page)
the word "product". According to the directive, product means all moveables, including electricity but excluding primary agricultural products and game. Moveable property is anything other than land. The Consumer Protection Act, on the other hand, defines a product as being any goods or electricity.

For several years lawyers have debated whether or not computer software can be said to be goods. Interest in this question has so far centred on the applicability or otherwise of various statutory warranties. If software is goods, it must comply with the requirements of fitness for purpose and merchantable quality laid down in the Sale of Goods Act.

There is a widely held view, however, that the supplier of software is providing services not goods, since it is the information contained in the program that the user wants rather than the medium on which it is fixed. Information, it is argued, cannot be classified as goods, and sufficient legal precedents can be called in support of this argument to make it very persuasive. It may be that some programs are easier to define as goods than others, the most obvious distinction lying between off-the-peg packages and specially commissioned, bespoke software.

But arguments of this kind only serve to confuse the already complex area of liability for defective software, which this legislation was supposed to clarify. There is really no excuse for the government's failure in this

DETECTIVE SOFTWARE

For the most part, it is safe to assume that software falls within the ambit of the Consumer Protection Act. Predictably, consumers will be the main beneficiaries.

act to grasp the nettle and finally declare on which side of the fence computer software falls.

Despite the strength of argument that software is services, it is likely that it would be defined as goods within the meaning of the Consumer Protection Act, should the point arise in a UK court. The New York Bar Association recently deliberated on the matter, and in the resulting report concluded that software should be deemed goods. The legal arguments in favour of its conclusions are not wholly convincing; at times they are contradictory and confused.

But what swayed the writers of the report and may be expected to sway its readers were policy considerations. Both producers and users, the report concluded, have an interest in uniformity and certainty of legal treatment. In an area of the law where everything is often uncertain, that is a hard argument to refute.

For the most part, it should be safe to assume that software falls within the ambit of the Consumer Protection Act, although there will be some exceptions. Software supplied as part of a telecommunications or cable program service is undoubtedly part of a service. In addition, there will be some contracts in which the emphasis on continuing support, revisions and updating make the agreement more clearly one for the supply of services than goods.

As might be predicted from its title, the main beneficiaries of the act will be consumers — that is, private as opposed to business users of defective products. Where a business causes damage to a consumer as a result of using defective software in its manufacturing process, both the business and the software supplier will be liable as producers. Of course, the consumer will invariably sue the manufacturer, who must then seek a contribution from the software producer. It is advisable for all manufacturers in this position to ensure that their contracts with software suppliers contain a provision indemnifying them against loss or damage in the event of a defect in the software.

The act does not improve the lot of businesses that suffer loss themselves as a result of using defective software. Producers are not liable under the act for loss of or damage to the product itself, or for loss of or damage to property that is neither of a type ordinarily intended for private use, nor intended by the injured party mainly for private use. Injured businesses must continue to prove negligent manufacture.

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Once upon a time, when the computer revolution was still young and people were uncorrupted by practical experience of its impact, some bright spark came up with the phrase "the paperless office". It seemed obvious: as computer technology moved out of the air-conditioned rooms where it was tended by dedicated DP professionals, and into the office, so the medium of information transmission would pass from paper to electricity.

As we now know, it did not quite work out that way. To be sure, the migration of technology from DP department to desk top proceeded even more rapidly than the most sanguine of predictions. But in the process, the amount of paper generated has increased enormously. The micro has become a tool for doing what was done before, only more so; and that includes aiding and abetting global deforestation.

A paperless office may be utopia — at least until a paper-like and paper-thin display is devised — but the truly electronic office remains an achievable goal. Recent developments suggest that it is at least getting nearer. Perhaps the most crucial progress in the enabling technology has been the continuing increase in processor power. With 80386-based machines available for under £2,000, almost any office worker can have what is to all intents and purposes a minicomputer on their desk. Given that the pattern of working with the personal computer remains essentially single-user, this leaves a grossly underutilised computational capacity. That capacity might easily and usefully find itself channelled into handling other office equipment in an integrated environment.

To use that surplus power, networking will need to be routine. The full benefit of an integrated office — where all the functions can work together in a very natural way — will only occur if there is ready communication between the component parts. Networking of micros is still in its infancy, though there are some signs that IBM's Token Ring system is on the way to turning into another de facto standard. The sooner that becomes so — and the teething troubles of what are complex and fiddly systems are sorted out — the sooner progress can be made in wiring up the office.
Allied to straight computer networking, the ordinary telephone network will play a key role in any future office environment. Again, changes which have occurred over the last few years make the necessary convergence of technologies look much more likely. This is partly a reflection of the modernisation of exchanges, which itself is a harbinger of the switch to a fully digital telephone network. Although digital networks can be set up locally within a company to integrate computers and communications, the full benefits only come once that network can be extended through to the outside world. In particular, the adoption of the Integrated Services Digital Network (ISDN) standard will accelerate changes in this area enormously. As the discussion on page 92 shows, progress is already being made, with the UK apparently well ahead.

The convergence of micros and telephones is likely to lead to a new breed of integrated work stations, of which ICL's One Per Desk and BT's Qwertyphone were less than successful early implementations. Indeed, the coming together of the various component parts of the fully electronic office will only succeed if this kind of synthesis takes place. After all, even a micro takes up a substantial area of valuable desk space.

As Ian Stobie reports in the article opposite, there is already some movement towards combining some of the key elements in one box. Putting together a fax machine with a scanner is an obvious step. Incorporating an intelligent optical character recognition device would be another. And given the fact that a laser printer and a photocopier are very similar in mechanical design, it surely cannot be long before there are combined photocopiers and printers, which then add intelligence to become scanners and fax boxes too. Add a telephone handset and a screen and you have the beginnings of the ultimate office work station.

The earlier vision of the new office founndered on the failure to cope with raw data. The integrated work station solves the problems of communication, but leaves that of storage untouched. But once again, recent developments, this time in the field of optical discs, may come to the rescue.

The write once read many times (Worm) technology has come a long way in recent years. The fact that IBM is now offering its own variant can be seen as the final seal of approval on the whole approach. Potentially it could allow rows of filing cabinets not only to be replaced but, more importantly, to be integrated fully into the office environment. The data stored in them would become live rather than dead reference material. The technology for doing this is discussed in greater detail by Carol Hammond on page 94.

Clearly much new technology is around which could help turn the dream of the integrated office into a reality. But perhaps even more important, there is a world of difference in office workers' attitudes to that new technology. The paperless office pipe dream of a couple of decades back was conceived as some grand scheme which would be imposed on workers with little reference to them or their readiness for it. Today's moves towards an integrated office environment are taking place against a background of increasing acceptance of micros, advanced PABXs, fax and networks as a matter of course.

As a result of the accumulated experience of the last decade, manufacturers too are far better prepared; in particular, they have a clearer idea of what will work in practical everyday situations. Ultimately it is this spirit of realism on both sides, rather than any fancy new technology, which will determine whether we will move closer to the truly integrated office with or without paper.
WHEN TECHNOLOGIES CONVERGE

LINKING PCs TOGETHER AND TO OTHER ELECTRONIC DEVICES GIVES YOU SOMETHING THAT IS QUITE DISTINCT FROM THE OLD BIG-COMPUTING DP, AS IAN STOBIE EXPLAINS.

spreadsheet, are still implemented on an individually orientated basis. There is also still a wide range of human tasks that the computer cannot help with.

While personal computing was about enhancing the productivity of an individual, the integrated office is about enhancing the productivity of the group. But supporting a group is different to supporting an individual. The two approaches are not in competition — the integrated office is an extension of the philosophy of the PC. Both are interactive forms of computing, unlike traditional data processing, and both should fit into an existing division of labour without disrupting it too much.

People are still feeling their way into this particular future. Part of the excitement of the integrated office is that it is not yet clear precisely which technologies and functions will end up working together in a sensible way. But already many of the possibilities are clear: networks, mail, communications, document production and possibly expert systems will all be involved.

One virtue of the integrated office concept is that it forces you to lift your eyes from the technology and concentrate instead what it is all for in terms of goals at the organisational level. A key idea is that it functions with a work group by helping the group members interact with each other more productively. This makes network mail a central feature of the integrated office.

Network mail complements the ordinary voice telephone, as you can use mail when people are not sitting by their phone. Other advantages are that it gives you a permanent record if you wish; it is quicker than ordinary paper mail; and you can be more confident that your message gets through. Reading network mail is also generally quicker than getting the same message by phone as you can scan through it and pick out topics and headlines.

A typical modern integrated mail system is the one provided with the Torus Tapestry networking software for IBM local area networks. It provides a similar interface for all your text-editing jobs, including routine word processing, creating network mail, or sending telexes to the outside world. For detailed editing you can use a normal word-processing package such as WordStar. Once you have sent a message across the Tapestry network you can check if it has been read. You can also copy mail to other network members very easily.

With Tapestry and other network mail systems such as Top Mail on the Macintosh you can attach any kind of file — a spreadsheet, a chart or even a program — to your mail message. This is already a very powerful feature, but in future facilities of this kind are likely to go much further. For example, you could add comments inside an attached file. You could flag proposed changes in a document or spreadsheet in some way, and send them to your colleagues for comment. Perhaps you could superimpose pop-up notes on it, in a kind of network version of Note-It. Or, as on the Discus

TELEX — STILL GOING STRONG

TELEX has a long history. The first telex machine was installed in 1933, and the system was already established in pretty much its present form by the start of the Second World War. Telex now has about two million users worldwide in over 200 countries. Because of its relative antiquity as a business communications medium, telex has several limitations. It is fairly slow, with messages transmitting at 50 baud. This translates into a top speed of about 60 words a minute. Telexes use the old five-bit Baudot encoding scheme rather than ASCII, so you can only send messages consisting of upper-case letters and numbers. Graphic images, programs or bulk data are out of the question.

On the plus side, telex lines are separated from the normal voice telephone system, which gives you some protection against casual hacking. But the main reason for using telex is that it is the most established real-time business hard-copy medium. True, it is something of lowest common denominator, but there is no problem finding people with compatible kit to talk to.

(continued on page 90)
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system described on page 94, you could attach voice notes which are played back to your recipients when they open the document.

Ideally you would be able to also do this noting and commenting in real time. This means that once your recipient has read your message and its attached documents you could open up a simultaneous channel for a chat, perhaps in the form of a pop-up text window. The technology also exists to allow you to point with your mouse at documents displayed on the other system’s screen, or to open up a simultaneous voice channel.

This gives you a powerful kind of electronic conferencing, with the relevant documents readily to hand. And there is no reason why such conferencing has to be restricted to two participants. The number is limited only by the resources of the system and the space available on your screen for windows for all the participants.

Powerful as these mail and conferencing systems are, they still only mark the beginning of what linked computers could achieve in assisting routine office transactions. One problem when dealing with someone outside your immediate work group is that you do not know what they require. Systems based on simple applications of artificial intelligence, should hold out great advantages in such circumstances.

FAX — THE UPSTART

FAX is growing much faster than telex. At the moment there are about the same number of fax and telex machines installed in the U.K. — around 100,000 each, according to market research company International Resource Development — but fax sales are outstripping telex by a factor of at least 10 to one.

Fax a visual medium. A document is transmitted line by line, as an image rather than as a series of characters. This means it can handle handwriting, graphic images and the character set of any nation, all with equal facility. On the other hand it cannot transmit programs or bulk data, they require a completely error-free transmission method such as X.25. Fax is fax compared to telex: an A4 page typically takes under a minute to send.

In the past fax has suffered from compatibility problems, and this has led some people to think of it as a workable medium only within an organisation, where purchasing policy can be standarised. According to this view telex still reigns supreme for general business use, despite its technical inferiority. But things are changing fast, as new fax machines upgrade the quality of the installed base. All modern group 3 machines can talk to each other, and also to most of the earlier group 2 machines. A dedicated stand-alone fax machine consists basically of a scanner, modem and printer mounted in the same box. Current fax machines typically work at a resolution of 200 by 200 or 200 by 100 dots to the inch. This is rather lower than the 300 dots per inch achieved by PC laser printers and the image scanners used in desk-top publishing.

Group 4 fax machines will have higher resolution. This standard is still emerging, but as well as offering compatibility with earlier group 2 and 3 machines it is likely to use a resolution-independent coding scheme, so manufacturers can go to 300 and 400 dots to the inch as soon as it becomes economic to do so.

The earliest facsimile machine was rather surprisingly developed back in the 1840s, by a Scotsman called Alexander Bain. This makes it almost as old as the penny black stamp and the Royal Mail. The current fax boom started in 1980, when group 3 fax came in. What is really pushing fax forward is its runaway success in Japan. There, because of the complex nature of the Kanji written character set, instant hard-copy business comms has had to wait for the arrival of fax. The release of this massive pent-up demand has driven the cost of fax down fast, and is incidentally fuelling the development of related scanner technology.

Unlike telex, fax machines use the ordinary voice telephone line. Sending short messages can be very cheap, especially at night-time rates. This is one way a PC-based fax system scores over the dimmer dedicated machines, as it can store non-urgent fax messages on disc and transmit them at cheap times.

In fact you do not even need to go this far: At its simplest level, each network user could simply establish a help file which says things like when they can be contacted, on what issues and in what sort of way. It would be available to anyone interested through a network help function.

Many people have core functions which involve some formalised procedure, and in many organisations dealing with them involves using approved memos and forms. This again is very amenable to some sort of computerised help function. A simple system could be built up from a personalised series of help screens which tell you what to say in the memo, or which forms to use.

The obvious next step is to have the mail user fill the memo or form on-screen, there and then. An interactive form-filling system could give help simply by checking on the arithmetic and fetching values from a reference database. But logically it should go further, and provide the sort of help the originator of the form or procedure would be able to provide if they were actually present at the form filler’s side.

This is where expert systems come in as they are ideal for giving help, especially when the problem is governed by well-known rules or procedures. The logic involved is well within the capacity of present-day expert-system shells. You could ask things like, ‘Should I claim now under section 6B, or would I do better under 7D, and am I eligible?’

The advantage of an expert system over more traditional help screens is not just in the complexity of the problems that can be tackled. Its real asset is that the system itself can ask the questions: it can scan the form-filler’s input and start asking for clarification if it spots a problem. Otherwise it can keep out of the way. Ideally expert-system shells will become sufficiently easy to use to be programmed in a personalised way by the responsible individual, rather than at a departmental level. This will make the computer-assisted form much more human than its paper equivalent.

THE OUTSIDE WORLD

Most organisations have facsimile (fax) machines and telex, but the procedures involved in using them are often so cumbersome that they are used far less than they should be. Because the fax machine resides in another room or on another floor people do not bother to use it; instead they end up making unnecessary journeys across town. Similarly, people waste time making fruitless phone calls to people who always seem to be out, whereas a short telex would probably get through.

Once you have a network of PCs set up the cost of adding telex and fax is very small — a matter two or three thousand pounds at the most to provide a facility that can be used by everyone on the network. Obviously running costs have to be controlled, but they are easily monitored on a computerised system and are often exaggerated anyway. The cost of not using fax or telex when it is appropriate is often far higher.

The point is that in the integrated office, telex and fax become far more convenient to use. People can do it for themselves, without involving secretaries or telex operators who have to type everything out laboriously a second time. Ideally you should be able to use your existing word processor to prepare the message. Then you just tell the system that you want it sent as telex or fax, giving the recipient’s fax or telex number — or perhaps just their name if it has been previously entered in the system’s directory.
To operate a telex system of your own you need to rent a telex line from British Telecom, which costs about £90 a quarter. A PC telex card incorporating the necessary telex modem can be obtained for under £1,000, with multi-user versions costing a little more. You then pay British Telecom charges based onuse, but they are comparable with other forms of electronic mail.

The cheapest way of getting computerised telex is to use the services of a bureau. You can do this through an electronic-mail system such as Telecom Gold. But if the volume of your telex business is likely to go beyond a dozen telexes per week it is probably worth investigating leasing your own telex line and getting an add-on telex board for your PC. As well as reduced costs you get other advantages: you will know instantly when your telex has been received, something that a bureau takes time to tell; and you will have your own unique telex number for incoming messages, which you will receive with no delay.

As with telex, the initial crop of computerised fax products was really aimed at large existing users who wanted extra features. A computerised fax lets you do things like store messages and send them at cheap times of the day. It also makes it easy to send out batches of personalised messages — junk fax, in other words. British Telecom's Merlinfax PC-100 at nearly £7,000 is an example of such a system.

However, the same technology makes fax very attractive to PC users. The cost is much lower, as they already have the PC and a suitable printer. Both Comwave and Communicate do single-user fax boards with built-in high-speed modems for under £1,000. For just under £2,000 Communicate will sell you a multi-user fax board capable of supporting eight users. To this you need to add the cost of a scanner if you wish to fax existing paper documents. All scanners aimed at the computer market are very high quality by fax standards so a £1,000 machine would easily do the job.

Even if you do not have a scanner you can still send off messages from a computer-based fax unit. You can convert both text and graphics files into fax format without having to print them out first. Your fax board will come with software to handle the conversion, which does using a bit-mapped character set. This produces a much higher-quality fax compared to a conventional fax machine as there are no scan errors. The main point of sending an ordinary text file by fax is that, like telex, it is near instant. Not only do you get the fax but you will have your own unique telex number for incoming messages, which you will receive with no delay.

Incoming faxes can be stored on disc, then printed out. If you wish, it is possible to go a stage further, using optical character recognition (OCR) software to convert the incoming message to ASCII. In the truly integrated office this step would be very desirable, allowing you to make use of the message immediately with word processing or other standard software. Communicate saysthat it intends to offer OCR as an option with its fax system.

But there is a problem. At the moment most conventional fax machines scan at rather too low a resolution. The OCR software needs as much information as possible to work on. It is also likely to be thrown by any transmission errors. A few blobs or lost scan lines do not make much difference if you are reading a printed fax image by eye, but they make OCR very difficult. This means that OCR is unlikely to be used much in conjunction with fax until group 4 takes over, though the technology does work if you use good-quality fax equipment and transmit at 300 by 300 resolution. It is already a viable option for communications within an organisation, where you can make sure all the kit is up to the job. Despite its advantages in other respects, fax is not the ideal medium for text messages that are destined for further processing within your computer system: an ordinary electronic mail service like Telecom Gold, the X-25 data network and even telex are all much more suitable.

Another obvious application for high-grade, high-resolution fax is in desk-top publishing. Artwork or complete made-up pages can be sent far more quickly than by post or courier. Again, at least 300 by 300 resolution is required, along with a low error rate, so good-quality kit is essential.

Sometime towards the end of this year or the beginning of 1988 Sharp will introduce the MZ-IV01. This device joins together the functions of a fax machine, an A4 image scanner, a thermal printer and a photocopier, it will probably cost around £2,000. The scanner and facsimile transmission can both operate at 300 dots per inch, and though the printer works at lower resolution, images can be transferred to disc and printed out on a laser printer if desired.

This sort of technological convergence is likely to be very important to the future of the integrated office. Facsimile requires both an image scanner and a reasonable quality printer; the same elements are also required in photocopiers and for many desk-top publishing tasks. An image scanner simply converts a document into a bit pattern. In a fax machine the pattern is transmitted down a phone line and printed out at the other end. A digital photocopier holds the image in memory, cleans it up a little with its built-in software, and prints it out on the spot. A scanner in desk-top publishing use transfers the image across to a PC, where it may end up incorporated into a document as an illustration. As the Sharp machine quite clearly shows, one machine could do all these jobs.
he integration of computers and communications is already commonplace at one level. Electronic mail is growing fast, and more and more people are sending data down their phones. But at the moment the transmission process is slow and clumsy. At one end the digital data is converted to audio signals which can be transmitted over ordinary twisted-pair cabling, through the telephone network, and on to the other end, where it is laboriously converted back into digital form. In an ideal world you would be able to plug your micro straight into the telephone network and send digital data directly.

The Integrated Services Digital Network (ISDN) allows you to do just that. Moreover, it permits far higher data-transmission speeds than at present. Once a standard digital pathway has been defined over the telephone network — which itself must be upgraded to handle the digital data — it is not just micros which will plug in. The quality of voice transmission will be improved, fax will be faster and slow-scan CCTV will become increasingly common. And once intelligence is married to the digital standard, a whole new world of facilities becomes available — see box below.

**FUTURE PHONES**

The introduction of the ISDN standard will not only allow computers and communications to work together more closely, it will also transform the humble telephone. With the network fully digital, a wide range of new services and facilities will be available.

Some of the most advanced research in this area is being carried out at Bellcore, an independent consortium funded by the seven regional telephone companies which were split off from AT&T. The advanced telephone services which they are developing are not dependent on ISDN, and would work with any digital environment. However, ISDN does provide a very natural setting for them, and their development is likely to go hand in hand with its progress.

The system being developed at Bellcore is the Modular Integrated Communications Environment (MICE). It exists in a prototype form in the laboratories at Morristown, New Jersey. One of the features offered by such intelligent networks is voice dialling. You can either speak the number you wish dialled, or alternatively give a command such as "ring John"; the system will recognise the name John, and retrieve the previously stored number. Voice recognition can also be used for security purposes to ensure that only authorised personnel use certain phones.

Advanced message handling is also a feature. The network will respond intelligently to callers, and allow you to pre-program its behaviour. For example, you can specify that certain numbers — say your boss and your spouse — get put through straight away, while others are diverted to a secretary or dumped to an answering machine. Message retrieval will allow you to listen to messages left in voice banks, and it will be possible to retrieve text messages too, using a voice synthesis program.

One important feature of these intelligent telephones is that the number will be line independent. You will be able to pick up a call from any telephone, or arrange for calls to be routed through to any handset. In the future, the number will refer to the user, not to the piece of equipment and the line to which it is attached.

And of course such telephones will routinely send data as well as voice. For the full benefits of this capability a screen will become a normal part of the telephone. It might be used in addition to set up call forwarding in a graphical way, drawing lines between incoming calls and their eventual destinations. A screen would also allow on-line databases, telecommuting and teleshopping to grow substantially.

It also opens up the possibility of videophones once the rate of transmission down the line increases sufficiently to cope with the enormous data throughput required — something like 150Mbit/s. That in turn will probably require a second-generation refurbishment of the telephone system, including the use of fibre optics at all stages. The combination of later developments of ISDN with the kind of data capacity such a network would provide opens up the possibility for unimaginable changes in the office environment, not to mention the office telephone itself.

**ISDN**

AS THE CURRENT ANALOGUE PHONE NETWORK IS REPLACED BY A FULLY DIGITAL SYSTEM A VAST NEW RANGE OF COMMUNICATIONS OPTIONS IS OPENING UP.

GLYN MOODY LOOKS AT THEIR IMPLICATIONS FOR INTEGRATED OFFICE SYSTEMS.

The ISDN standard has been defined by the international CCITT body as the X-21 protocol. In its basic form, it specifies that the user transmits data in a digital format at 144Kbit/s. — way above the 300bit/s. or 1,200bit/s. currently offered by standard modems. But even more important than the gain in speed is the structure embedded in the system.

There are in fact three channels: two of 64Kbit/s. and one of 16Kbit/s. The latter is used purely for signalling information, and is invisible to the user. The other two can be used for either voice or data transmission; since both channels operate simultaneously, this opens up possibilities for sending data between computers and offering a voice commentary at the same time. This twin data plus signalling arrangement is known as 2B + D.

There is also a higher level of access, known as primary access — as against the basic access just described — which provides for a 30B + 2D arrangement.

Clearly there are enormous potential benefits for the computer user, and for the concept of the integrated office. Under the ISDN approach, ordinary voice communications become just another data signal, and computers are seamlessly linked in with the external telephone network. As well as having access to the ordinary public switched telephone network, ISDN links up with Kilostream and the Packet Switched Stream (PSS) service.

Unfortunately, between this dream and reality there stands a great deal of work to be done. At the user's end this involves replacing the office PABX with a digital version which can cope with ISDN and provide the full range of facilities under that system. An even bigger task is the worldwide replacement of old analogue telephone exchanges by digital systems.

As the table opposite shows, work is already under way in many nations, at least at the pilot stage. The UK is currently well advanced along this road, and offers ISDN as a commercial service while most other countries are still conducting non-commercial trials.

There is a price to pay for being ahead of the field. When BT started up its digital service there were no agreed international standards, and it was necessary for one to be devised. Instead of the standard 2B + D, BT opted for a single 64Kbit/s. voice or data channel. This service was introduced in June 1985 as the Integrated Digital Access (IDA). As far as the user is concerned there is little practical difference from the full ISDN standard. In addition to this basic access to IDA there is also a version called Multi-line IDA, which allows 30 simultaneous 64Kbit/s. voice or data channels, plus two for signalling. Now that the CCITT has defined a standard, BT has said that it plans to offer the full 2B + D service from next year, while maintaining the older system for current users.

There are at present about 50 business centres based in the major cities which offer IDA, and a total of 1,000 lines using IDA. The present total of 500 local digital
Complex interfacing (above) needed to connect
digital devices the analogue network. With ISDN
(below) things are simpler.

Computing centre

Modem

Modem

Staff

Secretary

Executive

Key controller

Modems

Line status monitor

Network

exchanges will go up to about 750 next year, of which
around 200 will offer IDA. By the end of 1990 it is
expected that half the lines in use will be digital, with
IDA available on a high proportion of them.

BT makes two types of charge for the service. There is
an initial payment of £500 for pure data use, or £560 for
mixed data and voice, plus an annual rental of £516 for
data and £526 for mixed data and voice. The usage
charge is unchanged.

A number of other countries are involved with trials,
though they are not as far advanced as the BT pilot. The
channel opposite shows the state of play for the European
PTTs. In the US, after some initial reluctance to follow
what was perceived as a purely European standard,
ISDN received a big boost when the 20 Bell operating
companies, which run the local telephone networks,
decided to back the system. Nearly all of them have or
are planning trials of ISDN.

Much work has gone into experimenting with ISDN
at Bellcore, the central research facility of the Bell
companies. Areas studied go well beyond simple
implementation of ISDN, and touch on all aspects of
the telephone in the future, particularly with regard to
its integration with the micro and the use of computer
intelligence within a telephone network.

Inevitably, Japan too has advanced pilot projects. For
some time Nippon Telegraph & Telephone (NTT) has
been working on its Information Network System
(INS). It started back in 1982, well before the ISDN
standard was established, and hence used its own partic-
ular variety, which was similar to the British IDA. Since
then it has affirmed its support for the international
standard. ISDN is now available in four cities, including
Tokyo and Osaka, and will be available across the whole
of Japan in the next 10 years.

Pilots are all very well, but until they are turned into
full-scale commercial versions, users are likely to remain
critical and aloof. The market research company IDC
has done some work in this area as far as Europe is con-
cerned, and it predicts that full services will appear in
Britain and France in 1991-92, in Switzerland and Italy
a year later, followed by West Germany in 1993.

As an international standard ISDN must be almost
unique in that it appears to have gained worldwide
acceptance with little opposition. This is partly a reflec-
tion on the strategic importance of the whole concept.
Communications and computer equipment manu-
facturers both recognise that this
is an area where
agreement is vital. The fact that there is this unanimity
suggests that manufacturers at least believe in ISDN as
the glue which will bind together tomorrow’s integrated
office. Now that the first services are beginning to come
through, it remains to be seen whether the users will
share that vision and commitment.

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NOTE: The UK service is offered on a commercial basis; the others are non-commercial. SOURCE: International Data Corporation

(continued on next page)
**WORM JUKEBOX**

Optical discs can be linked together within an optical library or jukebox-like player to provide even greater mass storage than is available from a single drive. The Kodak 6800 optical-disc library is a WORM system which can store over a terabyte — that is, 1,024 Gbyte — of information. By way of illustrating what this means in practice, Kodak claims that a terabyte is sufficient to store over 12 years’ worth of x-rays, CAT scans and ultrasound examinations for a 250-bed hospital.

The Kodak system is made up of a drive, controller and interface housed in a single unit that can accommodate up to 150 14in. optical discs. Conventional double-sided 12in. Worm discs can hold 2Gbyte, but each Kodak disc provides 6.8Gbyte of randomly accessible on-line storage. The complete set of 150 of these discs adds up to a capacity of around a terabyte. The Kodak discs hold more information than conventional 12in. discs thanks mainly to the use of a variable speed recording technique which writes data at a constant density and so maximises the utilisation of disc space.

The Kodak 6800 is available in four configurations, allowing combinations of up to three optical-disc drives containing from 50 to 150 optical discs. The base unit comes with a caddy loader which accepts discs inserted from the outside and then loads them into the 50-disc library. A robotic elevator player to provide even greater mass storage than is available from a single drive.

The Kodak 6800 system links together a PC, a scanner, a laser printer, a CD-ROM player and a WORM optical drive. In addition it allows you to develop and use applications-in MS-DOS which take advantage of the large amount of data which can be stored on optical discs, free of the normal 32Mbyte restriction on disc volume size. You could use it to scan printed documents or drawings, store them on an optical disc and retrieve them under the control of a database.

The system that Video Media supplies is based round a PC adapt card and drive software that allow one or more micros to communicate with a number of peripherals. An image-compression/expansion card, also supplied by Video Media to
digitise images, compresses images at an average ratio of one to 30 to save disc space. The card complies with CCITT standards for fax groups 3 and 4, so it may eventually allow you to use your micro as a fax terminal. You can also buy a board plus software package which digitises telephone-quality voice signals and stores them in MS-DOS format.

At present the Discus 1000 requires the following hardware: an IBM PC/AT or compatible, a Dest or Canon scanner, an MDS Genius monitor, a Canon or Hewlett-Packard laser printer, an Optimem or Alcatel-Thompson 1Gbyte Worm drive, and a Philips CM-110 CD-ROM player or equivalent. You also need an MS-DOS database or indexing package such as dBase III Plus, Foxbase, Status or Clipper. Video Media will provide a tailor-made database or indexing software to suit individual applications.

Users who already own the appropriate kit can just buy the necessary cards and software. If you need to add to your existing setup you can either buy the necessary components from Video Media or go direct to the appropriate manufacturer. Video Media estimates that the complete setup will cost around £45,000, but one of the advantages of the system is that it may well be able to make use of equipment that you have already installed.

The Discus 1000 system can also be incorporated into an Ungermann-Bass token-ring network, allowing the Worm disc and CD-ROM to provide mass storage for several users in the network under the MS-Net network operating system. These optical-disc drives can also be linked together or configured within an optical library or jukebox to provide even greater mass storage. Data can be downloaded from a mainframe via a communication link to a PC that forms part of a Discus 1000 system, and then stored on a WORM disc. The system can also be configured with a nine-track, 0.5in. tape handler.

You can choose to have a number of different peripherals and applications in your setup, and to support them you create your own main menu to the system. A library of symbols is supplied by Video Media to represent functions or applications such as word search, word processing, database, print and others.

Once you have chosen the appropriate symbols you position them on a sheet of paper and use the image scanner to feed them into the Image Icon Designator program supplied as part of Discus 1000. From then on you can select programs or applications just by pointing to the appropriate symbol using a mouse.

A typical use for the Discus 1000 would be to scan in an image, display it on-screen and then manipulate it in some way — say by using a drawing package to edit it or magnify it. You could then compress and store it or print it out. With a voice digitiser you could record and store a voice message which could be linked to the scanned image under the control of a database. This opens up a multitude of new ways of working. For instance, you could alter a technical drawing and attach a voice message to explain why.

Discus 1000 also allows you to send two images to your laser printer at the same time and print them on a single sheet of paper. For example, you could scan in a business form and overlay it with information from your micro or mainframe database, then print the combined image. In this way it would be possible to dispense with pre-printed forms.
Any compressed image and its related data can be stored on a hard disc, 12in. Worm or CD-ROM. A single-sided 1Gbyte Worm disc can contain up to 50,000 A4 scanned images, 500,000 pages of text data, 72 hours of recorded speech or any combination of these. A 500Mbyte CD-ROM disc will store half the quantity.

Users with a Worm and CD-ROM connected to their PC via an SCSI interface simply treat the Worm as drives E and F and the CD-ROM as drive G. Normally MS-DOS has a disc-volume size limit of 32Mbyte but the manufacturer of Discus 100, Advanced Graphic Applications, has got round this by manipulating the sector sizes so that the disc volume size is increased to 500Mbyte.

Increasing the sector and disc-volume sizes usually brings in a time penalty, making access slower. This does not matter when you are trying to access graphics as the data itself is usually voluminous and thus takes a long time to transfer. With text files the difference may be noticeable since the files themselves are relatively small. A large number of text files can therefore be crammed into the same space, making the time overhead in the searching process more significant.

Video Media claims that by dividing up your optical media into more directories and sub-directories than is usual on a hard disc you can achieve acceptable access times. It quotes times of seven seconds to scan or print a
A typical setup for the Discus 1000 system.

Because Discus 1000 is run straight from MS-DOS you can use standard software to access data on CD-ROM. Video Media says it will have no difficulty incorporating OS/2 within Discus 1000 when it arrives because it complements the concept of a system which integrates data between different machines.

Advanced Graphics Associates have come to an agreement with the 3M Corporation to enable Discus 1000 users to use the Worm drive as a pre-mastering mechanism for CD-ROMs. This would allow Discus 1000 data to be prepared totally in-house and would give the user complete control over what goes on to a CD-ROM, saving time as well as money. The mastering cost of around £2,000 per disc would remain, but pre-mastering on Worm might prove particularly attractive to large corporations who need to distribute the same data to a limited number of key staff dispersed over several locations.

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Software required: MS-DOS 3.1 with micro or mainframe database/indexing package

Prices: driver card and software £4,345; image-compression and expansion card and software £7,425; voice card £1,485; voice software £660

Manufacturer: Advanced Graphic Applications of New York, NY

UK distributor: Video Media Operations Development, Kingsgate House, 115 High Holborn, London WC1V 6JU. Telephone: 01-405 3257

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The number of languages suitable for use with micros has grown considerably over the last few years. Paradoxically, this is making life increasingly difficult, both for existing users and for newcomers to computing.

Deciding which language to learn or which to use for specific applications is difficult without detailed knowledge of the strengths and weaknesses of each one. It is not even very helpful to talk to experts on particular languages since most people are, understandably enough, prone to consider their own favourite to be the best thing since the abacus.

All digital microprocessors are controlled by streams of instructions representing machine code stored in the machine’s memory. Higher-level languages differ only in the methods they adopt to generate this stream of numeric instructions. Each one represents a different strategy and enabling programmers to communicate their ideas and requirements most effectively to the hardware.

Above machine code, the lowest programming level uses assembly language which puts the programmer more or less in direct touch with the microprocessor chip. It does so using simple mnemonic commands to generate the stream of machine code that the hardware needs. The problem with assembler is that while the language is quite straightforward, program construction can be complex because of the need to maintain control of all the machine’s lower-level functions.

INTERMEDIATE PROGRAMS

Higher-level languages seek to make the construction of programs more easily understandable by human operators, and leave the generation of machine code to intermediate programs. This can be done by introducing a series of commands that approximate to normal language and then adding a number of rules on how they may be used. It is the intermediate programs that have the capacity to understand these new commands, and this is where the real power lies. Their effectiveness controls the presentation, accuracy, capacity and speed of the final program.

There are two main ways of implementing a higher-level language. In the first, you load into memory a list of all the available commands, together with code to check that the rules are observed. You then provide and maintain an area of memory for the commands to be entered into. You also need to make provision for saving and loading this list of program commands to and from disc. As commands are entered in this system they are stored in memory. Upon request from the operator, each command in turn is interpreted and executed.

This is called an interpretive system. Its big advantage is that it can be directly interactive during program development without needing special provision from the programmer. If the program contains an error, either in syntax or data, program execution will stop and the interpreter will indicate the type of error and where it occurred. The programmer can examine the program for the error condition and make whatever corrections may be necessary. It is even possible to display the values of program variables, since they still exist in memory at the time that execution ceased. Unfortunately, interpretation of commands on an individual basis takes up a lot of processor time so interpretive versions of languages are usually quite slow.

The second approach completes the translation from high-level commands to machine code by using a compiler. In this method, the high-level program is written using a word processor or text editor and is saved to disc. The compiler is then loaded into memory and instructed to process the text file. Compilation consists of reading the text file and writing a new file which contains the series of high-level commands translated into machine code. In practice, compilation may be a little more involved than this, but the principle remains the same.

Once compilation is complete, the new file can be loaded and executed to perform the functions specified in the original text file. An advantage of this method is that since each translation of a high-level command only occurs once, compiled programs tend to run much faster than interpreted ones.

Unfortunately there are also serious disadvantages to this method. For one thing, errors of command syntax in the original program will not be discovered until the compilation stage. Errors in data handling may not become apparent until the program is run, and even then may only appear under very special circumstances. Once errors are detected, program execution may cease, returning control to the operating system and thus losing the values of all the variables. In extreme cases processing will go into an infinite loop, making it necessary to reboot the machine.

Software manufacturers are aware of the advantages and disadvantages of each method and have recently tried to combine the best of both worlds by providing all that the programmer needs in one package. Some of the more popular languages now provide a text editor along with compiling, error-checking, debugging and linking facilities all in one program environment. It thus becomes possible to return immediately to the program text if errors are encountered, thereby simplifying program construction.

DECIDING FACTORS

Program-development time is a most important consideration, and can be a critical factor in deciding which language to use. The actual commands and structure are what give the high-level language its flavour; strengths and weaknesses are decided when a language is initially designed and developed. The command structures of languages vary enormously and are nearly always a compromise between program readability and the efficiency in the eventual code. Some languages are so well suited to their particular purpose that their popularity continues to grow; some remain alive simply through the inertia of having so many users; yet others emerge briefly and then fade away. If you are new to programming, the languages that you choose to learn can set your programming style for the rest of your days.

Good professional programmers will have knowledge of at least two or three high-level languages and an adequate grounding in assembly language. Knowledge of assembler can often be put to excellent use to improve or extend the existing capabilities of some high-level languages. In this way, knowledge of differing syntax, structure and capability can be acquired and applied to the evaluation of new languages as they arrive.
APL
APL has been around for a long time. It was created by Dr Kenneth Iverson in 1962 as a problem-solving language. The name simply stands for A Programming Language. It uses complex algorithms which may be expressed in a highly compacted and succinct form. As a result, APL tends to place emphasis on the shape and structure of data rather than the quantity. The notation and command syntax is extremely concise, which makes programs very difficult to read. It is a good example of a highly specialised language.

FOR: Excellent data type specification
AGAINST: Difficult to read. Does not handle high volumes of data very well.

BASIC
INITIALLY designed as a teaching language, Basic proved so successful that it is still number one in terms of the number of users. The name is said to be an acronym derived from Beginners' All-purpose Symbolic Instruction Code. Its initial advantages were English-like commands, a fairly relaxed command syntax and no structure to speak of. With Basic running in an interpretive environment it is easy to type in a quick program and run it to see what the effect is. It was much maligned at first because its lack of structure made it easy to write untidy programs. Recent versions like Borland's Turbo Basic and Microsoft's Quick Basic have provided lots of extra features, including the speed of a compiler and the ability to build structured programs.

FOR: Easy to learn and easy to read.
AGAINST: Can be slow in comparison to some other languages.
C

COBOL

Cobol is one of the old warhorses — a compiler-based language originally developed on mainframe machines by the US Department of Defense. The name is an acronym of Common Business Oriented Language. As language originally developed at Massachusetts Institute of Technology. It is available in interpretive and compiler versions and is structured in a similar way to Prolog, which it pre-dates by about 10 years. Lisp offers the ability to manipulate lists of symbolic alpha and numerical data recursively. Recursive processing is a relatively new idea in programming; it means that a routine can repeatedly call itself until particular conditions are satisfied. It is a powerful concept, but it can be a difficult one for new programmers to grasp. Lisp is excellent for artificial-intelligence (AI) applications and knowledge-based system.

FOR: Powerful symbolic processing capabilities. AGAINST: Mainly useful for AI applications.

FORTRAN

Another of the older languages, although it is still quite popular. The name is a contraction of Formula Translation. Fortran is a compiler-based language. It was developed by IBM in the 1950s and, as its name implies, it is extremely powerful at number handling. As with most of these older languages originally developed on mainframes, it requires large amounts of memory; full implementations have only recently become available on micros. Developing Fortran programs can be quite a long-winded process.

FOR: Powerful number handling. AGAINST: Difficult to read. Poor alpha string handling.

LISP

LISP is a list-processing language developed at the Massachusetts Institute of Technology. It is available in interpretive and compiler versions and is structured in a similar way to Prolog, which it pre-dates by about 10 years. Lisp offers the ability to manipulate lists of symbolic alpha and numerical data recursively. Recursive processing is a relatively new idea in programming; it means that a routine can repeatedly call itself until particular conditions are satisfied. It is a powerful concept, but it can be a difficult one for new programmers to grasp. Lisp is excellent for artificial-intelligence (AI) applications and knowledge-based system.

FOR: Good file- and number-handling features. AGAINST: Awkward to learn.

OCCAM

The most recent of the languages listed here, Occam is a highly specialised and well developed for the Inmos Transputer chip. It emphasises a parallel-processing capability that will be best realised in multiprocessing environments. This emphasis on concurrency of operation naturally makes Occam somewhat strange to learn, but it appears to be a language of the future; a working knowledge could repay handsome dividends as multiprocessing Transputers become more widespread in their applications.

FOR: Statement concurrency and multiprocessing. AGAINST: Limited to specific machines.

PASCAL

Pascal is a list-processing language developed at the Massachusetts Institute of Technology. It is available in interpretive and compiler versions and is structured in a similar way to Prolog, which it pre-dates by about 10 years. Lisp offers the ability to manipulate lists of symbolic alpha and numerical data recursively. Recursive processing is a relatively new idea in programming; it means that a routine can repeatedly call itself until particular conditions are satisfied. It is a powerful concept, but it can be a difficult one for new programmers to grasp. Lisp is excellent for artificial-intelligence (AI) applications and knowledge-based system.

FOR: Good file- and number-handling features. AGAINST: Awkward to learn.

PROLOG

Prolog — short for Programming in Logic — has been called the European version of Lisp, having been developed at the University of Marseilles. But this notion does not accurately service: although there are superficial similarities, Prolog has a power and style all of its own. Like Lisp, it is intended for use with artificial-intelligence applications and knowledge-based systems. It is usually a compiler-based language, and the programming methods can be difficult to grasp. This is because where most languages provide a sequence of operations to be performed on data, Prolog declares a number of rules, and data is checked against them to ascertain the truth or falsehood of program statements. To Borland, the recent implementation by Borland, has boosted the popularity of this language enormously.

FOR: Logical structure. Easy to read. Powerful knowledge-statement handling abilities. AGAINST: Awkward to learn. Poor number handling.

Smalltalk

This seminal language was developed by the Learning Research Group at the Xerox Palo Alto Research Center in California. It is unusual in that it consists of objects that interact by the sending and receiving of messages. The programmer implements a system by describing outgoing messages and the results of particular message reception. Smalltalk uses an object-oriented point of view for normal data but uses a standard data/procedure-oriented process — similar to Algol — for number handling. It is a structured language and uses a modular program-development approach.

FOR: Excellent graphics capabilities. Good data handling. AGAINST: Difficult to learn and read.
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**November 1987**

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**December 1987**

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Also; Top 10 printers — the pick of dot, laser, and the rest.
COMMUNICATIONS
DATA COMMUNICATIONS
FOR BUSINESS

By Bennet P Lientz and Kathryn P Rea
Published by Blackwell Scientific Publications, £24.50 ISBN 0 632 00274 4

THIS IS an American book, primarily intended for college undergraduates studying the business applications of technology. However, at no time is the tone condescending and Data Communications for Business succeeds in covering its subject matter thoroughly.

It is divided into two parts, complete with informative diagrams and photographs. Part 1 covers the technical aspects of communications technology, such as the different types of hardware and software available. Part 2 discusses how to go about putting them into use. Each part is divided into chapters which end with exercises and problems — the book’s one obvious display of its academic intention.

To finish, there is a useful glossary of terms and a list of abbreviations, acronyms and definitions; there is even an index of abbreviations, a glossary of terms and a reference section gives the names of minicomputer models.

unix
THE UNIX FOR BEGINNERS BOOK

By Bryan Strong and Jay Hosler
Published by John Wiley and Sons, £27.50 ISBN 0 471 80666 8

THERE IS something faintly paradoxical about a book called Unix for Beginners. It is a bit like Arc Welding Made Easy: somehow it seems unlikely. Yet this book is aimed not just at the Unix ignorant, but even at the non-computer-literate, and is designed to give a thorough grounding in the basic Unix system. Amazingly, it largely succeeds.

The background of the authors probably has something to do with this. Strong is a lecturer in psychology, while Hosler has the detailed computing experience. Between them, they have put together a book which is designed to be used very much as a hands-on guide. In addition there are chapter reviews in the form of self tests, and spaces for notes.

After a slightly superficial whiz through the history of computers, dragging in poor old Babbage again, there is a basic introduction to the procedure for starting up a Unix system. This is followed by sections on Vi, the text utility, as well as the mail and interactive-dialogue facilities. The book is rounded off with several parts on file structures and text formatting. Although inevitably designed for the user of the larger system, it has a useful appendix for PC-based Unix, followed by Unix command summaries, a good glossary and an index, and command reference cards. In addition to all this, the book is clearly written and unpatronising. Who could ask for more? It is enough to make you believe that Unix might almost be usable.

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* ISBN 3 909797 70 1 English/French

OTHER Western European computer markets are now just as active as Britain's. The products are still mainly American or Japanese, but the computing terms which also arrive suffer a variety of fates. Some are imported unchanged, but others are rejected in favour of a local term or are so radically altered as to become unrecognizable.

As computer terms are increasingly turning up in the course of ordinary business transactions there is clearly a need for a range of good bi-lingual dictionaries. The computer field moves too fast for ordinary dictionary publishers, so this is an ideal niche for the specialist publisher.

Schneillmann-Verlag of Switzerland produces a daunting range of such books. Its Computing and Data Processing series alone consists of around 100 separate books, each one a two-language combination of German, English, Italian, French, Spanish or Dutch.

We looked at two: the English/French and English/German volumes. Each book is about 120 pages long, in two sections so you can translate both ways with a page or two at the end of each section dealing with units. Production is pretty basic: the books appear to be computer printed rather than typeset, and are paperback. But this will not matter if the information they contain is the stuff you want.

For the needs of personal-computer users, the hit rate of appropriate terms seems low. There are no RAM or ROM, spreadsheets or floppy discs, but lots of things like card punches, Ø-rings and take-up reels. But even given the data-processing bias — which is acknowledged in the title — we still found plenty of relevant terms that you would be unlikely to guess.

Matrixdrucker might be fairly obvious as German for matrix printer but you would be unlikely to guess Zugriff, which means access, or Aufzeichnung, which means record, or even Formularvorschub, which means form feed.

But there was a worrying problem with the French volume: many of the terms given seem archaic or even incorrect. 'Computer', for instance is given as calculateur, whereas the usual term now is ordinateur. PC is OI in French, standing for ordinateur individuel. We checked with the French Technology Press Bureau who confirmed that calculateur is just not what the French would say.

The French take their language seriously, especially when it comes to the introduction of foreign terms. A special body, the Association Generale de Usages de la Langue Francaise (Agulf) regulates their use and oversees the coining of new French terms to take over the role of foreign imports. Some of them are especially apt: RAM in French is memoire vive, ROM memoire morte, which both seem rather better than the originals.

Agulf has the power to take people to court for the use of unpermited terms, and often does. The regulations apply to anything printed — invoices and headed paper as much as magazines or newspapers. This makes it especially important for any French technical dictionary to be up to date and accurate. Perhaps Schneillmann-Verlag falls down because it is Swiss; certainly the German volume is better.

To go with the computer boom there is flourishing European computer press. Some of the magazines are well worth reading,
The equivalent French magazine is probably L'Ordinateur Individual. This monthly gives the Macintosh more coverage than most British magazines, and has more general features and interviews than Practical Computing, but again coverage of the IBM world predominates.

OFFICE AUTOMATION

MANAGEMENT GUIDE TO OFFICE AUTOMATION

By Joseph St. John Bate • Published by Blackwell Scientific Publications, £7.95

ISBN 0 00 383353 4

THE cover of the Management Guide to Office Automation claims that it is a guide to planning and managing office automation. It also says that it is aimed at senior and middle management in commercial, administrative and financial organisations. Its audience certainly does determine the way the book is written, since it is as long-winded. It contains a lot of useful information, but it could be better organised. I also felt it could have explained the technology in a more comprehensive manner. But that said, it does at least approach one problem often forgotten about: the people who have to use the kit.

The book is very much concerned with evaluating what staff do, how they will fit into an automated office and how their jobs might change in the future. It even looks at how computerising an office will affect people's future career outlook. It really is what it says is it: a guide for managers who have to computerise an office. It looks at what types of application would be needed to replace the functions of different staff, with little emphasis on particular packages or how to choose them.

Worthy as the book is, I found it long-winded. It contains a lot of useful information, but it could be better organised. I also felt it could have explained the technology in a more comprehensive manner. But that said, it does at least approach one problem often forgotten about: the people who have to use the kit.

The writing is occasionally sloppy, but the author seems to be well informed; he worked for Unilever and Mars, and draws on these companies for examples.

Ideally, this book should come with a set of templates, presumably for Lotus 1-2-3; the price certainly seems to demand it. As it stands, it is hard to see how hard-pressed marketing managers tapping all this stuff in. This is a pity, since the aims of introducing some systematics into the subject and using the humble spreadsheet in an unusual area are good ones. A near miss.

Oasis Products

OASIS VIRTUAL INSTRUMENT SYSTEM

* The OASIS Virtual Instrument System (VIS) emulates conventional DVM, OSCILLOSCOPE, CHART RECORDER, X/Y PLOTTER and DATA LOGGER in one easy to use package and also provides sophisticated data analysis tools.

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HARDWARE

VIS is based on a precision computer controlled 16 channel A-D converter, with six programmable ranges and read rates of 50k samples per second at 8 bit resolution, 25k at 12bit. This simply installed unit has proven long term stability and reliability.

SOFTWARE

The menu-driven acquisition, analysis and display programs combine on screen set up of measurement parameters, SPREADSHEET data manipulation and a range of data display formats, including 8 trace CHART RECORDER and oscillogram.

Total data mobility from measured information to memory, disk, screen and HARD COPY output.

The OASIS VIS carries full documentation to allow the beginner or professional programmer to create new interface applications or personalised instrument emulations.

PRICE

At £399 (ex VAT), the price of the complete VIS system is less than any one of the instruments it replaces. Performance enhanced versions also available, e.g. higher acquisition speeds.
This month's program is a true pop-up resident utility which I have called Ppop. It intercepts the keyboard-handling routine, interrupts 9, to give you instant control of the printer from direct from the keyboard.

When the Alt and Caps Lock keys are pressed simultaneously, a pop-up box appears on the screen which offers options to send pre-arranged control characters direct to the printer. Provision is made to indicate if the printer is busy or off-line. Pressing the Esc key removes the box, restores the screen and returns you to your program at the point that you left it.

When pop-up programs first began to appear on the software market, I was fascinated to know where the contents of the screen behind the box were stored until required for restoration. I am still not sure, but for this program I have developed a simple swap routine that takes data from the buffer Box BUF and swaps it with the contents of the screen at the appropriate point. The screen is restored simply by calling the same routine and swapping the data back.

**BASIC LOADER**

I have had a lot of letters from people who use the Basic loader to get the utilities in this series on to their machines, so I have made some slight changes to the layout in this program to cut down the number of lines needed for the Basic loader. By placing the uninitialised buffer and data areas at the end of the program, these bytes do not need to be entered on the loader listing. The program will simply grab as much memory as it requires—around 15K—when it is installed, effectively protecting beyond the end of the existing data area. The eventual resident section of program code will take up more space than it strictly needs, but it is only an extra 500 bytes or so, and it saves Basic users an extra 51 lines of listing.

This month I have made more extensive use of equates than before, and I have used the assembler's ability to complete simple calculations. The first three equates are all attribute bytes which will produce certain colours and effects when placed in the correct locations of screen memory. These colour details are noted in the remarks.

LF, FF, CR and Esc refer simply to the numeric value of the individual characters. Box WID and Box LEN refer to the actual size, measured in characters, of the pop-up box that will appear on the screen. Box LIN and Box COL are only used in the calculation of Box POS and Box CUR; they indicate respectively the line and column where the top right-hand corner of the box will appear. Remember that MS-DOS for the IBM counts screen lines and columns from zero.

Box POS is the actual value used by the program to locate the box on the screen. Each character shown on the screen actually occupies two bytes in video memory, so one 80-column line on-screen occupies 160 bytes in memory. The position, in bytes, from the start of the screen can thus be calculated by multiplying the line number by 160 and adding the column number multiplied by 2.

The Box CUR value is used by interrupt 10hex to set the position of the cursor inside the box. This interrupt requires line and column positions to be placed in a register as a word in which the high byte contains the line number and the low byte the column number. Multiplying the line number by 256 to make it the high byte and adding the column number gives the position of the top right-hand corner of the box. An additional line and column figure is added to correct for the position of the cursor within the box itself.

The Msg LEN equate indicates the length of the 'Printer not ready' message, and the final two equates indicate the segment addresses of mono and colour RAM. Using equates in this way makes it easy to change both the size of the box and its position on the screen; you only need to alter the Wid, Len, Lin and Col equates.

The code section starts with the usual jump to the Install routine, which sets up the program and links it into the system by hooking the relevant interrupt. The Install routine first displays the Sign On message and then goes on to prepare the buffer area with the inter-leafed Scnbox message.

**MESSAGES**

It would be possible to write the message area with interleaved character and attribute bytes, but this makes the assembler code much more difficult to read. I therefore decided to leave the message area in plain text and add this little routine to interleave the appropriate attribute bytes into the Box BUF buffer area.

Normally the Box Buf buffer and all the data bytes and words would be located before the Install routine, and the Scnbox message would be lost along with the Install routine when the terminate and stay resident (TSR) protection was applied. However, in this instance there is a loop with the number of words to transfer in CX, SI pointing to the message area Scnbox, DI pointing to the beginning of Box Buf and the attribute in AH.

Taking a byte at a time from [SI] into AL, and then transferring AX to [DI], gives the correct character/attribute interleave. During this loop the source must be incremented by 1 — equivalent to one byte — while the destination is incremented by 2, equivalent to one word. Once this loop has completed, the current interrupt 9 address can be collected by using function 33hex of interrupt 21hex. Into this address is placed code at O ld Int 9 Off and Old Int 9 Seg for use by the new interrupt routine.

The address of the routine is now placed into the vector table using function 25hex of interrupt 21hex. The final step is to protect the code from subsequently being overwritten by DOS.

The Protector label in this instance is marked as $+(BOX WID*BOX LEN*2) This is actually way beyond the end of the code as generated by the assembler: the expression translates as the current memory location — shown by the $ sign — plus twice the number of characters required by the box. Thus Protector indicates a location which is 506 bytes beyond the end of the code. Since these bytes are initialised it does not matter what their value is when the program is loaded. It is these bytes which users of the Basic loader do not need to enter.

**KEY PRESS**

The program is now loaded and functioning. Each time a key is requested interrupt 9 is called and the routine is invoked from New Int 9. The first task is to ensure that other interrupts are enabled. The flag register must also be saved on to the stack to allow the original interrupt 9 to be called.

Like all interrupts, this routine will terminate with an Iret instruction, which takes the top two words off the stack to form the return address and also takes the next word into the flag register. By pushing the flags on to the stack (continued on page 107)
This program sets a resident printer controller routine into memory which can be called by pressing ALT CapsLock. Routine produces a Pop-up Menu with LF and FF options for printer. Other Options may be added as required.

NORMATT EQU 1FH
CMDATT EQU 1EH
PREDAT EQU 4FH

QUITSTEP:

BOX_CUR EQU

BOX_LEN EQU

BOX_WID EQU

EQU

NORMATT

printer.

NEW_INT9:

ADD

MOV

MOW

PUSH

PUSH

PUSH

PUSH

CALLDWORD

JMP

JNZ

DEC

MOV

MOV

POP

MOV

JNZ

MOV

JNZ

MOV

JNZ

MOV

JMP

QUIT

; Get for Attribute

; Check Selected and not Busy

; Printer OK so continue

; FLASHING RED Attribute

; Characters to display

; No - so message

; Position in BOX

; Set the Cursor

; Display CX characters

; Make those spaces

PROC

EQU

BOX_POS EQU

BOX_CUR EQU

BOX_LEN EQU

BOX_WID EQU

OFFSET BOX_CEL

OFFSET BOX_POS

OFFSET BOX_CUR

OFFSET BOX_LEN

OFFSET BOX_WID

EQU

MOV

INT

CMP

NL

MOV

IN

CMP

EQU

MOV

MOV

CLARK

; Ask for Character

; Escape

; by again

; Convert to Upper Case

; No - so continue

; Point to LF character

; Character count

; Go and LPRINT

; Is it 'L'?

; No - so continue

; Point to LF character

; Character count

; Go and LPRINT

; Is it 'P'?

; No - so continue

; Point to PICA sequence

; Character count

; Go and LPRINT

; Is it 'M'?

; No - so again

; Point to ELITE sequence

; Character count

CALL

LPRINT

JMP

GET_CMD:

; Get a Character from Keyboard

; Is it CR?

; No - quit

; Convert to Upper Case

; No - so quit

; Point to LF character

; Character count

; Go and LPRINT

; Is it 'P'?

; No - so continue

; Point to PICA sequence

; Character count

; Go and LPRINT

; Is it 'M'?

; No - so again

; Point to ELITE sequence

; Character count

GET_CMD:

; Prepare to restore screen

; Point Si to Buffer

; Save Di Screen Page

; Set line count

; Set column count

; Swap

; Restore screen position

; Bump by 1 line

; Save it

; Decrease line count

; Go again

EXIT:

; Clear stack

; Reset original cursor position

; Original cursor type

; Pop D1

; Restore registers

; Get Printer Status

; Set to standard

; Turn cursor off

; Return from INT & call

MAIN ENDP
The state of various keys.

and 18hex, the two bytes that store

checks the bytes at offsets 17hex

location 40:Ohex and the program

pointed to the data segment at

saved on the stack. ES can now be

been completed, BX and ES are

normal work of interrupt 9 having

flags back when it returns. The

an ordinary subroutine, and the

routine is active by looking at the

registers are restored, and an Iret is

the routine where the ES and BX

program can continue by saving all

the registers and ensuring that the

DS register points into the current
code segment. The program must
also be marked as active so that
future interrupts will bypass it.

The next task is to get a couple
of video addresses that will be
needed later. The first is the address
of the current video controller chip,
which is stored at offset 63hex into the
data segment; the second is the number
of the current display page, stored
at offset 62hex. Both these
addresses must be stored in the
program's own data area. Details of
the current cursor position and
type are collected by using func-
tion 3 of interrupt 10hex, and these
too are stored in the data area.

On the assumption that a colour
monitor is in use, the program
moves the address of colour

(continued from page 105)

the old interrupt 9 can be called as
an ordinary subroutine, and the
interrupt instruction will simply pop
the flags back when it returns. The
normal work of interrupt 9 having
been completed, BX and ES are
saved on the stack. ES can now be
pointed to the data segment at
location 40:hex and the program
checks the bytes at offsets 17:hex and
18:hex, the two bytes that store
the state of various keys.

If either the Alt or the Caps Lock
key is not pressed, the program
jumps via Quickest to the end of
the routine where the ES and BX
registers are restored, and an Iret is
executed to allow processing to
continue. If they are both pressed,
the program checks to see if the
routine is active by looking at the
contents of the Prog_Flag byte. If
it is 1 then the program is active
and it quits as before.

If Prog_Flag contains a zero the

program can continue by saving all

the registers and ensuring that the
DS register points into the current
code segment. The program must
also be marked as active so that
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On the assumption that a colour
monitor is in use, the program
moves the address of colour

(continued on page 109)
He probably didn't know a VAN from a LAN either.

But Einstein had an excuse.
Fortunately you don't any longer.

The new easy to use Breaking The Jargon not only provides you with definitions of computer terms, it also gives you an idea of how the terms are used. As an example, LAN stands for local area network - great you say, but what's a local area network? Breaking The Jargon explains it all.

This new lexicon is based on a series called Background Briefing which appeared in Computer Weekly from November 1986 to March 1987, written by respected computer journalist Nicholas Enticknap. He's made it simple to find a simple definition, and simple again to understand the full meaning.

Breaking The Jargon is just the first in a new series of Computer Weekly publications designed to give practical guidance in areas of interest to readers. This reference book is essential for all companies using computers, for the 80's business person who comes into contact with computers, or anyone who has an interest in computers. No office or briefcase should be without one.

Einstein surely would have found a computer useful in his work and Breaking The Jargon might have been his first step. Make it yours. Order now - Breaking The Jargon will be available after June 1, 1987 for just £8.95 (including p&p). Reserve your copy today by returning the coupon. Send to: Computer Posting, 120-126 Lavender Avenue, MITCHAM, Surrey CR4 3HP or place a phone order by ringing them on 01-685 9435.

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Return to Computer Posting, 120-126 Lavender Avenue, MITCHAM, Surrey CR4 3HP or ring 01-685 9435 and place your credit card order.
This number is read into AX from PRACTICAL COMPUTING September 1987 109 of lines is put into BX to allow one offset from Vpage_Offset must be added in case the machine is not offsets noted on the screen. Thealt length will be 32767. The program now calls the Prt_Msg subroutine to display the message in flashing red in the correct position in the box on the screen. Execution has now reached the Put_Box label in the program. It puts the number of characters per line into CX and then calls the Swap routine. This swaps a line of characters between the screen and the Box_Buf area each time it is executed. Once one line has been swapped, the program must restore the starting value of DI and increment it by 160 bytes or one whole screen line. The process of swapping line positions is continued. The counter in BX can be repeated until BX is empty. Once all the lines have been swapped the value of DI must be cleared from the stack. Now the Set_Curs routine can be used to position the cursor inside the box on the screen and then turn the cursor off. The next part of the program checks the printer condition by using the printer status function 2 of interrupt 17hex. It returns a byte of information indicating whether the printer is on-line, busy, etc. This byte is checked and if the printer is available, the pogram continues at Get_Cmd. If the printer is not available a message must be displayed to that effect. First the Fredatt attribute is loaded into BL and the current page number is loaded into BE. Then the number of characters to be displayed is loaded into CX, SI is set to point to the Prt_Msg message and the cursor position is swapped into DX. The program now calls the Prt_Msg subroutine to display the message in flashing red in the correct position in the box on the screen. The program is now at Quit_Cmd in the program, where it asks for the Escape key to be pressed before the program can terminate. Once the Escape key has been pressed the screen must be restored before existing. A minor problem here is that the Box_Buf and Box_Ptr counters are swapped back to clear the "Printer not ready" message; otherwise Box_Ptr will be left containing this message after swapping is completed.

**CHARACTER DISPLAY**

Fortunately, this is easily accomplished by using function 9 of interrupt 10hex, which allows up to 255 characters to be displayed from any point on the screen. After positioning the cursor, the attribute and page number are loaded as usual into BX, the number of characters into CX and the character string into AL. This sets up a space — into AL. This function will then display [CX] spaces on the screen at the appropriate place, and with the appropriate attributes. The program continues to Quit where the box will be swapped back off the screen. If the printer checks out as available, processing will branch to the Get_Cmd label. This is where you can make changes to accommodate differing printer requirements.

**PRINTERS**

At Get_Cmd, the Get_Char routine is called to collect a character from the keyboard. Return or Escape at this point will cause the program to terminate. Other characters are checked to see if they are acceptable command characters.

The checking process is in the form of the chain GC1 to GC4. If a particular section finds that the character is a valid command, then SI and SP are loaded accordingly before processing the input. When the chain to Get_Cmd is executed, the screen is cleared, the cursor is set, and the program continues at Get_Cmd.

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(continued from previous page)

Between Quit and Exit, exactly the same process is performed as at Put_Box and the contents of the screen and Box_Buf are swapped. The final steps necessary to put things back as they were are restoration of the cursor position and type, and then marking Proc_Flag to indicate that the program is no longer active. The registers can then be restored and the program exits via an iret instruction to whichever routine called it in the first place.

The Set_Curs, Get_Char, Lprint and Prt_Msg routines are all very simple, and should require no further explanation than that provided by the comments in the listing. The Swap routine uses a special technique to prevent snow on IBM CGA screens. When accessing the screen memory directly there is a clash of interests between the main processor and the video processor. On CGA systems this will cause random flashes on the screen as the two processors access memory normally; when it is 0, vertical retrace is taking place. To locate the earliest point at which the 0 period starts it is necessary first to wait until it switches to 1, and then wait for the switch back to 0. Once this happens, there is just time to sneak in and access one word of screen memory data without causing snow before the video processor comes along again.

The actual swap process works as follows. The first step is to save the line count BX on the stack and load the port address of the video processor status register into DX. Since the next piece of coding is so timing-sensitive, the interrupt flag CLI is cleared to prevent software interrupt from occurring. The port is now read and the access bit is tested.

The program loops until the bit becomes a 1. Once this has happened, the program goes to the next loop, which waits in a similar fashion for the bit to become 0. When that occurs it immediately reads the required word from screen memory.

The screen word is now in the BX register and can be exchanged with the corresponding word in Box_Buf, putting the original screen word in Box_Buf and the original Box_Buf word into BX. Processing continues, with another couple of wait loops similar to the first, until the contents of BX can be written into screen memory.

**BUILT-IN ROUTINE**

Once this is done, interrupts can be allowed to operate once again, and both the SI and DI registers are incremented to point to the next words to be transferred. The whole routine repeats until the CX register is empty.

To create the box on the screen the program makes use of the box-graphics characters within the IBM character set. The characters are numbered from 179 to 223, and can prove extremely useful in giving a final polished appearance to the output of utility programs. If your word processor or text editor does not make special provision for these characters, they can usually be entered by holding down the Alt key while tapping the character number on the numeric keypad.

Some printers will not reproduce these characters correctly, so your printed program listing may not display them correctly. Even on printers that do handle these characters, no difference shows between double- and single-line characters. This means that characters 201 and 218 will appear identical when printed. If you use the Basic loader you will find that the screen box appears as a natty combination of double and single lines.

All the programs in this series are available on IBM-formatted discs at a cost of £5 for each program. Each disc contains the assembler source code, the assembled program and a document file describing the operation of the code in detail. Please send your order to Jim Bates, c/o Practical Computing; cheques should be made payable to Jim Bates.

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WHAT CAN I USE IT FOR?

As well as making the use of the printed word in one way or another in our daily lives, the applications for Desktop Publishing are all around us. If you belong to a club or society or if you run your own business, the possibilities are endless! Our list of example applications will give you some other ideas.

- Technical Sheets
- Club Newsletters
- Office Forms
- Application Forms
- Club Certificates
- Presentation slides
- Business Contracts
- Library cards
- Photographs
- Menus
- Technical Sketches
- Specimen Forms
- Design tickets
- Work Estimates

PUBLISHING PARTNER

SoftLogik Corp™ includes all of the features which you would expect in a good Desktop Publishing package. It combines word processing, page layout and graphics facilities into a single program. All of this can be used to create documents on your Atari ST. First you can do a rough page design and start adding blocks of copy. See how it fits. See how it looks. Move pages around as you wish. When you are satisfied with the result, save it and then print it.

3. Simple, powerful, affordable

Printing and publishing is a fairly complex business which takes years of training and experience to master. You wouldn't think that you could set up a small business without a lot of experience and expertise. But with the ST's user friendly GEM environment. It is so user friendly and easy to use that you can produce your own documents without even opening the fully comprehensive 159 page manual which accompanies the program. Using the mouse to manipulate the self explanatory pull down menus and windows, you can be up and running in no time, creating a variety of documents instantly. The computer's screen will show you what you want to see at any one of the printers which the program supports (the list is growing all the time).

THOUSANDS OF TYPE STYLES

This is no exaggeration. Unlike most other desktop publishing software packages, which offer you 2 or 3 different fonts, Publishing Partner offers you 2,400 different fonts per font. Publishing Partner offers you 14 variations of each font. This is the total number of possible permutations is over 2,000. And that's not all, each style can be used in any one of 216 sizes in one point increments from 1 point to 216 points! All this is achievable on an expanded 80287 with just 512K RAM. Other competing packages require 1024K RAM just to get the larger sizes above 72 point and still can't match all of the variations available.

6. WORD PROCESSING

Publishing Partner contains the power and features that you would expect to find on a dedicated word processing package. In addition it includes facilities which a professionaletypsetting machine would. For example the program can cope with 216 different type sizes, with over 4,000 style variations of each one. The following are some of the facilities which you will find within the capabilities of Publishing Partner:

- Character spacing from -128 to +127
- Kerning from -128 to +127
- Character spacing from -128 to +127
- Spaceing, anytime and anywhere on the page. Watch an ordinary document without even opening the fully comprehensive 159 page manual which accompanies the program. Using the mouse to manipulate the self explanatory pull down menus and windows, you can be up and running in no time, creating a variety of documents instantly. The computer's screen will show you what you want to see at any one of the printers which the program supports (the list is growing all the time).
America's leading clone maker was
its manufacturer seemed to have
operating system of the future, as we
Octagon Industries to
together a refinancing package with
their dog has been queuing up to buy
some secret attraction. Everyone and
at pains to emphasise that OS/2 does
be simply to put potential users' minds at
sorely needed capital into the man-
ufacturer, which lost £4.5 million in the
last financial year.

Just as it seemed that the deal was
likely to go through, in stepped
Aricot with an offer of shares or
cash to shareholders. After much
squabbling between the two man-
gements, it looked as if Aricot
would get its way.

But then along came Norsk Data,
the highly successful Norwegian
manufacturer of minicomputers, with
even better offer. At the time of
writing it seemed likely that the Norsk
package would be accepted by the
shareholders. On the other hand, it
could be time for a fourth suitor to
show up.

Perhaps the biggest mystery in all
this is why companies should want to
buy Wordplex in the first place.
Hasn't anyone realised that dedi-
cated word processors died about
five years ago? Those who haven't
should look at the current Wordplex
line. Its 90 Series starts with a twin-
floppy machine plus daisywheel. The
price — a mere £6,000. You could
buy an IBM PS/2 Model 80 for that.

The explanation usually invoked is
that both Aricot and Norsk want
Wordplex for its user base. But this
amounts to not much more than
1,500 sites in the UK and around the
same abroad. It also ignores the
likelihood that anyone daft enough to
buy word-processing systems these
days probably couldn't cope with the
kind of shiny new technology Aricot
and Norsk have in mind.

The sceptically minded may be a
little concerned about OS/2 — the
operating system of the future, as we
are continually being told. After all,
it was initially launched by only one
company, and many people
remember the bad old days when each
manufacturer seemed to have its
own incompatible operating
system.

However, Compaq has acted
swiftly to put potential users' minds at
rest. On 28 April: "Only the
users who really need the capabilities
of OS/2 will move to it. Everyone else
will continue to be happy with DOS!" Not much enthusiasm there —
and yet by 6 July OS/2 has become
"a revolutionary advance in the
benefits to individuals and organ-
isations by personal computers."
It's a fast-moving world, computers.

ICL has been doing well lately.
Profits are up, and far from being
propped up by its parent, STC, it is
doing most of the supporting itself.
A recent announcement by ICL may
indicate the secret of this success.

It's all about niche markets. So
your mainframes and micros aren't making much headway against Big
Blue? Never mind: all you have to do
is find some nice little specialist
area, and corner the market. For
Britain's biggest mainframe manu-
facturer it's games — or to be more
precise, management games. ICL
has set up a joint venture with
Cranfield School of Management to
organise and market business
games. They will include both off-the
shelf packages, bespoke games, and
the running of a national man-
agement game competition. Has ICL
found its true forte at last?

Eagle-eyed readers tempted by Sir
Clive Sinclair's latest piece of
customer gee-whizzery may have
spotted that the advertisement for
the Z-88 in our May issue is different
from the one which appeared in the
previous month. Cambridge
Computer will switch off its Lotus
full address or invites readers to send off
for goods by mail order. Instead it
suggests that anyone wishing to
place an order or obtain more
information should ring its hotline.

The change could be the result of a
complaint to the Advertising Stand-
ards Authority by an aggrieved
member of the public who objected
to Cambridge Computer's advertise-
ment and its direct-mailing leaflet.
The grounds for the complaint were
that the ad did not include the full
address and that expanding the RAM
to 3Mbyte was not possible. The
complainant also questioned whether
the computer was available at the time,
and pointed out that the ad failed to
explain that there would be a
delivery delay in excess of 28 days.
The ASA has since upheld the complaint.

In the sophisticated world of
computing it seems that companies are
prepared to put forward some
very convoluted arguments to
market their products. A Hampshir-
shire-based firm, CBT, claims that its
Easyreader monitor could save UK
companies millions of pounds, and gives
figures to prove it.

The argument goes like this. An
estimated 900,000 users of tradition-
ally cheaper VDU's (usually under
£1,000) suffer from eye-
strain, headaches and, as a result,
absent themselves from work from
time to time. The cost to industry is
estimated to be £12 million a year.
Ordinary screens are small, and so
people are forced to run off copies to
see what their work looks like. The
cost is estimated to be around 60p
copy, not counting the cost of
reproduction.

The Easyreader is claimed to solve
the eye-strain problem, and because
each screen is A4 size and upright
— just like a piece of paper — it solves
the trial copies problem too. CBT says
that on this basis savings could
costed per copy, not counting the cost of
reproduction.

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20 Megabytes
4.77/8 MHz

- The PC88 Turbo
- Legal BIOS
- NEC V-20 Super Processor
- Switchable 4.77/8 MHz Clock
- 640K RAM
- 20MB Half Height Hard Disk
- 360K Half Height Floppy
- Parallel Printer + RS232 Serial Ports
- Clock/Calendar with Battery Back-up.

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**AT-Compatible**

20 Megabytes
6/8/10 MHz

- The PC-286 Turbo
- Legal Bios
- Switchable 6/8/10 MHz
- 640K RAM
- 20 MB Half Height Hard Disk
- 1.2 MB Half Height Floppy
- Parallel Printer + Two RS232 Serial Ports
- Clock/Calendar with Battery Back-up

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