LASERS TAKE OVER

HARDWARE  Apricot Xen-i 386 • Mac II
SOFTWARE  Harvard Professional Publisher
FEATURES  The superconducting micro
PLUS  How healthy is Ashton-Tate?
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, autodailer, 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: 129K.

**Traveling SideKick**

It’s the electronic organizer for this electronic age. Neither you nor your secretary need to face 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 “Avenue” (by reading that backwards), “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 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 business graphics, easy windowing, and storing screen images in memory. It comes complete with source code, ready to compile. Minimum memory: 192K.

---

**Turbo Prolag**

Our new Turbo Prolag has drawn rave reviews—which we think are well deserved—because Turbo Prolag brings 5th-generation language and super-computer power to your IBM PC and compatibles. Turbo Prolag is a high-speed compiler for the artificial intelligence language, Prolag, 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 Prolag, the natural language of Artificial Intelligence. Minimum memory: 384K.

**Reflex° and Reflex Workshop**

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.

**Resources**

Why more than half a million people are using Turbo Pascal!

Because at up to 4,000 lines of code per minute, Turbo Pascal® is faster than any other Pascal compiler. And because Turbo Pascal is backed by a complete range of “toolbox” that give you most of the programming tools you’ll ever need.

The Worldwide Programming Standard

"For the IBM PC, the benchmark Pascal compiler is undoubtedly Borland International’s Turbo Pascal,” says Gary Ray of PC Week. We and more than 500,000 other people around the world think Mr. Ray got that right.

Since launch, Turbo Pascal has become the de facto worldwide standard in high-speed Pascal compilers.

Turbo Pascal has got to be the best value in languages on the market today.

Jerry Pournece, BYTE Magazine

Turbo Pascal turned what was an academic’s hobby-horse about the unihedness of BASIC into a fully fledged industry and culture.

Practical Computing

Free 8087 Support and BCD Reals

Now Turbo Pascal is an even better deal because it includes two of the most popular options—8087 math co-processor support for intensive calculations and Binary Coded Decimals (BCD) to eliminate rounding-off errors for business applications.

Turbo Pascal also includes a full screen, WordStar®-like editor. The compiler instantly locates errors, automatically activates the editor and shows you the location of the error in the source code. This provides an integrated programming environment that will improve the productivity of newcomers and experts alike.

A Whole Family of Tools

Success breeds success, so the Turbo Pascal family is never static. It is continuously expanding, with new products like Turbo Editor Toolbox and Turbo GameWorks.

The secret of software success is not merely low price, but top quality allied with complete documentation, like our 400-page reference manual.

All of which are some of the reasons why Turbo Pascal is clearly the leader, and the recipient of awards like PC Week’s “Product of the Year” and PC Magazine’s “Award for Technical Excellence.”

An Offer You Can’t Refuse

Turbo Pascal is now an even better deal than ever because you can get a lot more for a lot less. The compiler, a completely integrated programming environment, and BCD reals and 8087 support are now available for only £69.95. Better yet, save almost £65.00 when you choose the Turbo Jumbo Pack. Six different Turbo Pascal products (Turbo Pascal 3.0, Turbo Tutor 2.0, Turbo Editor Toolbox, Turbo GameWorks and Turbo Database Toolbox) for only £245.00! Hurry! Place your order today. Minimum memory: 128K.

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Prices exclude VAT & Delivery

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All prices are subject to C.W.O.
LASERS TAKE OVER
Once upon a time lasers were exotic and expensive. Now they have a place in almost every office and every manufacturer seems to be launching one. But just how fast are they? And how good are the new units that have broken the £2,000 price barrier? We investigate this exciting world.

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Three technologies have shaped the pattern of working in the modern office: the telephone, the microcomputer and the photocopier. The impact of two of them - the phone and the micro - has been fairly obvious; hitherto the third has been taken for granted, its ubiquity masking its subtle but pervasive effect. Recent developments may be about to turn the spotlight on to the photocopier.

The primary impact of the photocopier has been to increase the amount of information passing across a desk. Before the days of Xerox and its host of competitors, copies could mean one of two things. They meant messy carbon copies with limited numbers and low quality or, for larger runs, they would involve one of those splendid devices like a Gestetner or Cyclostyle machine. Although they worked well enough in their own way - which nowadays looks quaintly Victorian to our high-tech eyes - they were hardly a convenient method for generating copies of a large number of documents on a regular basis, say as part of a restricted office circulation list.

The photocopier changed all that. Small or large runs became equally easy. No specially prepared original was needed as with the Gestetner machines. Furthermore, it was possible to copy not just typed or written documents, but also graphs, images, even pages from books and magazines - whatever the laws of copyright may say. This tremendous new power unleashed the torrent of data which most of us have to cope with today.

In this context, the more recent effects of the micro can be seen not as anything startlingly new, but rather as a second wave of this information deluge. As anyone working with computers knows, their chief effect, like that of photocopiers, is to increase the amount of paper which has to be dealt with. So much for the paperless office, a once fashionable phrase which has now completely disappeared from manufacturers' advertisements.

Of course, micros differ from photocopiers in one important respect. The prodigality of the photocopier is limited in that all copies are by definition the same. The micro introduces the new possibility of varying the output while retaining the respect. The prodigality of the photocopier is limited in that all copies are by definition the same. The micro introduces the new possibility of varying the output while retaining the

sector, prices are falling — following the same pattern as micros a few years back. What started off as a premium-priced machine costing around £4,000 can now be had for around £1,500. It is no coincidence that Jack Tramiel has announced a laser printer, and that Alan Sugar is rumoured to be looking at one. Both men are sharp at spotting the next mass-market product, and it is clear that lasers now fall into that category.

Already laser printers are beginning to take over in offices, mirroring the pattern of micro acquisition a little while ago. Like micros, lasers are totally addictive; once you have used one, you never want to go back to a dot-matrix, no matter how many pins it has. This has partly to do with the noise of even the quieter matrix machines; acoustic hoods are falling from favour for personal printing, as opposed to heavy-duty departmental work. But the attraction of the laser has more to do with the fact that we have been working in offices based around the photocopier ethic for the last 30 years. When the laser printer arrived, it simply assumed the photocopier's mantle as the natural instrument of the office-information generation.

Peering further into the future, most micro users might soon have a laser printer, which will cost about the same as an Amstrad PC — and might even be made by Amstrad. More and more intelligence will be embedded into it, until it becomes a document scanner, optical character reader and fax machine, all in one box. As a result, the telephone too will migrate along the desk into the same unit. At this point — probably towards the end of the 1990s — we will see the final convergence of those three technologies which have gone to shape so much of the preceding century. And as the micro and the telephone shrink to vanishing point through continuing advances in chip production, all that will be left will be the latest and most exciting incarnation of the humble photocopier.

5 YEARS AGO...

The 16-bit micro has been with us for some time now, and a number of 16-bit systems have found their way into various microcomputer installations. Now it looks as though these machines are to be upstaged by a new generation of 32-bit micros. Industry rumour says that Hewlett-Packard has a 32-bit machine on the way, to be joined by a 32-bit micro developed by Acorn in conjunction with National Semiconductor.

The chip comes from National Semiconductor and is claimed to be the only true 32-bit microcomputer. It is capable of supplying the user with the power of a minicomputer at about 10 percent of the cost. This chip, and the others in the series, are to be incorporated by Acorn into two new products. As a second processor for the BBC Micro, it will come on a board with 256K of RAM and an operating system in ROM. The interface to this processor will be handled by the "tube". Acorn expects to market this product to the existing user base of over 2,000,000 Apple, Pet and Tandy machines.
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.

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FEEDBACK

The virtues of an LCD

REGARDING the letter from M J Hosken, in your April issue, concerning not looking at the screen while keying in. I too avoid looking at the screen, though for an entirely different reason. I can't stand the thing! The glare, noise and whatever other unknowns come out of it lead to discomfort and a steady decline in efficiency. It would appear I am not alone. In a recent For What It's Worth TV programme, concerning building sickness syndrome, 43 percent of VDU users questioned said they found them unpleasant. What I would like is a nice, boring black-and-grey LCD screen. But only portable are blessed with them. I am sure that staff productivity would increase if they had these, rather than CRTs. I find myself dry coding/running programs on paper, rather than face a CRT, thereby losing all the advantages of screen manipulation and continuous testing. The answer is an 80-by-25 add-on LCD. It would transform the computer into a much more affable machine. The LCD could be used for most of the text and coding work, leaving the CRT for graphics and colouring. Clive Sinclair's new Z-88 portable has an 80-by-eight unit and costs only £200. Surely there must be companies who could produce a similar screen three times deeper than this, and sell it for around £100.

R SUMMER,
London SW12.

Running Basic with a Hercules card

YOUR correspondent Michael Earley in "Ask PC", June 1987, complained about the lack of Hercules graphics support for IBM PC clones. In response to this problem we have produced H-Graphics, a programmer's toolkit for the Hercules and compatible graphics cards. It costs £45.

H-Graphics provides full Hercules graphics support on the IBM PC and compatibles for programs written in Basic, GW-Basic, Quick Basic, Pascal, C and Clipper. As well as the usual drawing commands there are facilities for writing text on the graphics screen, for creating windows and for loading, saving and printing screens. Quick Basic as it stands does not support Hercules graphics; H-Graphics provides that facility and also allows the programs to be run under the Basic interpreter for development and debugging. Support for Turbo Basic will be available shortly.

F E RICKETT,
Laboratory Software Ltd,
2 Ivy Lane,
Aylesbury,
Buckinghamshire HP22 5AP.

WordStar without backups

MANY people — quite wrongly in my estimation — say that WordStar is complicated and difficult to use. Yet they are ready to praise the Amstrad PCW with Locoscript which, although quite sophisticated in the facilities it provides, presents a sequence on start-up which would frighten an experienced user, let alone the raw beginner to whom it is being marketed. It may well be that this false impression of WordStar is propagated by such convoluted explanations as that given by M A Rahin in your June issue. The procedure he described involves some 22 keystrokes to avoid the creation of a backup file.

Surely it is far simpler to allow WordStar to make the backup copies for insurance as they are intended, and occasionally clean up the directory by keying X from the opening menu to go to the system and then entering DEL *.BAK.

If your working environment is under the control of batch files which normally change directories automatically, you may need to learn how to change to and from the word-processing directory by means of the CD command, but this is surely more logical and easier to understand than the procedures being suggested by Mr Rahin.

J SIMPSON,
Shoreham by Sea,
West Sussex.

Crime and punishment

IN AN otherwise reasonable review of my book Is Man a Robot? Glyn Moody makes a serious error which I would like to correct. He says I would do away with prison altogether and that I fail to accept that my stated position provides a justification for some form of restraint. May I quote from page 261 of my book: 
"We are entitled to pursue criminals relentlessly and to incarcerate them when apprehended ... Compulsory incarceration ... may be necessary in order to achieve a degree of social protection."

GEOFF SIMONS,
Stockport,
Cheshire.

Angry at Apple

AM I ALONE in my sense of fury at Apple for the insane design of the Imagewriter II? Would anybody else be treated seriously if they offered a design for a tractor feed that pushed the paper through the rollers?

R ELLIOTT
IBM Technical Co-ordinator,
Clydebank College,
Clydebank.

Easier than 1-2-3

THE REVIEW of low-cost spreadsheets in the June issue raises some points. Spreadsheets like Lotus are the standard method of financial calculation. Before that it was self-written programs; before that the calculator; before that the adding machine. Each standard is more powerful, handles more information and produces more comprehensive results.

A lot of our customers are those who have found Lotus too cumbersome. They find Moneypower quick and easy to use, and the power of its reporting saves time.

P H GOLDEN,
Moneywise Software,
North Cheam,
Surrey.
We steamed it.

We shook it.
How can we be so sure our Vectra computer won't let you down? Because we asked Lloyd's Register of Shipping to give it a going over.

Lloyd's test all kinds of equipment for seaworthiness. They believe a computer should be able to round the Cape, reach the Pole and spend a week in the Doldrums.

Which is why they tested the Hewlett-Packard Vectra as if lives depended on it.

First, they left it in a temperature of 55°C for 100 hours.
Then they lowered the temperature to -25°C for 16 hours.
In the next test they again raised the temperature to 55°C but this time with a humidity of 95%.
They also rolled the Vectra each side of the vertical, they vibrated it for two hours and they fluctuated and interrupted the voltage and frequency.

The results, we think, will surprise you.

Apart from suggesting we should secure the capacitors and resistor more firmly, Lloyd's gave us a clean bill of health.

For those on dry land, the message is clear.

If the Vectra can cope with life at sea, it should find office life plain sailing.

To find out more, phone Julie Gane on (0734) 696622.
OLIVETTI STRIKES BACK AT PS/2

OLIVETTI has announced its answer to the IBM PS/2 series in the form of a new range of micros based on the 80386, 80286 and 8086 chips. It has also produced a multi-tasking environment for the 80386 chip in advance of the appearance of Microsoft’s OS/2. All the machines use the new-style AT-layout keyboard, and can be set up with 32in. or 52.5in. floppy drives. At the top of the range is the 80386-based M-380, which comes in three versions. The M380/T is a floor-standing unit that bears a remarkable resemblance to IBM’s Model 80, except that it possesses a small display for diagnostic messages. There are also two desktop versions, the M-380 and the M-380/C compact model. The M-380/T runs at 20 MHz, and the other two at 16 MHz.

The M-380/T and M-380 come with 4Mbyte of RAM, expandable to 64Mbyte on the M-380/T. The M-380/C comes with 1Mbyte expandable to 4Mbyte. Hard-disc storage starts at 40Mbyte on the compact model and 68Mbyte on the M-380. The 125Mbyte hard disc on the floor model can be expanded to 270Mbyte.

To enable users to exploit the power of the 80386 processor, Olivetti has a multi-tasking manager called 386-Topjob which allows several tasks to be run concurrently under MS-DOS. It also enables the user to address memory beyond the current 640K limit. Up to eight tasks can be run at once, including well-behaved programs like Flight Simulator. Olivetti says that it expects 386-Topjob to have a future even when OS/2 has arrived.

Olivetti has also announced two new versions of the M-24 and M-28, corresponding to IBM’s Model 30 and Model 50 in the PS/2 range. The M-240 and M-280 run faster processors and have higher-resolution graphics. They are also able to accommodate backup tape units. The new Positive Graphics Controller supports graphics up to 640 by 400 pixels; there is also an EGA option.

The first of the machines to go on sale will be the M-240, which is due to appear in July. The M-380 is scheduled for February and the M-280 for the last quarter of the year. For 1987 at least, the M-24 and M-28 will continue to be sold. The M-380 costs from £4,410 and the M-240 from £2,033.

At the launch of these machines, Olivetti announced new networking and terminal products, as well as prototype Worm and CD-ROM mass-storage devices. More importantly, it disclosed that it believed that there would be no impediment — neither technical nor legal — to producing a clone of the PS/2’s Micro Channel.

For further information contact British Olivetti Ltd, PO Box 89, 86/88 Upper Richmond Road, London SW15 2UR. Telephone: 01-785 6666.

Intelligent scanner

KURZWEIL Computer Products’ Discover 7320 is a PC-based intelligent character recognition scanner. It allows automatic scanning of documents that include both text and graphics.

Discover is claimed to recognise almost any font from 8 point to 24 point in size. Scanning takes place in background mode so that users can work on other applications while it is being done. The system consists of a proprietary PC board with 2Mbyte of RAM along with a desk-top scanner unit. It has been tested to average a scanning speed of around four pages per minute. It costs £8,000.

For more information contact Kurzweil Computer Products, Unit 8, Sutons Industrial Park, Reading, Berkshire RG6 1AZ. Telephone: (0734) 688421.

PS/2 memory expansion

ORCHID, Intel and AST have announced add-ons for IBM’s PS/2 micros. The Orchid Ramquest 50/60 for the PS/2 models 50 and 60 provides 2Mbyte of RAM. It can be used as extended memory with a processor running in Protected mode under OS/2, or as Lotus/Intel/Microsoft (LIM) expanded memory with MS-DOS. Four boards can be installed to provide 8Mbyte of memory. The Ramquest 50/60 costs £749 and is being distributed by First Software.

First Software will also be distributing Intel’s Above Board 286 and PS/286. The Above Board 286 is designed to work with high-speed PC/AT compatibles or the IBM PS/2 Model 30. The Above Board will operate at a maximum speed of 12.5 MHz in an AT compatible, and at 8 MHz in a PC compatible. It can carry up to 2Mbyte of memory plus a further 2Mbyte mounted on a separate piggy-back board.

The 512K Above Board 286 costs £660, the 2Mbyte version £2,085. The 512K PS/286 costs £705 and the 2Mbyte version £1,135.

AST’s Rampage/2 expanded memory board for the IBM Model 30 and the Advantage/2 multi-function expansion board for Models 50 and 60 will be available in Europe during the third quarter of 1987. The Rampage will offer users a minimum configuration of 64K of added memory, expandable to 2Mbyte. Rampage/2 supports standard PC-DOS expanded-memory applications software including Lotus 1-2-3, dBase III, Symphony and Framework.

First Software is at Intec-1 Wade Road, Basingstoke, Hampshire RG24 6NE; telephone (0256) 463344. AST Europe is at Gran Wharf, Brentford, Middlesex TW8 0BA; telephone 01-568 4350.
Amstrad PC-1640 to be sold in Britain

FOLLOWING the launch of the Amstrad PC-1640 at the Comdex show in Atlanta in early June, Amstrad has decided to give the range a British preview at the PC User Show.

Amstrad will be previewing the three EGA versions of the PC-1640. UK shipments are expected to start in August and to reach full flow by early September.

Amstrad has denied rumours that it will be dropping the PC-1512. It will continue to sell into small businesses and the home. Meanwhile the company hopes that the addition of the EGA will satisfy the demands of corporate business customers.

Amstrad also intends to launch a new word-processing system, the PCW-9512, in September.

For more details contact Amstrad, Brentwood House, 169 Kings Road, Brentwood, Essex CM14 4EF. Telephone: (0277) 228888.

Two more by Hercules

HERCULES has added two cards to its range of products: a monochrome text card and a version of the Hercules Colour Card without a parallel port.

The text card is a half-card sized alternative to the IBM Monochrome Display Adaptor (MDA). The board is suitable for those who need text-only applications on IBM-type monochrome displays. It can be used on IBM PCs and compatibles in conjunction with standard text-mode software and supports text programs which are compatible with IBM's MDA. The Colour Card/CP costs less than the original Colour Card and has all its features with the exception of the parallel port. It is thus suitable for users who already have a parallel port and do not need one, or who are linked into network configurations.

The Hercules Text Card costs £99, and the Colour Card/CP costs £109. For further details contact First Software, Intec-1, Wade Road, Basingstoke, Hampshire RG24 1NE; telephone: (0256) 463344. Softsel, Softsel House, Syon Gate Way, Great West Road, Brentford, Middlesex TW8 9DD; telephone 01-568 8866.

The US-based company PC's Limited has now established a UK subsidiary that it has named Dell Computer Corporation. What distinguishes the company from its rivals is that it cuts out its dealers and sells its micros by mail order. This obviously eliminates dealers’ profit margins, which can be around 35 percent, and allows it to sell its machines at low prices.

PC's Limited was set up in 1984 by 19-year-old Michael Dell, who is now the company's chairman and chief executive officer. The formula appears to have worked in the US, where the company looks set to turn over $150 million this year.

Dell says it will be spending £2 million on advertising in the UK in its first year. The majority of it will be in the computer trade press, and it will be linked to mail-order sales. Dissatisfied purchasers will be able to get their money back if they return their machine within 30 days.

Support will be provided over the telephone, and machines will be backed up with a free 12-month on-site maintenance contract. Each machine has its own built-in diagnostics, complete with an LED display panel on the front of the machine which will give a constant readout of information that can be relayed to Dell hotline staff.

The basic Dell systems come complete with monochrome monitor, a Hercules-compatible graphics board and an 84-key keyboard conforming to the old-style IBM layout. The 80286-based machine running at 8MHz, the 286-8, starts at £1,299 with a 20Mbyte hard disc. The 286-12, which runs at 12MHz, starts at £1,799 with a 40Mbyte hard disc. There is even an 80386 model, the 386-16, which runs at 16MHz and costs from £3,199 with a 40Mbyte hard disc.

For more information contact Dell Computer Corporation, Farley Hall, London Road, Bracknell, Berkshire RG12 5EU. Telephone: (0344) 863420.

AT clones from Qubie, Walters and Wyse

WALTERS INTERNATIONAL and Wyse have announced 80386-based IBM-machines, while Qubie and Wyse are launching 80286 models.

The Walters 80386 machine costs £2,500 with a 1,2Mbyte floppy drive as standard. A 20Mbyte hard disc costs £395; 360K 3.5in. floppy drives and 720K 5.25in. floppies are available as options. The price includes a monochrome monitor and an 84-key keyboard with the old-style AT layout.

For information contact Walters International, Matrix House, Lin- coln Road, Cressex Industrial Estate, High Wycombe, Bucking- hamshire HP12 3RD. Telephone: (0494) 32751.

Qubie’s 80286 micro runs at 10MHz, and is fitted with 640K RAM, a 360K floppy drive and a 20Mbyte hard disc. A high-resolution monochrome monitor and card, and a 101-key keyboard are also supplied as standard. It costs £1,395.

Contact Qubie at 7 Perrier Street, London SW18 1SN. Telephone: 01-871 2853.

Wyse has launched four micros. The 80386-based Wyse PC-3216 is clocked at 16MHz. With a single floppy drive it costs £3,995, and with a 40Mbyte hard disc £4,995. The three new models of the PC-286 family are the 8MHz model 2018, the 12.5MHz model 2212 and the 2.5MHz model 2214. They range in price from £1,395 to £1,795, depending on configuration.

Further information is available from Wyse Technology, 26-28 King Street, Maidenhead, Berks SL6 1EF. Telephone: (0628) 70420.

Transputer PC boards

MICROWAY has launched the Monoputer, a Transputer-based product designed to use an IBM PC or compatible as a host and file. The Monoputer runs a 20MHz Transputer processor and has 2Mbyte of RAM. The board is bundled with a full-specification stand-alone PC/2 compatible 286 processor. Its costs £1,500.

For more information contact Microway (Europe), 32 High Street, Kingston-upon-Thames, Surrey KT1 1HL. Telephone: 01-341 3466.
UK SOFTWARE developers have been quick off the mark with software for Windows and OS/2. They include several ambitious products which show off various features of IBM and Microsoft's new operating environments, and some are ready for release.

Blyth software is bringing out Quartz, one of the first database programs designed to make full use of the features of Microsoft Windows and OS/2. Quartz lets you design input forms and reports on-screen, using either the keyboard or a mouse. You control the package by selecting options from pull-down menus or using commands.

You can have up to 60 files open at a time, with a maximum of 12 active on-screen at any given moment. The Windows clipboard lets you move Quartz data between windows into other applications, and you can access DIF, Syk and ASCII files. Quartz goes on sale priced at £695 for the single-user version.

For details contact Blyth Software, Miford House, Benhall, Saxmundham, Suffolk IP17 1JS. Telephone: (0728) 3011.

Guide is an ideal medium for interactive browsing.

To make the concept work properly you need a good screen-based graphics user interface, and the ability to swiftly transfer the large amount of data involved to and from disc. This makes Guide an ideal application for Windows and OS/2.

For information on Guide, contact Office Workstations, 5 Abbeyment Techbase, 2 Easter Road, Edinburgh EH7 5AN. Telephone: 031-659 6737.

HPS Software Developments has come up with another program it would probably be impossible to do in the old software environment. Termtype emulates the functions of a Hewlett-Packard 2392A terminal, allowing you to link through to a mini or mainframe from your PC.

With Termtype you can have your terminal session going on in one window while other Windows applications remain active on-screen. Under MS-DOS the best you could do was to flip between the host and MS-DOS environments, running them sequentially rather than concurrently.

Termtype also allows you to use Windows facilities like mouse-actuated pull-down menus from within the terminal-emulation window. You can use the clipboard to transfer data between your mini or mainframe application and other Windows applications.

Termtype costs £250. For more details contact HPS Software Developments, 196A Whittington Road, London N22 4PD. Telephone: 01-884 6644.

To run any of the packages mentioned in this article you need a copy of Windows. If it is not bundled with your machine it can be obtained from any software dealer for £75. In case of difficulty you can contact Microsoft, Excel House, 49 De Montfort Road, Reading, Berkshire RG1 8LP. Telephone: (0734) 500741.

Doing DTP the old way

LE PRINT is a £380 desk-top publishing package aimed at people with word-processing experience but who lack the inclination to get heavily involved in new ways of doing things.

Le Print abandons the usual approach to desk-top publishing, and makes no attempt to show on screen what your output will look like: it is not a WYSIWYG package. Instead you enter WordStar style dot commands into your document, using WordStar or any other word processor capable of producing ASCII files.

For example, to get a centred 24 point headline in Times, you might enter:
- FA TIMES
- CH 24PT
- CE ON

Le Print recognises these commands and outputs the reformatted and transformed document to your printer.

Unlike most desk-top publishing packages Le Print supplies the fonts as part of the package so you do not have to buy them for your printer. It includes 16 distinctive type styles, such as Courier, Prestige and Old English. You can use them in sizes from a tiny 4 point to a massive 200 point, which is a couple of inches high.

While Le Print cannot offer the power and flexibility of packages like Ventura Publisher and Aldus Pagemaker, it offers a straightforward and relatively low-cost route to desk-top publishing that does not require much new learning.

For more information contact Headway Computer Products, Headway House, Christy Estate, Ivy Road, Aldershot, Hampshire GU12 4TX. Telephone: (0252) 335575.

SOFTWARE SHORTS

- OS/2 appears to be well inside its schedule. Kits for software developers are being shipped now, a month earlier than expected. Versions for end-users are expected early next year.

- In a direct attack on Borland's Turbo C, Microsoft is introducing its own fast C Compiler. Quick C costs £75 and will be available in September. Contact Microsoft on (0734) 500741.

- Ansa is releasing Paradox 2.0, a full multi-user version of its multi-file database. Paradox 2.0 costs £295 and supports one user; the six-user network pack costs a further £795. Telephone: 01-580 4766.

- Macspin is a £189 data-analysis and charting package for the Macintosh that supports three-dimensional charts. Details from Logotron on (0223) 323656.

- ChemWord adds scientific features to Microsoft Word or Word Junior. The £200 package lets you add diagrams, formulae and equations. Contact Laboratory Software on (0296) 431234.

Budget packages

ASHTON-TATE has announced a cut-down version of Framework. The £99.95 integrated package includes a spreadsheet, database, graphics and word-processing. Purchasers can upgrade to the full Framework for £350. Contact Ashton-Tate on (0628) 33123.

Samna has also launched a low-cost program aimed at the Amstrad 2010, this time a cut-down version of the word-processing program Samna Word 4. The new program costs £99 and is called Samna One Word — though one supposes it can handle documents longer than that. Contact Samna International on 01-587 1121.

Concord is a £99 free-text retrieval package. It lets you search through all your existing word-processing documents to pull out chunks of text relating to specific topics. It can cope with most databases and email too. Details from Bytesmiths on (0277) 211490.

PRACTICAL COMPUTING August 1987
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The new Epson laser costs less than the paper it's printed on.

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The new laser printer costs £1,795 (ex VAT). The paper it's printed on here costs us nearly twice as much. (Expensive stuff this advertising lark.) But we reckon it's worth it.

Particularly since this is the only laser printer you can buy with easy-change IC font cards.

What are they? They're unique to Epson. They're about the same size as your credit cards. They slot into the laser and each gives you a variety of fonts extra to the seven we've already built in.

So you can build up a library of them and never be constrained to just printing in the typeface your software package offers again.

Now then, if you're replacing a daisy wheel, sick of the racket your old printers make, need to print really fast, like to use graphics, fancy flexible fonts or have simply never yet found the printer that makes things look as stunning as you want them to, you want our new laser printer.

Right then, here it is, the new Epson GQ3500 (don't we give them pretty names?).

Two easy-change font card slots; seven resident fonts; prints six A4 pages in sixty seconds; 300DPI graphics; 640K memory; SelectType push-button controls for choosing paper size, line spacing, print modes, number of copies portrait or landscape images and all that kind of stuff; IBM compatibility; prints on any standard paper, envelopes or OHP foils.

What are you waiting for? A bribe?

Oh, all right then, buy the new Epson laser and get an HP emulation IC card as standard, absolutely free (normally you'd have to pay us £125 for one).

Now, please fill in the coupon very carefully. There's about a hundred and fifty quids worth of paper there. Don't waste it.

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To: Epson (UK) Ltd., FREEPOST, Birmingham B37 5BR; alternatively call up Prestel *280# or dial 0800 289622 free of charge.
APPLE AND TOUCH IN CO-OPERATIVE DEAL

APPLE has announced that it is taking a minority investment in the company Touch Communications, and that together they will be developing Open Systems Interconnect (OSI) networking software products for the Macintosh family. The first Mac implementation of the Touch OSI products will be available by the end of this year. This marks another step along the road of integrating the Macintosh with existing products from other manufacturers. In particular it will allow Macintoshes to access IBM and DEC equipment. Touch Communications is based in Scotts Valley, California, and was founded in March 1985. Lotus Development has announced a tie-up with Telerate to develop products for the financial services industry. Telerate claims to be the leading supplier of real-time fixed-income and foreign exchange data. A special data feed will be set up for financial analysis and modelling, which can be taken up by 1-2-3 directly. This is Lotus's second foray into the world of specialist products for the financial sector. Recently it launched One Source, a regularly updated CD-ROM of financial data which can be fed into 1-2-3 spreadsheets. Lotus has reported record figures for its first quarter. Sales rose 22 percent to $85 million, and profits rose 20 percent to $13 million. As well as strong sales of 1-2-3, the Japanese version of the product has been doing well: it was the top-selling PC software package in Japan for the last six months.

Comprehensive PC insurance policy

CORNHILL INSURANCE is offering an insurance policy for users of business systems from micros to minis which covers software as well as hardware. Called Computer Cover, it provides cover for most risks to all elements of a system, as well as consequential loss due to disruption of business. It insures against accident, malicious causes, fire, storm, water damage and theft. Also covered is the cost of breakdowns excluded by maintenance agreements, for example, those caused by power failure or operator error.

Damage and breakdown cover includes the cost of any necessary temporary repair and costs of fast permanent repair, as well as debris removal and consultants' fees. Software is covered automatically at any location or in transit. The policy covers the increased costs of working while the system is out of action, and the cost of recovering lost data and the purchase of replacement programs.

For further information contact Cornhill Insurance plc, PO Box 10, Y7 Ladymead, Guildford, Surrey GU1 1DB. Telephone: (0483) 68161.

Reuters buys up database firm

REUTERS has bought 1 P Sharp Associates for £29 million. J P Sharp was founded in 1964 and has become one of the leading online database companies. This move marks a further diversification of the interests of Reuters, and a significant strengthening in the business services market.

Another sale in the world of communications is that of One to One by Comtext International. One to One has become established as one of the three main electronic mail providers in the UK. Comtext already owns BPT Communications, a company involved in telex.

Compsoft competition

COMPSOFT has announced a competition for users of its Delta database package. The top prize will be a holiday for two in Florida; the other two prizes will be European Weekend Breaks. Details of any Delta products — Professional

DELTA, Professional Delta-Net and Delta 4 — are eligible. The closing date for entries is 31 August. Further details from Compsoft, Compsoft Manor, Farncombe Hill, Godalming, Surrey GU7 2AR. Telephone: (04868) 29925.

NEC Multispeed warranty

NEC has announced that the Multispeed portable PC and APC-1V Powermate will both now come with a full three-year warranty on all electronic and mechanical components, including disc drives. Details from NEC Business Systems (Europe) Ltd, 35 Oval Road, London NW1 7EA. Telephone: 01-267 7000.
DISCOVER THE SECRET OF SUCCESS AT THE ALTOS '87 SHOW ABSOLUTELY FREE.

Finding effective solutions to business problems is the secret of success. It's also the theme of Altos '87 Wembley Conference Centre, 16-18th September.

At the show, you'll have the opportunity to see how some of those solutions could be made to work for your business. We'll be demonstrating a whole range of application software that can be tailored to your specific business needs.

We'll also be staging a series of business seminars with guest speakers from different areas of industry covering everything from choosing a system through to multi-user systems for the corporate user.

And for everyone that visits the show, there's the chance to win a week's free use of a Porsche 911 Turbo. Altos '87 For anyone in business, it's the ultimate show of success.

Tell the boss, it's Altos '87
One good idea leads to another.

The Macintosh Plus

The Macintosh SE

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In 1984, Apple introduced the Macintosh®. A computer based on the idea that people shouldn't have to work the way computers work. Computers should work the way people work.
In 1986, the introduction of the Macintosh Plus established Macintosh as the new standard in personal computing. Which of course led to yet another great idea. The Macintosh SE. The next step in the Macintosh evolution. The Macintosh SE combines the same intuitive graphic interface of the Macintosh Plus with many of the technological enhancements corporate customers have been asking for. Like a second 800K internal drive. Or a built-in 20 megabyte hard disk with a single 800K internal drive.
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Of course, the Macintosh SE runs all your Macintosh programs. Only faster. And, because it's a Macintosh, you'll never have to become a computer expert to use it.
In addition to the Macintosh SE, Apple proudly introduces the Macintosh II.
A computer so powerful and so flexible it challenges the very definition of what a personal computer can be. And do.
Inside the Macintosh II resides a new microprocessor. The Motorola 68020.

Which takes you through virtually every Macintosh program at four times the speed of a Macintosh Plus.
The Macintosh II also boasts a new coprocessor which enables it to perform mathematical calculations at two hundred times the speed of the Macintosh Plus.
But the biggest news is the Macintosh II's open architecture, with six expansion slots that allow you to customise your Macintosh to serve virtually any function you can imagine.
Internally, the Macintosh II offers you more memory options than a politician. From one to eight megabytes.
And although our internal forty megabyte hard drive is probably sufficient storage for most users, you can employ an internal drive of up to eighty megabytes.
The Macintosh II offers you a choice of viewpoints. A thirteen inch colour monitor or a twelve inch black and white.
Today, the Macintosh II will satisfy the needs of the most power hungry business user, scientist or engineer.
Tomorrow, it will also lead the way into startling new technologies. After all, one good idea inevitably leads to another.

Please send me more information about the new Macintosh range. Post to: Apple Computer (UK) Ltd., FREEPOST, Information Centre, Eastman Way, Harrow, Middx. HA1 3UB or dial 100 and ask for Freephone Apple.

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NEC ahead in monitors

NEC now commands 14 percent of the UK market for 14in. colour monitors, according to Romtec. Microvitec is in second place with 19 percent, with Taxan third at 12 percent and Tatung fourth with five percent. Romtec concludes that the arrival of NEC’s Multisync monitor, which can handle most types of display card, has triggered very rapid growth in the market as a whole.

Backup units are doing well

Sales of backup storage devices are doing well in the US, according to Frost & Sullivan. The company predicts an annual growth in unit shipments of 23 percent in the micro sector, fuelled by falling prices. The main factor behind the demand is the need for data security.

DTP gaining ground

Sales of hardware and software for desktop publishing (DTP) are set to grow to nearly £1 billion by 1990 in the European market as a whole. A study by Wharton Information Systems sees most of the growth occurring in stand-alone systems, although by 1990 multiuser installations will account for about one-third of total in micro software. The next six positions in the top 10 are exclusively mainframe or mini companies.

Lotus is pushed into second place

A merger between Computer Associates, best known for Supercalc, and UCCEL, a mainframe software company, has changed the league table of software companies. Computer Associates is now a long way ahead, trailed by Lotus and Microsoft, who are neck and neck. All the leading software companies are American and, interestingly, the top four are all involved in micro software. The next six positions in the top 10 are exclusively mainframe or mini companies.

Amstrad almost reaches 40 percent share

AMSTRAD is doing very well in the UK business micro market, according to Romtec. The market-research company’s latest figures are for the first quarter of 1987, and cover all distribution channels: High Street retailers, office-equipment dealers, micro dealers and distributors, and direct sales by the vendors themselves.

Fax takes over Telex role in UK

FAX is taking over from telex in the UK. This is the only conclusion possible from a report by International Resource Development Inc. At present the installed base is about the same, at 100,000 units each, but fax outsold telex by over 10 to one in 1986.

The projection is that by 1991 fax will outsell telex by a factor of 15, with telex sales actually falling in volume terms. All the equipment is coming from Japan according to IRD, which comments: “As in the US, the domestic vendors just can’t compete with the Japanese on price and features.”

Plenty of scope for expansion in Europe

THE EUROPEAN PC market is still far from saturated, according to a study by Intelligent Electronics Europe (IEE). So far, less than 10 percent of white-collar workers use PCs. Top European vendor by volume, according to IEE, is IBM, with Olivetti, Apple and Commodore the only other companies to have shares over 4 percent. These figures relate to the calendar year ending December 1986, before Amstrad had time to make an impact.

Amstrad is doing very well in the UK business micro market, according to Romtec. The market-research company’s latest figures are for the first quarter of 1987, and cover all distribution channels: High Street retailers, office-equipment dealers, micro dealers and distributors, and direct sales by the vendors themselves.
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PRACTICAL COMPUTING August 1987
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 Microft's popular menu generator MENUGEN, 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 presented either 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 fail-safe 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 MENUGEN 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.

THE DATA PROTECTOR
There are now over 10,000 users of Microft products worldwide.
FOR YOUR EYES ONLY

DEDICATED CHIPS ARE NOW AVAILABLE TO HANDLE THE CODING OF SENSITIVE INFORMATION SO THAT IT CAN BE TRANSMITTED IN SAFETY ALONG OPEN DATA LINKS.

The electronic encryption and decryption of sensitive data is no longer restricted to the top-secret domain of the CIA, GCHQ and Smiley's people. The incorporation of relatively simple and inexpensive encoding chips into ordinary PC systems can now help to protect any organisation's sensitive data from the illicit probings of Smersh, Spectre and commercial competitors bent on industrial espionage.

The need for data protection has never been higher. Vast amounts of potentially sensitive data now stream through national and international communications channels on easily intercepted microwave and satellite links.

Electronic funds transfer at point of sale (EFTPOS), bank cash dispensers, on-line credit enquiry systems, facsimile machines, mainframe computer modem links and even local area networks — they all carry data considered private by the owners. All are potentially vulnerable to the electronic eavesdropper, and passwords provide only limited protection. Even schoolboy hackers can find a way into most systems given time. Once entry has been gained, communication continues in plain language.

To provide protection from all but the most determined and sophisticated of snoopers, some form of data-encryption scheme has to be employed. With the benefit of today's dedicated coding chips and ingenious encryption algorithms, this is a straightforward matter. But it would be unwise to think that data transmission can ever be completely secure. The protection provided even by the most modern of techniques does have to be questioned.

In the Second World War the Germans relied almost exclusively on the Enigma coding machine for the protection of secret communications. They were confident that even if the Allies captured one of the machines they would never be able to decode messages unless they knew the regularly changed master key. As it happens, an early Enigma machine was passed to the British by the Poles. Before long the Bletchley Park cryptoanalysis team learnt how to break the codes using the first electronic digital computer, which was known as Colossus.

The Colossus machine was developed by a team which included Alan Turing. It used 2,000 valves and stored information on punched paper tape. Several Colossus machines were operational by the end of the war, and most of the top-secret German signals traffic was decoded. This operation, known as the Ultra secret, was a major contribution to Allied success. It was so sensitive that it was not declassified for over 30 years.

Research into the development of new codes and the development of new code-breaking techniques has continued ever since behind the locked doors of government security agencies. Yet it is unlikely that the goal of a completely secure coding scheme can ever be achieved with confidence.

The most secure systems are reserved for highly sensitive diplomatic and military use, but other potentially less secure systems have been made available commercially. "Less secure" in this context refers to the amount of computer time needed to crack a single message. In theory the eavesdropper must start from scratch every time the key is changed. Protection is therefore often measured in terms of years of mainframe computer time, but with the constant worry that someone will develop a short-cut algorithm of which the code designers themselves are not aware.

Another pitfall is the danger of interception of the secure message before it has been encoded. Data sent to a monitor screen, for example, is in serial form and generates significant radio-frequency emissions, which can be intercepted by nearby monitoring stations. To overcome this bypass problem, sensitive military data is only handled on approved equipment which has been carefully screened and tested to ensure that radiation has been minimised.

The level of protection available for commercial data is inferior to that used for government applications, but there are several schemes in use which should be adequate for everyday data security. The most widely known coding technique is the Data Encryption Standard (DES) developed by IBM and approved by the American National Standards Laboratory in 1977. At least four chip manufacturers supply devices which will encode and decode DES data.

The DES requires both the sender and the recipient of the message to use the same key, which it splits into two parts. The master key is changed relatively infrequently, while the session key is changed for each message.

To maintain key synchronism between the two ends of the link, the session key is encoded using the master key and is sent over the link before the message itself. Physical transmission of the master key is still necessary from time to time, and that is both troublesome and potentially hazardous. The DES operates in any one of three different modes, depending on the application and the required level of protection. It is suitable for encrypting and decrypting data files within a system — to prevent unauthorised use for example, and for protecting data-communication links to a remote site.

Chips which implement the DES scheme work on 64-bit blocks of data, encoding and decoding them by means of a 56-bit key. One of the first implementations was the Intel 8294 device, which appeared in 1978. This chip was intended to be connected to the data bus of an eight-bit microcomputer like any other peripheral device. It was capable of an 80 byte per second conversion rate. More recent devices operate at higher data rates. They include the WD-20C03 from Western Digital, the T-7000 from AT&T and the AMD-9568 from Advanced Micro Devices.

One of the newest cryptographic schemes of all is the RSA public key/private key system. It is named after Professors Rivest, Shamir and Adelman of MIT, and is unique in that it does not require the physical exchange of key data before you establish a communication link. In fact, anyone who is suitably equipped and who has access to the public key directory can send a secure message to anyone else in the directory.

The scheme uses a key which is computed from two very large prime numbers. One of the numbers is represented by the private portion of the key, the other by the public portion. To send a message, the originator encrypts the text using their private key, then encrypts their originator signature using the public portion of the addressee's key. On receipt, the addressee uses his or her private key to decode the identity of the originator so that he or she can look up the originator's public key, which is then used to decrypt the main message.

The combined public/private key length is such that it would take many millions of years of computer time to find the right combination, using the best of known mathematical techniques.

Unfortunately, the precise manipulation of the large numbers required in the encryption and decryption process makes this technique slow and difficult to implement in hardware. This in turn makes its use for high-speed data links unattractive. However, with suitable disc-file buffering for encryption and decryption, the RSA might be just the thing for sending love letters over the Telecom Gold.
Actually, it would take a double page spread to give you the whole picture. That's because with Viking I's 19" ultra-high resolution monochrome monitor you can now display two facing pages of text and graphics. And if you use Lotus 1-2-3" and Symphony™ you can view six times as much data at once. Viking I's 1280 x 960 display resolution is refreshed at 66Hz, to give you a steady, flicker free image. Which means, if you're a CAD/CAM user you can enjoy the sort of pin-sharp image you'd expect from dedicated engineering work stations. And by using Hitachi's powerful ACRTC HD 63484™ controller chip, Viking I offers stunningly fast drawing speeds.

So if you're tired of working in cramped conditions, take a look at Viking I. You'll never do things by halves again.

To find out more about the Taxan range of products, call us on 0344 482648.
Most people seem to find it difficult to adapt to change, and there is often a sort of halfway house which bridges the old and the new. Early horseless carriages, for example, looked like the horse-drawn variety, while the first television sets were just like wirelesses with small picture tubes built-in. British Telecom is probably being sensible, therefore, in launching a new system called Text Direct which bridges the gap between the clanking old telex system and real electronic mail like Telecom Gold.

Text Direct provides every subscriber with a unique telex number and a way to send and receive telexes, but without the added cost and delay of installing a dedicated telex line. Where a telex line costs £88 to start and then £88 per quarter, Text Direct costs only £20 to join and then £25 per quarter. British Telecom can sign you on to the service almost immediately.

With Text Direct you do not need to spend over £1,000 on a telex machine. Telexes are transmitted in the modern way, from your desk-top micro via a modem. Anything that can send an ASCII file down the phone line will do — a smart electronic typewriter or Tandy 100-type lap computer or any old supermicro.

Of course, telex users expect their communications system to be awkward to use, and here Text Direct will not let them down. Logging in is the first requirement. Rather than break new ground with, say, a Linkline number, or even provide a common group account like the one supplied to all Telecom Gold users, Text Direct expects you to get your own Packet Switch Stream (PSS) data communications account and pass-word. The alternative is to dial long-distance telecoms, or even provide a common group account like the one supplied to all Telecom Gold users. Text Direct then gets positively prolix:

DEAR JACK,

This Telex is being sent to you by British Telecom's new system called Text Direct. It is in upper and lower case, and has a carriage return (inserted every 65 characters or less) embedded in the text. Here are a few interesting telex characters:

Pounds £
Dollars $
Exclamation !
Angle brackets <>
Double quotes "

Let's see how this arrives — and when.

Regards

THE MESSAGE RECEIVED

DEAR JACK, THIS TELEX IS BEING SENT TO YOU BY BRITISH TELECOM'S NEW SYSTEM CALLED TEXT DIRECT. IT IS IN UPPER AND LOWER CASE, AND HAS A CARRIAGE RETURN (INSERTED EVERY 65 CHARACTERS OR LESS) EMBEDDED IN THE TEXT. HERE ARE A FEW INTERESTING TELEX CHARACTERS: POUNDS £ DOLLARS $ EXCLAMATION ! DOUBLE QUOTES " ANGLE BRACKETS <> THE AT CHARACTER @

LET'S SEE HOW THIS ARRIVES — AND WHEN. REGARDS

Text Direct then gets positively prolix:

Welcome to Textdirect.
Previous logout: 01 JAN 80 00:00
Unread messages: 0
Total messages: 4
Storage: 8 kilocharacters.
...leaving you to guess what to enter next. Try Read and its says:
Filename:

Please login

Having got this far, Text Direct still has no idea what business you might be about, so you have to type LOGIN to tell it that you plan to log in. Now, at last, you can enter your identification such as WHIZCOMP followed by your password.

Text Direct then gets positively prolix:

NAME: SCHOFIELD
0000000000
XXXXXXX
Login successful.

You can then enter text, ignoring Returns and line spaces. After a quick dip into the manual you try typing in your outgoing message, ignoring Returns you have entered and line spaces.

Text Direct converts everything into one name is. So you enter Return, assuming an intelligent system will provide a list, but all it says is:

Not found

After a quick dip into the manual you try typing in SCAN UNREAD and take it from there.

Sending and reading unread telexes is actually quite easy, though it is certainly no easier than in either Telecom Gold or Mercurylink, formerly Easylink. The main drawback is the way Text Direct reformats your outgoing message, ignoring Returns you have entered and line spaces.

Text Direct converts everything into one (continued on page 30)
In the fire protection business, every risk is different. Every warehouse, factory, oil rig or office block has its own special problems. But, while no two fire protection systems are the same, they are designed and constructed from a wide range of standard components and sub-systems. This results in a heavy design and drafting workload, frequent revision, and a high output of drawings for both clients and regulatory authorities.

That's why Chubb Fire, one of the world's leading fire protection equipment manufacturers, decided to implement a computer-aided design system based on AutoCAD.

Over a three-year period, Chubb Fire has progressed to a multiple-workstation system which handles all drafting and design work, including design revisions. It also provides 3D visualisation of key design elements; a material "take-off" system, which automatically generates lists of materials required to fulfill a specific design; a materials management system and job costing.

Chubb Fire's comprehensive design and materials management system is one of thousands of examples of how AutoCAD is making a major contribution to design efficiency in applications ranging from architecture to robotics, in companies both large and small. Today, more than 80,000 installations worldwide, and over 6,000 sold in the UK, have established AutoCAD as the international standard for CAD on personal computers.

AutoCAD runs on more than 30 16-bit and 32-bit microcomputers, supports more than 140 peripheral devices for input and output and costs just £2,500 + VAT. A demonstration version is available at £50 + VAT.

The latest version, AutoCAD 2.6, offers extensive 3D capabilities, transparent zoom, pan and view commands, and associative dimensioning. AutoCAD's standard features include an unlimited number of layers, comprehensive editing facilities, and a complete internal programming language, AutoLISP. AutoCAD is now even faster and easier to use, and more responsive to your drafting and design needs than ever before.

Write or telephone for your information pack or the name of the nearest AutoCAD Main Dealer to arrange a "hands-on" demonstration of AutoCAD's powerful capabilities.

AutoCAD is a registered trademark of Autodesk Inc.
long piece of spaghetti, which is a disaster if you are trying to send a carefully formatted table. The only amusing aspect of this is the way the Text Direct software handles lines longer than regulation telex width. As you upload, it deletes the overflow and reprints it, starting on a new line.

As on most systems now, you can build up a library of telex addresses to make sending telexes easier, using the form

**ENTER: SE <ADDRESS FILE NAME>**
**<MESSAGE FILE NAME>**

This is almost exactly the same as the using short codes on Telecom Gold

**COMMAND: SE <FILE NAME>**
**<SHORTCODE>**

The real problems with Text Direct start when you want to read and delete stored messages. Instead of entering sensible file names like PCOM8700A or whatever for my uploaded telexes, I foolishly let the system create them. Each telex resulted in two names of the hideous format

```
<s2124apr12.ADR:OLD
<s2124apr12.TXT:OLD
```

and getting rid of them was extremely tedious.

If you have sent a dozen telexes, you might have two dozen files. On Telecom Gold you would just type

```
TELEX DEL SENT
```

or

```
DEL 1-12
```

in Scanned Mail, or you could batch delete a bunch of files using the Delp command. With Text Direct you have to type in each file name in full and confirm that you want to delete it.

On Telecom Gold, received telexes simply appear in your standard mail tray, which means each one ends with the prompt

```
Action required:
```

You can then type Del or Save or File, or simply enter a Return and leave the item on file. Deleting a telex you have read on Text Direct shows how picky the software is. The system asks you whether you want to delete the file, offering you yes/no options. Typing Y or y if you want to delete will not do; only the full Yes will do.

Where the Telecom Gold software copes quite well with the restricted telex character set, Text Direct barely even tries. It does transmit "$5" as it stands, whereas Gold converts it into

```
POUNDS 5
```

But where Gold changes $5 into

```
DLRS 5
```

Text Direct just puts ?. Where Gold converts a double quote into two adjacent single quotes, an exclamation mark into a full point, and the angle brackets into .LT. and .GT. — which means you can restore them using search and replace on your word processor — Text Direct simply changes them to ?, ? and ??, which is considerably less useful. Nor does Text Direct provide Telecom Gold's on-line editing and filing software.

Nevertheless, there are a few good things to be said about Text Direct. The system does work well. The Stratus 68000-based mini — IBM sells the same thing as the System/88 — is fast, and telexes are despatched within a few minutes. By contrast, Gold users have sometimes found their Prime superminis unresponsive and slow to get telexes out; in exceptional circumstances the delays have been hours. However, this could be because Gold is a success, while I used Text Direct when it was too new to have more than a handful of users. Only when Text Direct fills up will we find out if it is really any better.

Text Direct's neat box of documentation, produced by Baddeley Associates of Cambridge, is superb. However, Telecom Gold has also just released excellent new documentation. Gold's new Quick Guide, a readable 96-page ring-bound manual, is now being supplied to new users, though old ones have to pay £4 for it.

Pricing of the two systems is also comparable. Text Direct is a touch cheaper at 10p per minute compared to Gold's 11p. However, Gold offers an off-peak 3.5p per minute, while Text Direct has no off-peak reductions. Gold is also cheaper for light users, since it has dropped the £10 per month minimum charge, whereas Text Direct has a £25 per quarter standing charge.

Given that Text Direct is even less easy to access than Telecom Gold, that its software is even more unfriendly, that the system as a whole is less versatile, and that it probably costs more for many people, what is the point of it?

First, Text Direct provides every user with an individual telex number of the form

```
S3124100009-TDG
```

This is not as nice as a proper telex number and answerback, but it is better than Gold's bureau service, where the sender has to remember to put your mailbox number in the first line of text.

Second, Text Direct is not aimed at Telecom Gold at all. In my opinion, Text Direct is targeted against the very similar Mercury Link service, which is hopeless as an electronic mail system but provides a quick and easy way of sending telexes.

Finally, and most cynically, it could even be — as I hinted to begin with — that Text Direct is accurately targeted at business users for whom real electronic mail — which is only five to 10 years old — is too futuristic. If you have any better ideas, I am on 01-742 4431.

```
Prime superminis unresponsive and slow to
get telexes out; in exceptional circumstances
the delays have been hours. However, this
could be because Gold is a success, while I
used Text Direct when it was too new to have
more than a handful of users. Only when
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```

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MS-DOS DATE IN ENGLISH FORMAT

A recent visitor from the support company for our XT was rearranging the date format. He discovered a rogue file called Autoexec with no extension, as well as the Autoexec.Bat file. We do not know why, but the rogue file could not be edited. The normal Autoexec.Bat file now works as expected, except that on power-up the system uses the American mm-dd-yy date format, whereas before these changes it used the dd-mm-yy format. How can I get back to the old English date?

J O SIMPSON

We suspect that your colleague replaced the Command.Com file where it was using previously, and the new copy expects American dates while the old one accepts English dates. We do not understand what the file labelled Autoexec is trying to do, but it would not be used anyway unless it was renamed Autoexec. Bat. The fact that you cannot edit it suggests that the file attributes have been set to make the file read-only, so that it cannot be deleted or edited by accident. You can check the file attributes with the command

```
ATTRIB filename
```

and if necessary you can remove the read-only attribute with the command

```
ATTRIB -R filename
```

You can then edit or delete it in the normal way.

We too dislike the American date format of mm-dd-yy used by default on the IBM PC, and there are several ways to get it to use the English arrangement. If you are using PC-DOS version 2.1 — as opposed to MS-DOS version 2.1 — you can produce a new working copy with a changed date format. When you run the IBM Master disc to produce a new working copy on another floppy disc, it will ask you which date format you wish to use. It actually alters the Command.Com file. Boot up the new floppy and type Dir. If the dates that the files were written on are displayed the way you require, copy Command.Com from this floppy on to your hard disc, thus overwriting the one already there. From then on, the English date will be displayed when you boot from the hard disc.

If you are using MS-DOS you are not given this choice of date format. I expect that you have an extra memory board in the computer. If the board contains a battery clock you should be able to read the date and time automatically when you boot up. If this is not so, you will not be asked to type the date and time when you boot up, so the order of the terms that you normally would have to type is not relevant.

You can patch the Command.Com file using the Debug program to make the dates shown when you do a Dir listing appear in English format. Type the command

```
DEBUG COMMAND.COM
```

and press Enter. When prompted, type the lines shown in the listing on the right, with Enter at the end of each line. The patch is for PC-DOS version 2.0, but I have also used it on PC-DOS and MS-DOS versions 2.1.

You should now be back at the operating-system level. Reboot the system by pressing Control, Alt and Del, type Dir and press Enter. If you have got it right, you will find that the dates are now shown in the new dd-mm-yy format. It is prudent to make these changes on a backup copy in case of accidents. I found that this code worked for me, but I cannot guarantee it will work for you.

If you use PC-DOS or MS-DOS version 3 then Microsoft have made the choice of date format much easier. If you have a file called Config.Sys on the disc you use to boot the system, add the statement

```
COUNTRY=044
```

as an extra line in this file. If there is no Config.Sys file you must create one with Edlin or your word processor, and put just this one line in it. When this file is read automatically at boot-up time, the system will know that British dates are required.


c乡音心

Q I have tried everything I can think of, but cannot get the £ symbol to display on the screen or print on an IBM Proprieter using WordStar 3.3. Can you help?

E G ACRAMAN

A Micropro tells me that the problem may arise because you are using WordStar version 3.3, which only supports seven-bit characters — that is, ASCII codes 0 to 127. The £ sign is an eight-bit character, ASCII value 166, so it cannot be displayed properly. Our guess is that it will ignore the eighth bit, and thus show the corresponding seven-bit character.

WordStar version 3.4 supports eight-bit characters, so any character in the IBM set may be displayed on the screen. Provided your printer supports the IBM set it should print correctly too.

To cure the problem you need to upgrade your WordStar to version 3.4. This costs £125 and must be done through a dealer, who will require the return of your old master disc.

You could upgrade to the full WordStar Professional and get Mailmerge, the Correctstar spelling checker and the indexing program at the same time.

With version 3.4, you can get the £ sign by holding the Alt key down and typing 156 on the cursor pad at the right-hand side of the keyboard; it will not work if you use the numbers along the top of the keyboard. If you examine your DOS manual you will find a full list of the ASCII characters, and you may display any others in a similar way.

DOS DATE

```
A 1E66
1B66 AND AL,1F
1BB8 MOV BH,10
1BB4 CALL 2A89
1BBD MOV AL,2D
1B6F STOSB
1BC0 MOV CL,05
1BC2 MOV AX,DX
1BC4 SHR AX,CL
1BC6 AND AL,OF
1BCE W
Q
```

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John and Timothy Lee

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APRICOT XEN-i 386
COMPACT SUPERMICRO

By Glyn Moody

With its top-end machine Apricot has combined the latest engineering features with full IBM compatibility.

A couple of years ago Apricot was aspiring to become a £100 million company. Last year, its product lines in disarray, it experienced severe financial problems which plunged it into the red for the first time. Recently, however, it seems to have returned to a more even keel. It has now committed itself to the IBM standard, tightened up its range of machines and has even been on the acquisition trail, buying the network specialists DMS, and bidding for Wordplex, a company that manufactures word processors.

Against this background its latest 80386-based micro assumes a particular importance. If Apricot is to establish itself in the high-performance end of the marketplace, which is rightly seen as the only viable sector for its continued expansion, the latest addition to the Xen family needs to be right and not just good.

The Xen-i 386 comes in a number of versions. The one reviewed here had a single 5.25in. floppy, a 45Mbyte hard disc and a so-called paper-white monitor. The cost of this system is £4,547.

Externally the new machine looks identical to the 8086-based Xen-i reviewed in Practical Computing’s September 1985 issue. Indeed, the same box has been used, except for the back panel. At the front there is the disk drive, which can be either 5.25in. or 3.5in. — the cost is the same — together with indicator lights for floppy-disc access, hard-disc access, voice and power. The voice light is an indication of Apricot’s long-term commitment to speech recognition, despite the embarrassing failure of the Apricot Port-commitment to speech recognition, despite the embarrassment, which possessed it in rudimentary form.

At the back there are ports for the keyboard and mouse on the right as well as serial and parallel ports, both supplied as standard. There are three output slots for cards, one of which is taken up by a video adaptor. A d.c. power supply output is provided for use with the XP-i expansion-card box. The power supply input and on/off switch are also at the back. The optional Apricot mouse is unchanged from the device available with older machines. It is big and clumsy, and does not roll smoothly across the desk; producing an improved model should be an immediate priority for Apricot.

Three monitors are available from Apricot: green or paper white in monochrome and an EGA-compatible colour unit. For each type a different display adaptor is required. This use of a separate card for video is something of a reversal for Apricot, as it has hitherto incorporated the circuitry on the main board.

The main external difference between the new and old models of the Xen lies in the keyboard. Apricot has gone fully IBM compatible in this department, using the layout with separate cursor keys. The distinctive Microscreen found on earlier Apricot machines has finally disappeared. The keyboard has a rather mushy touch to it; it feels odd at first, but proves quite suitable for fast touch-typing.

APRICOT XEN-i 386

VERDICT

- Performance
- Ease of use
- Documentation
- Value for money

Q Q Q Q

Q Q Q Q

Q Q Q Q

Q Q Q Q

Probably the fastest 80386 machine yet.

Opening up the machine reveals a characteristically neat and tightly packed interior. One reason for this is that the power supply — formerly an ungainly and inconvenient chunk of iron which sat on the floor beside your desk — has now been incorporated within the low-height box. This represents a considerable feat of engineering, but the rating of the unit is only 100W, which seems low for machine of such high processor power. It certainly seems to preclude hanging power-hungry add-ons off the main unit. Not that Apricot makes it easy for you to add cards anyway. Because the extreme density of components packed within the main systems box — which is much smaller than comparable offerings from Compaq or Zenith — only three half-length cards can be accommodated, one of which has to be a video adaptor card.

Like the new IBM Personal System/2 machines the Xen-i 386 uses surface-mount technology and a number of gate arrays. The result is a very neat motherboard. There was only one jumper lead visible, suggesting that the design is now pretty stable. A four-layer PCB is used, with components mounted on both sides — again allowing a lot to be crammed into very little space. Memory is held in the form of the trendy single in-line memory modules (SIMMs) now used on most new machines. The standard configuration offers 1Mbyte of RAM, but swapping in SIMMs carrying 1Mbit chips takes this up to a maximum of 8Mbyte.

The ROM BIOS comes from Phoenix — the leading supplier of compatible ROMs for clones — but includes a number of Apricot additions. One neat feature of the machine is that on power-up the contents of ROM are copied into write-protected 32-bit RAM. Apricot says this speeds up the general performance of the machine. If you use an EGA-compatible card, it is also possible to copy across the contents of its ROM in a similar fashion.

The main 80386 processor is clocked at the usual 16MHz. Running our standard
SPECIFICATION

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Mass storage: single 3.5in. or 5.25in. floppy with 30Mbyte or 45Mbyte hard disc
Keyboard: standard IBM design
Display: Hercules-compatible monochrome or EGA/CGA adaptors available
Size: 380mm.(14.9in.) x 370mm.(14.6in.) x 105mm.(4.1in.)
Weight: 6kg.(13lb.)
Software in price: MS-DOS 3.2, Windows, VP-Planner, GWBasic 3.2
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Above: The XP-i expansion box plugs into a bus on the side of the system box.
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Printer currently used: ______________  Telephone: ______________________
Basic Benchmarks the machine turned in a cool 1.75 seconds. Although it is not particularly meaningful to start comparing figures to the nearest 1/100th of a second, the fact that this machine is at least nominally faster than any other — including the new IBM Model 80, which turned in 1.83 seconds — is an indication that once again Apricot has come up with a superb piece of engineering.

The performance of the discs is similarly impressive: running the Bagshaw Benchmarks produced figures of 31 seconds and 221 seconds for the hard and floppy discs respectively. This compares with 81 seconds and 235 seconds for the Xen-i 286. The Kaypro 386's hard disc turned in 59 seconds, while the Zenith Z-386 achieved 32.4 seconds. The Xen-i 386's performance is partly a reflection of the effort put into R&D by Apricot: even during its rockiest period it maintained a team of about 60 people working on various hardware and software projects.

Another result of this in-house expertise is that Apricot has bundled with the system a number of small but possibly handy utilities Microsoft Windows comes as standard, and when you are running it you can call up a program which mimics the absent Microscreen. A small window then displays a representation of the 12 function keys together with their current assignments. As you change the active window, the labels change too. This facility provides a handy reference aid for people unfamiliar with the machine or the software on it.

The Timebomb utility enables you to take the clock speed down to 8MHz to overcome any compatibility problems. Rather neatly, it allows you to set the length of time for which this speed is operating. You might allow yourself a minute at 8MHz to log on with, then let the machine rip at 16MHz once you are over the hurdle of any compatibility checks run by the software. This might prove useful when using modern cards and the like.

To cater for full-length cards, Apricot has provided one of its bolt-on expansion boxes. Two ports on its side connect into the main system box; power is taken from the d.c. socket at the back. This is a solution to the needs of those who want to add various exotic cards, but it is not completely satisfactory.

The Xen-i 386's main virtues are its performance and compact form, together with a reasonable price. They make it ideal for power users who want a really fast machine on their desk, but not on all of it. The Xen-i 386 is also ideal for Xenix applications. Apricot is hoping to sell large numbers of the machines for this purpose, and has produced a range of high-capacity hard-disc units. In this form, the machine will be sold as the Apricot VX.

As well as Windows and GWBasic, the Xen-i 386 comes bundled with the VP-Planner spreadsheet, which we reviewed very favourably in our February 1986 issue. There are four manuals, produced in a uniform style and to a consistently high standard. The manual for VP-Planner is a direct reprint of that from Paperback Software, one of the best manuals around.

Apricot remains the country's leading indigenous micro manufacturer, but that is not the only reason for wishing the company well with its latest product. Unlike IBM, it has always pushed the technology hard — sometimes, as is in the case of the ill-fated Portable, too hard. Its pricing is aggressive and generally its approach to micros has always been refreshingly different. By targeting the Xen-i 386 at the top end of the market, in both single- and multi-user environments, Apricot seems to be showing a just appreciation of both the current micro world and its own strengths and weaknesses. How it fares will depend on the evolution of business micros during the current period of uncertainty created by the launch and delayed availability of the new PS/2 and OS/2 products.

CONCLUSIONS

■ The Apricot Xen-i 386 is a superlatively fast, compact AT compatible.
■ Apricot has finally gone completely IBM compatible, even down to the keyboard.
■ The greatest weakness of the machine is its limited expansion capability within the main system box and the low rating of the power-supply unit.
■ As well as being ideal for power PC users, the Xen-i 386 lends itself to departmental computing based around Xenix.
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**PRACTICAL COMPUTING August 1987**

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**PREPARED USING VENTURA PUBLISHER**
All too often, valuable data is lost when people forget to make backups. With this system the job is done automatically.

Micros have become such an accepted part of business practice today that nobody thinks twice about using them. Unfortunately, it is also true that few people think twice about some of the more mundane aspects of micros, like making backups. Losing valuable data irretrievably is perhaps the business user's most painful lesson in the pitfalls of information technology. Hitherto this initiation rite has probably seemed the only way to get across the message that regular backups are not just good practice but they are essential whenever hard-won or voluminous data is involved.

But this is no longer so. The Automatic Recovery and Control (ARC) tape backup units from Digital Storage Systems are based on the familiar premise that prevention is better than cure. Instead of banging your head against the brick wall of users' insouciance, they allow you to circumvent it by getting the hardware to make backups automatically.

The idea is simple enough. An intelligent tape backup unit monitors all updating of files. Once its buffer is full, or after a preset time interval, all new versions of files are automatically backed up on to tape. In the event of power failures or some other catastrophe, there is a full audit trail available. The price of such a neat and simple idea varies from £1,600 to £4,000.

The ARC units come in two series. The ARC-8000 has the appearance of a small stand-alone disc drive, and uses high-density magnetic tape cassettes. The ARC-9000 series reviewed here comes as a low unit which sits on top of the main PC systems box, and uses standard 0.25in. data cartridges. It also has optional Winchester disc drives for boosting conventional storage.

Hooking the unit up to a PC, AT or close clone is simple. A half-length card takes up one slot, and a cable from it connects to the large 57-pin D socket in the back of the ARC unit. There is a separate power lead, so no power is drawn from the PC.

Software installation takes a little longer. First you must switch on the ARC unit with the PC turned off. This allows the tape streamer to go through a full diagnostics routine, signalled at the front via a two-character numeric display which shows the codes of any faults. Once the system has been set up, the same display is used to indicate the percentage of the tape which has been filled with data.

The micro is then booted up using DOS 3. Placing the ARC software disc in the floppy and typing TAPE sets off the automatic installation procedure. After asking a few questions about the target drive and suchlike, it makes a subdirectory called Tape, and then loads the relevant files across from the floppy.

Once these files have been transferred, you have the choice of running the ARC unit via simple menus, or directly from the command line. The menu is brought up by typing TAPE again, and has eight options. After installing the hardware and software, the System Setup option is used to set the time and date, the interval between data backup, up to two selected drives, and the tape

(continued on next page)
The Catalog command is like Dir in DOS, and allows you to inspect which files have been saved on tape. This can be accomplished with a single command. Whenever any of these files are changed on the hard disc, copies will be added progressively to the tape. It is also possible to save specific sub-directories rather than whole discs.

Complementing the Save command is the Retrieve command, which allows you to pull back copies from the tape to the hard disc. As with Save, there are a variety of levels at which this can operate: disc, directory and files. It is also possible to specify whether or not the chosen files will overwrite all files, including those which are read-only.

The Catalog command is like Dir in DOS, and allows you to inspect which files have been saved on tape. Again, the search can be narrowed down to any level. At the lowest level you choose a file by the time at which it was saved. All files are date and time stamped as they are saved to tape. This provides a unique reference to multiple copies of files which are constantly modified. It also allows you to choose which version you restore from.

Once installed, the ARC-9000 can be used without further attention from the operator.

<table>
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<th>Specification</th>
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**Description:** automatic intelligent tape backup unit for PCs

**Software in price:** memory-resident program and relevant utilities

**Hardware required:** IBM PC, PC/AT or compatible running MS-DOS 3 with at least 256K RAM

**Prices:**
- £1,600 for ARC-8020 20Mbyte cassette unit
- £1,800 for ARC-8040 45Mbyte cassette unit
- £2,500 for ARC-9060 with 60Mbyte tape streamer
- £4,000 for ARC-9062 with 60Mbyte tape streamer and 40Mbyte Winchester

**Manufacturer:** Digital Storage Systems, Colorado

**UK supplier:** Specialix Systems, Roseneath House, Giggis Hill Road, Thames Ditton, Surrey KT7 0TR.

**Telephone:** 01-398 7122

**Available:** now

Once installed, the ARC-9000 can be used without further attention from the operator.
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Programs are immediately accessed from the Shell menu by a single key stroke as are the 6 powerful utilities which provide a full function Calculator, Calendar, Notebook, File Manager, Macro and Program Editor.

The movement of text, figures, graphs and records is simplicity itself within WordPerfect Library, which gives an impressive degree of flexibility, in operation and is simplified by the use of function keys and a colour coded template dispensing with the need for complex control codes. Create your own menu structure, from which you can run DOS commands and batch files.

To improve your knowledge and to find out details of how you too can join the WordPerfect Library, telephone or write to Sentinel Software.

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FOR PEOPLE WHO MEAN BUSINESS
With colour and a full expansion capability Apple is hoping to move the Macintosh concept into the power-user mainstream.

The first thing that hits you about the Mac II is how much like an IBM it looks. Gone is the tidy all-in-one unit of the original 128K Mac and its latest upgrade, the Mac SE, which we reviewed last month. Instead you have what looks like any other desk-top PC, complete with system unit, monitor, keyboard and mouse. Like most desk-top setups, it is not something you would want to move around very often. While the Mac SE, with its single hard-to-reach expansion slot, was Apple’s gesture towards an open system, the Mac II embraces the philosophy wholeheartedly and has six slots.

The Mac II comes in the same off-white colour that the SE does, but there the similarity ends. The Mac II’s system unit is big and boxy — about the size of a PC, though more smartly styled. The plastic casing is ribbed on the top and sides, neatly hiding the ventilation slots.

At the front there is an indicator light for the 20Mbyte hard disc which was fitted to the model we reviewed. Apple also offers 40Mbyte and 80Mbyte options as well as a floppy-only version. To the right lie two slots for 800K floppy-disc drives. One floppy drive comes as standard; the second slot is covered by a plastic plate when not in use. At the back of the system box there is an on/off switch, a switch for switching off the Power as well. If you wish to reboot without actually shutting the power off first, there is also a Reboot option on the same menu; this has the advantage that the hard disc is not continually subjected to the stress of being switched off and then on again.

As with the Mac SE, the Extended Apple Keyboard is available as an alternative to the standard keyboard. The Extended keyboard has a layout close to that of IBM’s latest model, complete with function keys. Also, you have two ways of connecting the mouse. You can either plug both the keyboard and the mouse into the Desktop Bus connectors, or you can daisy-chain the mouse to the keyboard. The mouse itself is the new-style unit that also comes with the SE.

EASILY OPENED UP

Opening up the Mac II is a joy. You can wave goodbye to the long-handled screw-drivers needed to open up previous Macs — and in fact the Mac II is easier to open than many IBM compatibles. You only have to undo one screw at the back of the system box, then press down two catches at the top of the box to release the lid. It is then free to be lifted up and back, and removed completely. Putting it back on again is even easier, as it snaps back firmly on to the case. The motherboard sits right at the bottom of the unit. To the right of it are the power supply and cooling fan, housed together in a steel box. The hard disc is positioned to the left, mounted on a steel brace above the motherboard. The floppy-disc drive is positioned towards the front of the machine, where there is also space for a second floppy drive. The steel brace supporting the disc drive can be easily removed by undoing four screws. The disc assemblies can then be lifted out to reveal the motherboard.

Two batteries for the clock are mounted on the motherboard; they are said to have a life expectancy of eight years. Beside the batteries lie eight single in-line memory (SIMM) slots. On the review machine, four of these slots were occupied by small cards titled at an angle to the motherboard. Each card carries eight 256Kbit chips, making a total of 1Mbyte on the four cards. Memory can be increased by swapping in cards carrying bigger chips. Apple offers 1Mbyte cards, allowing memory to be upgraded to 8Mbyte. Above the chips lies the 68020
main processor and 68881 maths co-processor. A loudspeaker is mounted next to the motherboard, attached directly to the casing.

The maths co-processor is a significant addition, given the market at which Apple is aiming the Mac II. Apple sees the Mac II as a high-performance business machine aimed at medium to large businesses. It is being targeted particularly at organisations dealing in CAD, engineering, higher education and research, where high-quality graphics, modelling and computationally intensive tasks are likely. Packages written according to the Standard Apple Numerics Environment (Sane) will automatically invoke the maths co-processor to increase performance by up to 30 times. Lotus Jazz, for example, will be able to make use of the co-processor in this way.

Apple claims that the Mac II is four times faster in operation than the Mac Plus, but when the maths co-processor is addressed directly this speed advantage is said to increase to a factor of 200.

The Apple Sound Chip (ASC) has four channels, a stereo capability and a 44kHz sampling rate. The high sampling rate will allow very high-quality output, and the on-board stereo sampling generator means it can drive external stereo equipment like speakers, headphones and amplifiers. The Mac II supports the Midi interface, allowing it to be used as a controller in music applications. In future Apple hopes to use the capability of the sound chip to handle voice input and output, and to add sound to graphics.

The presence of the sound chip is evident from the moment you switch the machine on. Instead of the puny beep of its siblings, the Mac II emits a far grander sound, as if someone had struck a chord on an electric piano. You can adjust the sound the machine makes to accompany an on-screen
error message. To do this you go to the Control Panel, select the Sound icon, and then adjust the volume and quality of the sound. You are given four different sounds to choose from: Clink-Klang, Bong, Monkey and Simple Beep, which will cause various humorous screeching and clanking sounds to come from your machine.

The inside of the Mac II is very roomy, primarily because there are very few chips. Like IBM, Apple has opted for custom chips and surface-mounted technology. The spaciousness of the machine’s interior makes inserting expansion cards a relatively simple task.

There are six Nubus expansion slots. They use a bus and card design completely different from the SE; it is not possible to transfer cards from one machine to the other. Apple says that it chose a different bus for the SE to keep it compact; it would have been impossible to incorporate the large Nubus slot. This reasoning is undoubtedly sound, but it is a shame that Apple could not maintain compatibility across its two card-carrying machines.

One of the slots in the Mac II will always be taken up by a video card. Inserting extra cards into one of the empty slots is easy. You do not even have to undo any screws to take out the expansion cover shield; you just lift up the shield until it is free of the guide and pin holding it, then push out the plastic cover that lines up with it. Expansion cards all have their own cover shields that slot into the guide and pin.

Unlike IBM expansion slots, Nubus slots can operate independently of the processor. This allows the expansion cards to take control of the machine. Even the machine’s main power supply can be controlled by software running on a card so that, for example, a battery-powered modem card can wait to receive a incoming signal while the main machine is switched off. Once a signal is received, the software can switch on the power supply and run the main program to, say, download a file, then switch off again afterwards. Another advantage of the Nubus is that it does not require the user to confine the slots or set any DIP switches; also you can put any card in any slot.

The open architecture of the Mac II may well be seen by clone makers as an open invitation. However, a glut of Mac compatibles seems unlikely for a number of reasons. Apple’s use of its own custom chips will act as a deterrent to many people, while others may be put off by Apple’s track record in defending the copyright of its products. It was very active about three years ago, taking action against Apple II clone makers. Even more importantly, the Mac II is as yet unproven, and clone makers may be reluctant to invest heavily in copying a machine that is heading for a niche market with slim profit margins.

Apple supplied us with a monochrome monitor for this review since its own colour monitor was not ready in time. We were also able to use Supermac’s Spectrum graphics system, which consists of a video card and a 19in colour monitor with a maximum resolution of 768 by 1,024 pixels. To set the monitor status on the Mac II you go to the Control Panel and click on the monitor icon. You then click on Color or Black & White/Grays, whatever is appropriate, and scroll to the number of colours or shades of grey that you want.

With the standard video card you get a maximum of 16 colours or greys. With the video-card expansion kit you get a maximum of 256. Colour is displayed on monochrome monitors as the equivalent number of grey levels. If your monitor is colour you click on the Convergence Test button. A grid of four boxes then appears, which helps you check that the red, green and blue guns are set correctly for the best picture colour. You do this by adjusting the brightness control until the middle of the lines surrounding the boxes appears white.

Any test of Mac’s colour capability is hindered by the scarcity of colour software. We were able to see a display of pictures produced on a three-dimensional modelling package called Dimensions. Other than that the only package we had any success with was Cricket Graph, though Cricket Draw is said to work in colour on the Mac II as we have previously seen the Xpress DTP package do.

We were able to use Reflex, Write Now, Just Text and Ready Set Go 3. But we were surprised to find that many packages did not work properly on the Mac II. Macwrite, Macpaint, Full Paint, Comic Works, Superpaint, Colormate and Adobe Illustrator all failed to function; some of them would not even load. With the drawing and painting packages, four boxes appeared at the top of the screen, obstructing the menu bar, and whatever we drew appeared inside them.

The problems arise because some software developers have not followed Apple’s programming guidelines. Painting programs in particular have proved to be a problem, and many of them encounter difficulties with memory management that cause them to go into the screen buffer and repeat themselves. Apple’s own Macwrite does not work because it is one of the very first Mac programs, written before colour features were allowed for in Apple’s guidelines.

Apple says it will be providing upgrades for Macwrite, Macpaint, Macdraw and Macproject. At the moment it is envisaged that they will be free, though the upgraded Macwrite may require a few manual which might have to be paid for. The decision of Apple in the US to hive off its software operations may also affect this.

How outside software publishers deal with the problem is yet to be seen. Apple is compiling a list of packages which have been tested for compatibility. Microsoft has announced upgrades of Excel and Word 3, while claiming that existing versions will run on the Mac II.

There was also a dearth of expansion cards for us to test the Mac’s expansion capabilities with. AST has announced an MS-DOS expansion kit which puts the equivalent of a PC/AT on two boards and allows MS-DOS to appear in a window on the Mac II, but is not due to appear until late this summer. Apple itself will be launching a version of Unix System V version 2 in September or October. The £235 Apple PC disc will support a standard 360K 5.25in. IBM disc, when it appears.

When we booted up the machine from the hard disc, it occasionally booted out on us straightaway. We require the aid of advice from the very clear manual, which suggests that you boot up from a System Tools disk in the floppy drive and replace the System file on the hard disc with the file from the System Tools disc.

A further disappointment was that the base system costs about £1,000 more than Apple anticipated. Apple says there is no particular reason for this, merely that its original estimate when we previewed the machine in April was only a rough guess. The unfortunate consequence is that the machine is not as good value as we first thought. Apple believes that its target market for the machine is not price sensitive, and that for CAD/CAM use the Mac II is a lot cheaper than comparable work stations.

Apple sees the Mac II as being in competition with the IBM PS/2 Model 80, which costs just over £5,000 for a base machine with a 44Mbyte hard disc and mono monitor but no maths co-processor. The Mac II with a 44Mbyte hard disc costs £5,495, but Apple has the advantage that the Mac II is around now, with a fully functioning operating system. The Model 80 and the OS/2 operating system are not expected until the end of the year.

CONCLUSIONS

The Mac II looks good. It has nearly all the virtues of the original Mac plus an impressive colour capability.

The possibility of expansion opens up the world of the Macintosh to the outside — in particular to the IBM world — which will make it a more attractive proposition for business users. We will also find new markets in the CAD/CAM area.

The Mac II is as easy to use as its predecessors, and inserting expansion cards appears to be simple too.

So much software and few hardware expansion products are yet available to run on the Mac II, still less to make full use of its features.
+ PLUS WYSIWYG, so that what you see on screen is what you get from your printer. (And what you get is brilliant.)
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HARVARD PROFESSIONAL PUBLISHER DOCUMENT PRESENTATION PACKAGE

By Carol Hammond

The ability to handle long documents and detailed control over typesetting style are the special virtues of Software Publishing's DTP package.

The first time we looked at a desktop publishing (DTP) package for IBM compatibles was back in February when we reviewed Ventura Publisher. Harvard Professional Publisher (HPP) is Ventura's main rival and comes from Software Publishing, which also distributes the successful range of PFS products and HPP's two stablemates—Harvard Presentation Graphics and Harvard Total Project Manager.

HPP rivals Ventura rather than Aldus PageMaker because, like Ventura, it is not a page-based package; its strength lies in its handling of multi-page documents. HPP's roots lie in the typesetting industry. It was co-developed by Software Publishing and Bestinfo, the company which produces the Superpage package. Superpage costs around £7,000 and is aimed at typesetters who want to do page layout. Software Publishing claims that HPP is essentially a cut-down version of Superpage, aimed at business users, with its important features crammed into a £595 package. HPP has the facility to transfer files across to Superpage, where further refinements to typography and layout can be undertaken.

HPP certainly does offer a high degree of typographical control, including kerning, tracking and hyphenation. In this respect it is on a par with Xpress, which runs on the Mac. HPP uses its own in-built algorithm to control hyphenation and to ensure that no more than two consecutive lines end with hyphens. It does not, however, offer users the option of setting up their own exceptions dictionary where they can specify their own house style for particular words to be hyphenated.

HPP does not offer search and replace or cut and paste. These functions are deemed to be the province of a word processor, something HPP does not possess. The authors argue that since HPP works with files that have been imported from word processors, to include one within the package would be merely repetitive.

Some editing can take place within the package, but any hefty alterations should be made within a word processor. When you edit text within HPP, your original word-processed files are updated to incorporate the changes. This allows HPP to use the updated version if any pages are rerun.

In this respect HPP betrays its typesetting heritage. Typesetters expect word processing to be done by someone else; they are merely the vehicle to produce finished work in typeset form. To a large extent HPP adopts the same principle; it takes word-processed files and puts them alongside graphics to produce a typeset version of a document. Everything in the package is geared towards fast turnaround, and to that end it employs tags and style sheets just as Ventura does.

LESS FRIENDLY INTERFACE

What you lose with this approach to DTP is the ability to do more complicated individual page layouts. Another drawback of Harvard is that you have to deal with a less friendly user interface than on Mac packages like Xpress — or indeed with Aldus PageMaker and Ventura on the IBM, which use Mac-like interfaces.

The entities that HPP works with are document files, style sheets and format files. The document file contains the text and graphics which make up your document. You set up style sheets and format files and then attach them to your document file; they dictate the style your document is to follow and what typeface and style its headlines and text will appear in.

Software Publishing recommends that you create a separate subdirectory for each document to enable you to keep track of files as you work. All the files you want to use in a document should be kept in the same subdirectory, including the picture files, text files and page styles you expect to use. If you want to reuse the same formats and page styles you just copy them to the relevant subdirectory each time.

When you enter HPP you are met by the main menu which lists six functions: Lay Out Document, Define Page Style, Print Document, Import Files, Set Defaults and Exit to DOS. Define Page Style is where you set up your style sheets to provide the grids on which you lay out your pages. As with Ventura Publisher, you use style sheets to define the number of columns, the size of margins and so on. Unlike Ventura, HPP does not supply you with ready-made style sheets on disk.

The Page Style screen consists of a menu bar across the top and rulers along the bottom and to the right marked in inches and picas. You cannot change the measurement system to centimetres or millimetres, nor can you mix and match them in any way. This could be awkward, as it is quite common to measure text in inches, column widths in picas and picture sizes in millimetres.

The menu bar lists five options, complete with function-key numbers. You can activate the pull-down menus by pressing the appropriate function keys or by using the mouse. The first option gives you context-sensitive help. The Style menu allows you to get, create, copy or delete a page style, and zoom and exit to the main (continued on next page)
Rule/Box menu to draw rules, boxes and which appears on-screen. These options are chosen from a dialogue box to six—and the width of the margins. All orientation, the number of columns—up to eight characters long and press Enter. When you save a style sheet Harvard automatically adds Sty to the file name as a file extension. You then select paper size and matically adds Sty to the file name as a file extension. You then select paper size and orientation, the number of columns—up to six—and the width of the margins. All these options are chosen from a dialogue box which appears on-screen.

Once your page appears you can use the Rule/Box menu to draw rules, boxes and tints that are to appear on every page. Rules can be from 0.5 point to 12 point in weight. Tints can be anything from 10 percent to 100 percent strength in 10 percent increments.

When you select Draw Rule a pointer appears on the page. You position the pointer where you want the line to begin and click on the left mouse button or Tab. You then position the pointer where you want the line to end and press the right mouse button or Enter. The rule then appears on-screen. I found having to switch between the two mouse buttons rather fiddly, and would have preferred to have had just one button to press.

When you move the cursor to the edge of the screen the display normally scrolls to reveal parts of the page you cannot see. But if you have zoomed up to 150 percent this does not work, and to view a hidden portion of the page you have to reduce magnification, move to the part of the page you want to see, and then zoom up again to the larger size.

Formats and tags are used to specify the text styles for your document. A tag is a combination of type characteristics such as fount, size, line positioning, spacing above, indents and the number of columns the text is to span. You could call a tag for a headline Head1, say, and then use it for every headline with a document. You can tag your text on-screen by choosing from a list of tags you have set up, or you can add tags from within your word processor. When applied to a document, tags do not normally appear on-screen but they can be made visible if you wish.

Tags also allow you to provide effects like subscript, superscript and leaders, and are used for more detailed operations such as forcing fount changes within a line. This kind of tag is normally added to the text when you use a word processor or the HPP Edit window when you lay out a document, rather than when you are building a format file.

Being able to put commands into your word-processed text can save time, especially if you are only using a few headline and text styles. But if you have a large number of different style elements within your document, having to use commands is rather cumbersome compared with the menu-driven approach of Pagemaker. Harvard's command-driven approach is similar to Lotus Manuscript on the IBM and Just Text on the Mac.

To create a document you choose Layout Document from the main menu. The Document directory lists all the documents in the sub-directory and displays a file name prompt on the status line, where you can type a name for a new document. A name...
To format headlines within your flowed text you select Edit, followed by the column containing the words to be headlined. The text then appears within the Edit window. You select the Tag menu, which appears at the top of the Edit window, then choose the tag you want to use. HPP applies the tag to the text at the cursor position and formats it in the window accordingly, giving you a kind of preview facility. You can ignore this and select another tag, or accept it and incorporate the changed type style into your layout.

Once you have laid out your text you can incorporate pictures, rules and boxes. Rules and boxes are created in the same fashion as on the Page Style screen. Space for pictures is allocated by creating masks. You do this in a similar way to drawing boxes, but all you see is an area of empty space.

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Above: You can edit text in the Edit window, where there is also a preview facility. Below: Text is automatically reformatted to slow the effect of any tag you apply.

can be up to five characters long and must not end with a number, which is rather awkward. Being restricted to only five characters — rather than the eight which you use when allocating a page style name — was something I found rather confusing. A dialogue box appears in which you choose whether you want continued lines; a left-hand or right-hand page style; what font sets are to be used; and what format file is to be used. Continued lines are automatically generated and updated, and you can specify two different sets of founts per document. You can type an asterisk in the Format File field to select from a directory of document. You can type an asterisk in the File is to be used. Continued lines are auto- fount sets are to be used; and what format choose whether you want continued lines; a - was something I found rather confusing. you use when allocating a page style name - rather than the eight which can be up to five characters long and must must little updating. Ventura Publisher also handles long documents well and has a friendlier user interface; it cannot match HPP for typographical versatility, but in its latest version it is catching up fast.

CONCLUSIONS

- HPP should prove suitable for long documents with fairly simple layouts that will need little updating. Ventura Publisher also handles long documents well and has a friendlier user interface; it cannot match HPP for typographical versatility, but in its latest version it is catching up fast.

- If you want to produce short documents you may find Aldus PC Pagemaker more suitable; it is certainly far easier to use. If you want to move on to more complicated layouts or are simply looking for something that is easier to use, it is still worth turning to the world of the Macintosh and taking a look at XPress.

SOFTWARE REVIEW

When you choose Get/Place from the menu bar, the Picture directory appears, showing the picture files. You select the picture you want to place and a flashing box appears on the page. You size it to take the picture, which is then painted where you drew the box. Pictures can be resized — but only to their original proportions — or moved to another part of the page.

The same masking technique is used to create wraparound effects. A mask can be drawn around a picture so that the text flows round it. The smoothness of the resulting wraparound effect depends on how steady and accurate you were when using the mouse to draw the mask. If something is an awkward shape you are likely to have an unequal space between the end of the text and the edge of a picture; it would be extremely difficult to create a smooth curve.

The HPP manual does its best to explain what is quite a difficult package to use. As with all large manuals, there is a lot of cross- referencing but I felt that it would have been useful to have a section showing what different screens look like, and the options and menus available with each. The manual includes some useful suggestions on page layout and organising your files.
SOFTWARE REVIEW

GENERIC CADD & AUTOSKETCH

DRAFTING FOR ALL

By Roger Cullis

While object-orientated drawing programs are commonplace on the Mac, it is only recently that affordable packages have become available for ordinary IBM users.

Only a limited number of types of application have achieved wide acceptance on the microcomputer. The spreadsheet and the word processor are used universally, followed at some distance by database managers. After these three clear leaders you have to begin to scratch your head to find tasks which are performed by significant groups. Computer-aided drafting (CAD) is one such application, but already the number of potential users is several orders of magnitude smaller than that of those who wish simply to type or do What-if exercises.

Smaller volumes equate with higher prices, since the authors have to recover a greater percentage of the development costs from each sale. So up till now, the most popular CAD package has been Autocad, which costs a cool £2,000 a throw. On top of that you have to pay another £500 if you want its advanced drafting extensions. Just recently, however, the CAD market has seen the introduction of budget-priced software which could have a revolutionary effect. The new packages are petty-cash items, the purchase of which does not require major justification. Typical of these offerings are Autosketch and Generic Cadd, which cost £79 and £99 respectively.

The Amstrad PC-1512, like many other computers which come with a Gem interface, has a drawing program bundled with it. Why then should one spend good money - even as little as £79 - to augment something that is available free? The answer is that the bundled drawing programs are pixel-based. This means that when you enlarge an object, the enlargement will contain no more detail than the original. Autosketch and Generic Cadd, on the other hand, are object-based. A circle, for example, is stored as the co-ordinates of its centre plus the radius. When you zoom in to make the object larger, the program adds the necessary detail.

Autosketch and Generic CADD both require an IBM PC or compatible with two drives - either twin floppy's or a floppy and a Winchester. The display must be capable of showing a graphics screen with reasonably high resolution. Generic CADD needs at least 384K of RAM. In Autosketch, memory size sets a limit to the complexity of the drawing that can be displayed; a minimum of 512K is recommended.

You can use the cursor keys to move the plotting point about the screen, but a proper pointing device such as a mouse, trackball or digitizer tablet greatly facilitates the operation. Hard copy can be output to any printer which is capable of operating in graphics mode, but a plotter is the more usual way of transferring drawings to paper. Object-based drawing programs perform all calculations in floating-point arithmetic, so both Autosketch and Generic Cadd run much more quickly if the system has a maths co-processor.

If your computer has an IBM Colour Graphics Adaptor and a Microsoft mouse attached to the COM1 serial port, then Generic CAdd is ready to go as it comes out of the packing. Otherwise you run a simple menu-driven configuration program to customise the main program so that it runs with your equipment. As well as the IBM CGA and EGA display and the ubiquitous Hercules cards, a wide range of other display options are supported by the drivers supplied as standard. Even if you have an esoteric display format the chances are that you can purchase a special driver for it.

Autosketch comes with two program discs, one for use with a numeric co-processor, the other for use without. The first time you run the program, it will present you with a menu of supported pointing devices, displays, plotters and printers. For some devices there are additional questions to determine the precise manner in which you connect them.

With Generic Cadd it is important to use the drivers which come on the program disk rather than those provided by the peripheral manufacturer, as they will interfere with the proper running of the program. Another difficulty which is likely to be encountered is that the peripherals which will be used with this software are serial devices. They thus present all the problems associated with RS-232 standards, including the need to...
match baud rate, data-word format and handshaking connections. The manual provides comprehensive instructions for a wide range of devices, so with a little patience you should be able to achieve the correct arrangement.

A digitising tablet is the recommended pointing device for both programs, and it is a necessary adjunct if you intend to copy existing drawings by tracing them. If you do not wish to incur the expense of a digitiser — which can cost £900 or more — then a mouse can be used as a rapid input device. For those without even this basic peripheral, the cursor keys may be pressed into service to get you around the drawing.

Belying its origins, it is the screen display of Generic Cadd that more closely resembles that of Autocad. The drawing area fills most of the screen. It has a vertical line on the right-hand side separating it from the menu, and a horizontal line at the bottom separating it from the prompt area.

The menu lists the commands which the operator selects when making a drawing, and the prompt area gives an instruction such as “Enter a Command’ and displays information about the drawing in progress. At the top of the screen is an area reserved for the display of cursor co-ordinates. A cross-hair cursor in the drawing area identifies the current plot point on the screen and moves about as the pointing device is operated.

The Autosketch display is very similar to that of Gem. A menu bar at the top of the screen displays menu names, a memory-usage meter and a digital clock. At the bottom of the screen there is a prompt line where prompts are displayed to remind the operator what information the program is expecting. The drawing area in between

(continued on next page)
contains a small Gem-like arrow whose position is controlled by the pointing device. Another point of similarity with Gem is that Autosketch communicates with the user by means of dialogue boxes into which you enter values for specified parameters before completing the operation by clicking on an OK or Cancel box.

Both packages group drawing commands under a number of basic categories, accessible through the corresponding menu. Generic Cadd’s first group is used for drawing lines, circles, arcs, points and various other items which are collectively called objects. The technique used to create objects is first to specify by the appropriate command which object you require, and then to mark on the screen points which define that object. For example, to draw a circle, the centre and the radius can be specified; alternatively, three points on the circumference will determine it uniquely.

A number of objects may be combined to create a component, which can be saved to disk in a library and recalled when it is needed. These recalled components can be manipulated by changing their scale or rotating them. Text in a variety of fonts, sizes and colours may be added from the keyboard. Additional fonts can be created, and the new fonts need not be restricted to alphabetic characters. Zoom commands change the area of display: for example, you can zoom in on a small window so that it fills the entire screen. Drawings can be constructed in up to 256 layers, a feature which is particularly valuable for architectural plans or engineering assembly diagrams.

The drafting package uses control commands to produce a professional-looking result even when the operator may be relatively unskilled. For example, by setting a tolerance of 0.25 in combination with the Snapto command, a line may be joined to any point within the specified range. Ortho mode ensures that all lines that meet are strictly at right angles to each other; without this facility it is all too easy to make drawings slightly skew. A grid can be displayed to help with positioning.

**SPLINE CURVES**

Autosketch has a more limited range of commands than Generic Cadd, although they still permit the operator to create complex drawings. The Draw menu is used to generate objects such as circles, arcs and boxes. One sophisticated feature draws spline curves from up to 100 control points entered by the operator. The control points form a frame of connecting points which, when the operation is completed, are redrawn as a spline curve.

Libraries can be formed from subassemblies, drawings and they can subsequently be recalled and manipulated. The facilities for entering text are rudimentary. Two features of the editing commands are particularly valuable: Ortho, Attach, Snap and Grid.

**CONCLUSIONS**

For a user who wants to add a drawing facility on to an existing system both Generic Cadd and Autosketch are likely to be of interest. With a hardware package comprising a microcomputer, a plotter, possibly a special high-resolution monitor, and a powerful micro with numeric co-processor, each coming from a different manufacturer and costing upwards of £9,000, the system has to be made to work. Furthermore, it will usually be operated by someone who is skilled in drafting techniques rather than the use of computers, so a substantial training programme will be required. For these full-size packages are a worthwhile investment, but for less specialised applications Generic Cadd and Autosketch are likely to meet most requirements.
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Although Basic has its critics there remains a dedicated band of users. Borland’s typically good-value implementation gives them an additional option.

With Turbo Basic, Borland International has signalled its belief that there is still a future for the much-maligned Basic language. True, more and more programmers are turning to Pascal, C and even Prolog, but the overall market for languages is growing so fast that a first-rate Basic compiler can still make plenty of money for its authors.

Turbo Basic is certain to do just that. It is a world away from the traditional free-standing compilers, with their need for separate editors and linkers. Now the familiar development cycle — edit, compile, link, run and crash — can be performed quickly and easily in an integrated environment, complete with windows and pull-down menus.

In this respect, Turbo Basic follows the route marked out by its stablemates, Turbo Pascal and Turbo Prolog. It has the same WordStar-style editor and fast in-memory compilation, and an error trap that automatically re-invokes the editor and places the cursor at the offending statement. The user interface is much closer to that of Borland’s Prolog than the older Pascal, although it is only a matter of time before the latter compiler gets the same treatment.

At the heart of the interface is a set of four windows. The first two are the important ones, being used for editing the program and viewing its output. The Messages window is mainly used to display compilation statistics, while the remaining one is reserved for tracing a program’s execution with the Tron and Troff commands. There are plenty of ways of resizing the windows and moving them around, and the Edit and Run windows can be zoomed to fill the screen.

The whole thing is supported by a simple system of pull-down menus and a comprehensive Help file. All told, the user interface is well designed and quite straightforward to use. There are also good facilities for customising the package, including changing screen colours, editor control keys and compiler defaults.

The compiler itself works entirely in memory, with both source and executable programs held in RAM by default, which makes compilation very fast. Alternatively, you can elect to produce a free-standing Executable file, or a TBC file for use with Basic’s Chain command. One of the compiler’s biggest weaknesses is that it cannot generate separately compiled object modules; the only way of building a library of reusable routines is to duplicate source code via an Include command.

All this inevitably has an effect on program size. Holding the editor, compiler and source code in RAM leaves that much less space for the executable program. But you are still much better off than you would be with Microsoft’s Basic interpreters, since they impose a 64K limit on program and data. Turbo Basic’s limits are 64K for the source, 64K for each array, 64K for all non-array variables, and an unlimited code segment.

Program size is not the only area where Turbo Basic is ahead of the interpreters. The language itself has many more features. It achieves its aim of being compatible with both GWBasic and Basics, while at the same time offering lots of interesting new commands. Programs written for either of these interpreters should compile and run with little or no change, even if they use hardware-dependent features like sound, graphics and event trapping.

In addition, Borland has tried to make Turbo Basic compatible with another Microsoft product, the Quick Basic compiler. This is important because Quick Basic and Turbo Basic seem to be natural competitors — the first time that the brash young Borland has made a direct attack on the mighty Microsoft. Quick Basic, which we reviewed in the February 1986 issue, is now in its third major release.
Like Turbo Basic, Quick Basic sports a built-in editor and in-memory compilation. Its windowing system is less sophisticated, with user programs taking over the entire screen, which many programmers will prefer. A useful feature is that its menus and windows can be bypassed, with compilation invoked from the DOS prompt or a batch file. Version 3 has a sophisticated debugger, similar to Code View in Microsoft C.

The language elements that Quick Basic introduced, and which Turbo Basic has now borrowed, include many commands aimed at making Basic a more structured language. Optional alphanumerics labels replace mandatory line numbers. There are new ways of avoiding Goto statements, such as Select Case, Do-While, Do-Until, Loop and Exit. And the If-ElseIf-EndIf construction means that you need not squeeze an entire If command on a single line.

Perhaps best of all, both compilers allow you to write real multi-line functions and procedures, as you would in Pascal or C, complete with global, local and static variables. With Turbo Basic you are not forced to place these routines before the statements that call them, which means that you can put the top-level logic at the top of the program. This is not possible with Quick Basic.

Other Turbo Basic plus points include recursion, easier access to machine registers and interrupts, and an improved assembler interface. On the negative side, it does not support file and record locking, which Quick Basic does. Both compilers allow arrays to be allocated and released dynamically, and both have 8087 support.

One feature missing from both products is direct language support for the mouse. The joystick and light-pen are both well provided for, so why not use the same On-Event syntax for what is a far more popular pointing device? This omission is especially surprising in Quick Basic, which does support the mouse in its own user interface but not in the language.

For many users the key factor in choosing a compiler is speed. Turbo Basic makes your programs run faster than they would under an interpreter, but the amount of speed-up is very variable. In our tests we noted improvements ranging from almost nothing to a factor of 60:1. A program containing a good assortment of Basic commands ran in 100 seconds under GWBasic, 36 seconds with Turbo Basic, but just 14 seconds after compiling with Quick Basic.

As far as compilation times are concerned, the results are much clearer. Turbo Basic clocked a consistent 5,000 statements per minute for memory-to-memory compilation, compared to 3,300 for Quick Basic and 4,500 for Turbo Pascal. All these tests were carried out on an 8086-based Olivetti M-24.

One performance Basic in which Turbo Basic compares badly is in executable program size. A minimum program, which simply displays a greeting and exits, generates a 28K Exe file. In Quick Basic, the figure is just 3K, while in Turbo Pascal the equivalent Com file is 11K. This would not matter in a large application such as a payroll, where programs could be chained to minimise this overhead. But it does make Turbo Basic unattractive for small utilities such as file listers and directory programs.

CONCLUSIONS

For Basic programmers, or for users with a large investment in Basic programs, a compiler like Turbo Basic could be a much better option than changing languages. Turbo Basic is fast, easy to use, inexpensive, and rich in new commands and features.

In comparison with its obvious rival, Microsoft's Quick Basic, it scores well in terms of user interface, compilation speed, language features and memory model, but less well in execution times, program size and debugging aids.
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Creative writers have different needs from the ordinary office WP user, and this package sets out to address them.

Though numerous word processors are available, the economics of the industry still seem to dictate that virtually all of them are multi-purpose programs. Word processors are rarely angled to a specific group of users, and the only significant differentiation is by price. Webster's New World Writer attempts to buck this trend. This package is aimed specifically at writers; the special needs of secretaries, producers of form letters and the like are ignored.

Webster's is described as a "writing system". It combines basic word-processing capabilities with a spelling checker, a thesaurus and a writer's guide. It should be emphasised, though, that the only style checker included is in the manual, and that the capabilities of this program do not in any way exceed those of a good all-round word processor such as Word Perfect or WordStar 4.0. But Webster's is the only program costing less than £130 that I know to have a thesaurus, and this alone may make it very attractive to certain users.

Webster's is a relatively compact and simple program. The full package, including thesaurus and spelling checker, comes on just three unprotected floppies. It requires only 256K of RAM, which is modest for a package with these capabilities. The program is neatly presented, with a very sturdy 200-page spiral-bound manual and a quick-reference card. The manual is well laid-out, though it is occasionally confusing in the way it presents topics. It contains an excellent Writer's Guide, covering style points under headings like "Punctuation and Manuscript Preparation", "Trite Expressions", and "Words Likely to be Misused or Confused". There is full in-context help on-screen.

The editor itself is a single-document program. You have to name the document you are going to work on as soon as the program loads. A simple directory of file names in alphabetical order is available, but only on demand. Only one document at a time can be worked on.

There is no windowing or dual-document capability, and I think this restriction is a serious one. Surely creative writers of all kinds have a particular need to be able to move text from file to file, to keep notes online in a separate file from their document, and to compare successive drafts of a document. I know I do all these things, and the inability to do them would make me reluctant to settle for this program.

Once a document has been selected, the program comes up with a fairly plain editing screen. There is a four-line section at the top which provides menus and prompts, and a ruler at the bottom. These features are not removable, which is unfortunate as they clutter the screen. Though the menu names are always on display, you do not need to use them all the time to access commands, as most are also available through Alt-key combinations.

The menus are heavily nested, and you can move from level to level either by pressing initial-letter keys or by highlighting. The choices are mostly self-evident, though not always so: you have to select End, for example, to do a security save, and Appearance in order to start a new page. Some of the key sequences are a little cumbersome.

To change both margins, for example, you select Appearance followed by Format followed by Left Margin, then fix the margin using the cursor before you select Right Margin and do likewise, and finally select Use to apply the new settings.

Format changes within a document are handled by so-called "fences". A fence-mark is a special indication at the start of a paragraph that a format change is required: changes made at that point apply until the next fence-mark. This is a neat and flexible system once you have understood it. The program performs margin changes and other formatting adjustments efficiently and swiftly.

Up to three formats can be held with a document, allowing complex formatting changes to be applied automatically. This is a neat idea, though three is not a very generous provision, considering how cumbersome it is to define a format from scratch. Format definitions contain data on line spacing, margins, whether justification is required, and headers and footers. They do not cover as full a range of stylistic data as some more expensive packages; the style-sheets in Microsoft Word, for example, hold more comprehensive style definitions.

Webster's reacts smoothly on-screen. It scrolls vertically, and when you move the cursor after an editing change it reformats text automatically. It does not scroll hori-
**Webster's New World Spelling Checker**

**Case functions.** You can save a block to file, include Copy, Move, Delete, and Change ward/forward.

The usual basic set of editing functions is implemented, but there are no columnar capabilities and no mathematical capabilities, no automatic footnoting and no paragraph numbering, although they are all things which many of Webster's intended users would find extremely useful. Perhaps more understandably there are no maths capabilities, no columnar capabilities and nothing for handling form letters.

File-management capabilities are limited, but there is a disc directory from which Webster's allows you to copy, rename or delete files. Webster's will handle alternate characters: you can display any character in the IBM set on-screen and send an ASCII code to a printer. However, the printer drivers are not sophisticated enough to ensure that in every case what appears on-screen will also appear on the printer. There is no in-built subscript or superscript mode, and this is a sad loss.

The program's printer support is uneven. There are 24 printer drivers, including Dumb Printer, Standard Printer and Standard Typewriter — not many compared with a lot of top-class programs. The program does not allow you to define your own drivers, or to adapt the existing ones except in set ways.

Webster's claims to micro-justify text on supported printers, but as the drivers are nowhere described in the documentation, and my own printer is not supported, I was unable to test this feature. I found the limitations of the printer drivers annoying. Only by inserting control codes in each document could I send a necessary initialising code to my printer, for example, and I could see no way to tell the program that I was using port 2 for my printer.

It is possible to revise the printer setup — and other setup details — at any point, but not to set up two printers at the same time. If you want to change printers you have to go through the full setup process each time. One neat option in the printer menu makes it easy to print your document on both sides of paper, even if the printer does not support two-sided printing and has no queuing capability.

The speller and thesaurus are both heavily emphasized features of Webster's. The

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**WEBSTER'S**

**VERDICT**

- **Performance**
  - Poor
  - Average
  - Good
  - Excellent

- **Ease of use**
  - Poor
  - Average
  - Good
  - Excellent

- **Documentation**
  - Poor
  - Average
  - Good
  - Excellent

- **Value for money**
  - Poor
  - Average
  - Good
  - Excellent

□ Cheap and handy for journalists and creative writers, but lacking some important facilities that many such users will value.

Notes:

- **Boldface, underline and other typefaces can be obtained by inserting printer codes.** The program supports tabs but not decimal tabs. You can have two lines of header and one of footer. There is also provision for drawing boxes.

- All Webster's features are adequately implemented, but they do not compare in scope with the more complete capabilities of top-level programs like Word and Word Perfect. There is no outlining, no indexing, no automatic footnoting and no paragraph numbering, although they are all things which many of Webster's intended users would find extremely useful. Perhaps more understandably there are no maths capabilities, no columnar capabilities and nothing for handling form letters.

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- It is possible to revise the printer setup — and other setup details — at any point, but not to set up two printers at the same time. If you want to change printers you have to go through the full setup process each time. One neat option in the printer menu makes it easy to print your document on both sides of paper. The program first prints all the odd-numbered pages, then prompts you to turn the paper over to print the even-numbered pages. Webster's only prints the document in memory: it does not do background printing and has no queuing capability.

The speller and thesaurus are both heavily emphasized features of Webster's. The (continued on next page)
speller has an in-built 114,000-word dictionary, and lets you build up your own auxiliary dictionary. A major failing is that only a single auxiliary dictionary is permitted, and you cannot capitalise proper names in it. The speller is not memory resident, and it saves the document before performing a spelling check on it. Therefore it will not check words as they are entered, and there is no quick way of checking the spelling of a word while you are editing.

The checker sorts the words in the document, and then compares them alphabetically with its dictionary entries. It presents you with a list of suspect words to re-enter, and then compares them alphabetically with its dictionary entries. It presents you with a list of suspect words to re-enter, and then compares them alphabetically with its dictionary entries.

The thesaurus is on-line. It automatically looks up the word on which the cursor is positioned, or the word typed immediately after it is called up. It is also able to identify hyphenated words that are split at the end of a line. This two-stage process makes proof-reading reasonably fast, though inevitably not nearly as fast as with a resident routine.

For the in-context check you can select any of four different scan levels, allowing you to control the time the program spends looking up alternative spellings. A very full range of alternative word suggestions are comprehensive, and it is claimed that the full scan takes into account your past spelling errors in the current document.

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PORTABLE COMPUTERS

Moving on

Originally descended from the pocket calculator, the use-anywhere computer is well on the way to the ultimate vision of an electronic book. Glyn Moody plots its progress.

Portable computers seem to represent something of a Bermuda Triangle for the manufacturers. Year after year they blithely sail into this area with their latest machines, convinced they are about to take the world by storm. Instead they disappear, often without trace. In some ways this dedication to a phantom market is touching; it shows an almost non-commercial faith in the ultimate personal computer — one you take with you everywhere. There must be a winning machine out there waiting to be constructed but the technological barriers remain considerable, as the relatively slow and painful evolution of the portable machine shows.

Portable computers can be seen as the coming together of two ideas which both blossomed about five years ago. On the one hand there were the pocket calculators. Companies like Hewlett-Packard and Casio turned the calculator from a simple arithmetical aid into a wallet-sized box of tricks which did everything bar making tea. In fact, the level of sophistication that these devices attained was grossly at odds with the fact, the level of sophistication that these were clumsy compromises that hardly fitted into a wallet-sized box of tricks which did everything bar making tea. In fact, the level of sophistication that these devices attained was grossly at odds with the level of sophistication that these devices attained. The basic A4 size was in part dictated by the keyboard: beyond a certain point, small keyboards become unusable by touch-typists, and so lose much of their usefulness. The display, always the bugbear of portables, had led the way, the new 16-bit processors started to trickle through. One of these chips was the Grid Compass. Although designed as a mains-powered portable, the Compass could function off batteries for several hours, and could be carried around and used in this state. Many features of its overall design proved prophetic of later 16-bit machines which were truly portable.

One problem with the LCDs hitherto used on portables was their poor contrast and dependence on ambient lighting conditions. The electro-luminescent display used on the Grid was one of the first attempts to get round this difficulty, though its high power consumption has so far made it impractical for true portables. The mass-storage medium used was also exotic: bubble memory. Like RAM discs, it has not been taken up by the mainstream portables, largely because developments in disc-drive technology have solved most of the problems associated with earlier units. Grid later came out with the Gridcase, a truly portable plasma-display machine which used a conventional floppy-disc drive.

Ordinary floppy first appeared on the Data General One, another innovative machine which has never really received its due. It was a battery-powered portable which was IBM compatible — if you allowed its use of the then non-standard 3.5in. disc drives. Apart from their embarrassing lack of software, they offered enormous advantages for portables. They were light and small, and drew far less power than their 5.25in. siblings. They soon became standard on 16-bit portables.

By then the main emphasis had shifted away from the earlier eight-bit machines to
the new generation of 16-bit IBM compatibles. To be sure, development in this other sector did not cease altogether; improvements were made to the Kyocera machine and Epson came out with its PX-8, the successor to the HX-20. All these machines continue to sell as text-gathering devices which can be slipped inside a briefcase. But the general portable market had moved on, at least in the manufacturers' eyes. IBM compatibility was the order of the day, and so most companies gradually came out with an entrant in the contest. But whereas the earlier eight-bit portables seemed to have defined a real niche for themselves, these later machines are proving more of an enigma. Who exactly needs full IBM portability? The implicit assumption seems to be that computing needs to be done on the move, or at least in two locations. While the former certainly requires a portable but is surely a very small market, the latter could be equally well served by using a full-function mains-powered transportable system, or even two PCs, particularly with the advent of the cheap clones.

Nonetheless, manufacturers have rushed pell-mell to enter this 16-bit world of portables, as the table shows. One benefit of this First of the 16-bitters, the HP Portable eventually acquired a proper disc drive.

excessive enthusiasm has been a steady progression in technologies. After the Data General machine and a similar model from Texas had established the basic form of an 80-character by 25-line LCD with 3.5in. floppy, successive machines built on this. They offered two drives, more RAM and, with the Wang Portable, even a hard disc and printer, both built-in. Zenith has recently matched this by including a hard disc with its Z-183 machine.

Of all the manufacturers it is probably Zenith that has the strongest commitment to portables. In addition to the Z-183 and its Z-181 dual-floppy version, there is the Z-171 — an older machine which uses a vertical rather than horizontal format along with 5.25in. floppies. Only Toshiba, with its highly successful T-3100 mains-powered portable and battery-driven T-1100, seems as convinced of the viability of this market sector. Inevitably, IBM's endorsement of the portable came late and seemed rather grudging. Its Convertible machine was the same in outline as its predecessors, but by the time it appeared most competing machines had moved on some way, and the Convertible lacked many of their features. It was mainly of importance for signalling IBM's official blessing of the 3.5in. disc format and for using advanced production techniques which would bear greater fruit in the later Personal System/2.

Hand in hand with improvements in disc-drive technology has gone a marked improvement in displays. Apart from tweaks to the basic LCD design such as the super-twist technology, back-lighting has become the most popular way of improving visibility. Although battery-powered plasma displays have appeared, it seems likely that back-lit LCDs will remain the dominant technology. They hold out the hope that (continued on next page)
Outside this mainstream 16-bit world, there has always been a healthy alternative market. Eight-bit technology predominates and the machines are designed with particular markets in mind.

One of the most successful examples of the specialist approach has been the British Hawk Hunter. Built to work in harsh environments, this CP/M machine arrives at its starting point. More recently, the machine lies outside the scope of this article. Whereas the ruggedness. In one respect the machine lies outside the scope of this article. Whereas the

other portables described here have in common a minimum size imposed by the need for a usable keyboard, the Hawk drops to an A5 size and hence is virtually unusable for touch-typing.

Another British machine catering for a niche market is the Thorn Liberator. Ultra-slim and very light, it was conceived as a text-gathering device and all aspects of its design have been subordinated to this role. Once more the basic scale is set by the keyboard.

Beyond these low-weight but full-size machines there is the Psion Organiser, a hand-sized and hand-held device. Naturally it lacks the minimum-sized keyboard and so is only really suitable for single-finger typing.

Recently, there has been an increase in the pace of development of the portable market, at least in the 16-bit arena. There is even a portable Vax available. And yet the lingering doubts remain. Do many people really need truly portable computing power? And if so, are we anywhere near solving the packaging problems inherent in realising such a machine? Now that the pattern of the micro market has been set for the next five years or so — with old-style PCs and ATs at the bottom, and the new PS/2s at the top — it may well be a time for a final push to overcome the remaining difficulties in the relatively uncharted world of portable computing.

Against this background it will be interesting to see whether the new 16-bit machine rumoured to be coming through from Epson in the near future manages to give the industry a boost in the way the HX-20 did nearly five years ago.

Then there is Apple, perhaps the joker in the portable pack. A battery-powered version of the Macintosh is due to appear next year. The Mac itself transformed the way we use PCs; it is possible that a portable Mac could do the same again. It is worth remembering that working at Apple is Alan Kay, who pioneered the original mouse and window approach which ultimately led to the Mac. He sees as the final goal of micros the Dynabook concept: a full-function portable computer as powerful and as easy to use as a book. Perhaps that is what everyone is waiting for.
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A flurry of announcements reporting materials which are devoid of electrical resistance has set the computer community speculating about the ultra-high performance logic devices that they could be used to make. But as Mary Fagan reports, there is still a long way to go before such science-fiction dreams become engineering reality.

Materials that offer zero resistance to electricity when cooled to a certain temperature are causing a huge stir in the scientific community. They are the superconductors that are being hailed as the catalyst in a new technical revolution, opening up prospects such as super-fast magnetically levitated trains running at 500 km/h and transmission lines that could carry electricity for several hundred miles underground with scarcely any losses.

The concept is not new. Superconductivity was discovered as long ago as 1911 when a Dutch scientist, Heike Kamerlingh Onnes, discovered that mercury cooled to within a few degrees of absolute zero — that is 0 °K or -273°C — could conduct with no resistance. Physicists have been excited about the possibilities ever since.

The reason for the current euphoria is that superconductors can now be made that operate at much higher temperatures. Last year Dr Alex Mueller at IBM’s laboratories in Zurich discovered a ceramic that was superconducting at 30 °K (-240°C). Then in March, Paul Chu at Houston University reported absolute superconductivity in a ceramic at 77 °K.

What makes these high-temperature superconductors important is that they can be made and used with liquid nitrogen as the coolant. Until now, superconductors needed liquid helium, which boils at 4 °K, as the coolant. Liquid helium is hugely expensive, as is the cooling equipment needed to handle it. The pumps and piping to recover and recirculate the precious helium gas would alone cost around £10,000. Superconductors have therefore been confined to applications where the expense can be justified; the coils of the powerful electromagnets needed for medical imaging are one example. High-temperature superconductors will change this. Liquid nitrogen, which boils at 77 °K, costs about 40 pence per litre — around the same as milk.

It is easy to see what the pundits are getting worked up about. Superconducting coils can carry huge currents, and so can be used to make electromagnets that produce correspondingly large magnetic fields. The Japanese believe that magnetic levitation trains (Maglevs) using such magnets will be in operation by 1995. In medicine, the cost of magnetic-resonance imaging devices could plummet.

The power industries hope that cheap superconductors will mean loss-free power transmission. In America, up to 15 percent of the electricity that is generated is reckoned to be lost during transmission as a result of the resistance of the wires that carry it from place to place. Superconducting power cables could carry about 3GW — more than five times the capacity of conventional cables. They could also carry power underground for 100 miles — much further than is currently possible — opening up the prospect of taking electricity cheaply to remote regions.

Just as attractive is the idea of using superconductors to store electric current without losing power. Generators could operate continuously, producing power throughout the night for use at times of peak demand. The energy would be stored as a magnetic field in a coil of superconducting material, and tapped out as needed. Even the humble battery could be under threat. At a field strength of 100 tesla, a superconductor energy store could hold 4Kjoule of energy per cubic centimetre — about 100 times the energy density of a conventional battery.

In computers, the possibilities seem endless — superconducting links between devices on a chip, and between chips and...
Japanese companies who kept up their fields. This property should make them use conductors which could be magnetic shielding, superconductors, one of the most important chips are a good five to 10 years away. It seems likely that high-temperature, very expensive oscilloscope that which has now launched a high-frequency search for superconductors. IBM has also used the JJ technology in its recently launched superconducting quantum interference devices (Squids). The fact that JJ conductor experiments with them for as little as £1. It is the engineering problems to overcome before high-temperature superconductors can be of any real use. There is particular concern over how much current they can carry, and about how difficult it will be to manufacture them in usable forms. All the new superconductors belong to a family of ceramic oxides called perovskites. They are coarse-grained, brittle compounds with a surface that looks something like matt black paint. Many sceptics say that although the material itself may be superconducting, the boundaries between crystals will interfere with the flow of the current and therefore make them useless.

Among the many other applications for superconductors, one of the most important could be magnetic shielding, as superconductors are impervious to magnetic fields. This property should make them useful in military projects, where they could be used to stop interference between electronic circuits, and even to make it impossible to bug a room.

This ceramic chip carrier is coated with a superconductive film.

**SUPERCONDUCTORS**

One of the most surprising facts about high-temperature superconductors is that they are ceramics, a class of substances that is normally associated with insulation rather than conduction. Until the discovery by Alex Mueller last year of a matt black ceramic made of copper, oxygen, lanthanium and barium, researchers had concentrated mainly on metal and semiconductor-based materials.

Mueller's ceramic was found to superconduct at 30 K. This was the biggest news since 1973, when scientists made an alloy of niobium and germanium which was superconducting at 23.3 K. Then came Paul Chu's dramatic breakthrough: complete superconductivity at 77 K and strong evidence of the onset of the phenomenon at 93 K. Chu's material was a ceramic oxide of barium, copper and yttrium. Both Chu's and Mueller's materials are in the same perovskite family of ceramics.

Since the original IBM discovery, the company has made many variations on the perovskite theme. All have transition temperatures — the temperature at which they become superconducting — of around 90 K, which is well within the limits needed to use cheap liquid nitrogen as coolant. The latest round of reports claims that superconductivity has been achieved at up to 300 K, and the scientific community eagerly awaits the magic words "room temperature". But it has to be noted that the measured characteristics of the material — how they react in a magnetic field and so on — are hard to reproduce and unstable.

The reasons why activity has reached fever pitch are understandable enough. The ceramics are not actually hard to produce. They can be made by grinding the ingredients in a pestle and mortar, baking in a furnace and cooling. Paul Grant at IBM's Almaden laboratories even claims that schools could carry out basic superconductor experiments with them for as little as £1. It is the engineering problems to come that could prove to be the great challenge.
announced the development of superconducting wire and tape over the past months, the maximum current densities they could support have hovered in the region of 1,000 amperes per square centimetre. Connections within chip devices, for example, need current densities of 100 times as great. Estimates are that a wire measuring 1 millimetre in diameter could carry 10 amps. For the powerful electromagnets people are talking about, 1,000 times more than this would be needed.

In May IBM said that it had managed to send huge electric currents through a special film of superconductor. The film is just one single crystal layer in thickness, about 1/100th the thickness of a human hair, and was made using a technique called vapour deposition. At temperatures of 77°K the film could support current densities of 100,000 amperes per square centimetre.

Professor Colin Goodman at STC’s laboratory in Harlow points out several problems that could hamper the use of the materials in computers. He claims that no one yet knows how to make really good electrical contact to link the new materials to ordinary conductors such as aluminium, gold, copper and silver. “The act of putting metal down on superconductors creates a high resistance, in the region of 10 to 100 ohms, between the normal conductor and the superconductor,” he explains. “It’s not clear why this happens, and it’s crucial that we know how to interface to them.” Goodman also believes that the grainy nature of the ceramics will make it difficult to manufacture very small devices.

Another problem for would-be chip-makers is that the materials, once exposed to moisture, turn into more normal oxides that do not conduct electricity at all. This means they cannot be etched in traditional wet etching processes. The alternative might be to use costly and sophisticated dry etching techniques such as plasma etching and ion milling. Unfortunately the new materials are easily damaged if bombarded by high-energy ions.

But despite his reservations, Goodman believes that the ceramics have huge potential as the substrates and leads used to link chips and other electronic devices, and to stop crosstalk between circuits. He also cites interest in the use of superconductors in aerials, where they can increase efficiency sharply. He claims that gains of around 20 decibels can be achieved, making them much more efficient transmitters and receivers than today’s devices.

For more widespread applications, the limitations on density and the difficulties of forming the ceramics are perhaps more serious. To be practical they will have to be made into wires, coatings and so on. Getting them into useful shapes will in many ways be a bigger breakthrough than developing them in the first place.

In April, Toshiba claimed to have developed the world’s first ceramic wire that can superconduct at –179°C. In the same month both Bell Laboratories and Argonne Laboratories in America said they had also produced flexible, current-carrying superconducting wires. The Argonne workers pointed out that even though the ceramics are brittle, if made into thin enough wires they can be relatively flexible.

Not to be outdone, IBM announced in April that it had developed a way of spraying large and complex surfaces with the materials. The company uses a technique called plasma spraying, in which the material is heated to thousands of degrees and deposited instantly on a surface where it solidifies. The coated objects are then heat treated to anneal them, after which they become superconducting.

SPRAY-ON WIRING

IBM says that the technique opens up the prospect of spray-on computer wiring and magnetic shielding. It claims to have already laid down thin lines and coated tiny holes in the type of ceramic substrates used to carry chips in computers. But even these advances draw warnings from many observers, some of whom believe that manufacturing the necessary shapes in bulk will turn out to be too expensive and difficult to be useful.

There are also many critics of the idea of loss-free power transmission. One of them is the Brookhaven National Laboratory in New York, which has been studying the use of superconducting underground cables for some time. The Brookhaven people point out that an alternating current inevitably generates radio waves, whatever the material through which the current is being conducted, so it is untrue to say that losses could be reduced to zero. Brookhaven work on traditional superconductors showed that, at best, the a.c. losses were about the same as in an ordinary overhead cable. Once the cost of cooling has been taken into account, the benefits of even the new ceramics may not be so startling after all.

Perhaps the biggest overall criticism is that the superconducting materials have yet to be proved stable over periods of time. Even if the scientific and engineering problems can be solved, there is still the question of supplying the basic raw materials. A dearth of one of the main components, yttrium, is already hindering research in the Britain. Yttrium costs £300 per kilogram, and the entire world production is only about 500 tonnes every year. Investment in new plants to make yttrium and other materials will be needed if superconductors are to catch on in any big way.

When any new technology appears, there will always be arguments between its supporters and its critics. No one doubts that the scientific achievements of the past months are remarkable, and that they could well change the face of many industries. But the revolution proper is yet to come. As Colin Goodman comments: “People now have to settle down and do the real engineering work.”

Mary Fagan is Technology News Editor on New Scientist.

SUPERCONDUCTORS

| ANNOUNCEMENTS IN SUPERCONDUCTIVITY |
|--------------------------|---------------------|
| DATE | TEMPERATURE (°K) | INSTITUTION | MATERIAL |
| 1911 | 4 | — | — |
| 1973 | 23 | — | niobium-germanium alloy |
| Apr 86 | 30 | IBM Zurich | barium, lanthanum, copper oxide compound |
| Dec 86 | 28 | Tokyo University | barium, lanthanum, copper oxide compound |
| Dec 86 | 28 | University of Houston | barium, lanthanum, copper oxide compound |
| Dec 86 | 35 | Tokyo University | barium, and oxides of lanthanum and strontium |
| Dec 86 | 36 | AT&T Bell Labs | lanthanum, strontium, copper oxide compound |
| Dec 86 | 37 | Tokyo University | N/A |
| Dec 86 | 40 | University of Houston | undisclosed |
| Jan 87 | 39 | IBM Zurich | N/A |
| Jan 87 | 43 | Okazaki National Research Institute and Tohoku University | N/A |
| Jan 87 | 46 | MITI Agency of Industrial Science and Technology, Tsukuba Laboratory | lanthanum, strontium, and copper oxides |
| Jan 87 | 70 | Chinese Academy of Sciences, Beijing | N/A |
| Feb 87 | 98 | University of Houston | N/A |
| Feb 87 | 100 | China | N/A |
| Mar 87 | 100 | MITI National Research Institute for Metals, Tsukuba | N/A |
| Mar 87 | 123 | MITI National Research Institute for Metals, Tsukuba | Oxidised barium, yttrium, and copper |
| Mar 87 | 240 | Wayne State University | Two-phase ceramic material based on a barium- yttrium- copper oxide compound |

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The 520ST-FM with 512K RAM and free mouse, represents a further improvement on the 520ST-F. This model is an improvement on the 520ST-F because it includes a more powerful built-in disk drive. The 520ST-FM is also supplied from Silica Shop with a free software package that is not available from other manufacturers. The 520ST-FM also includes a new version of the Silica 'ST Starter Kit', see paragraph on the 1040ST-F.

The 1040ST-F is also supplied from Silica Shop with a free software package that is not available from other manufacturers. The 1040ST-F also includes a new version of the Silica 'ST Starter Kit', see paragraph on the 1040ST-F.

For the businessman and the more serious home user, Atari have their most powerful model, the 1040ST with 128K RAM. This low cost machine has all the features of the 520ST-FM computer, plus the addition of a built-in TV modulator.

The 1040ST-F is a powerful machine that is capable of handling all the new applications such as large databases or spreadsheets. Like the 520ST-FM, the 1040ST-F has its own power transformer built into the keyboard. This means that you cannot use it with a domestic TV (Silica Shop do not supply an RF modulator). The 1040ST-F is the ultimate computer for the home user. It comes with the Silica Shop's own software package, the 'ST Starter Kit', which includes a comprehensive range of software.

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**COMPANY PROFILE**

dBase is still Ashton-Tate's biggest money earner

Despite praise, Framework's sales are slow to grow.

**MORE THAN JUST dBASE**

Ashton-Tate has grown rapidly over the last few years, its success being largely due to dBase. It now intends to have a presence in all major application areas and to shake off the "one-product company" image. Mike Lewis takes a look at its history and its prospects.

Even by the standards of the software industry, Ashton-Tate looks like a remarkable company. Not many firms have seen faster growth and few have sustained that growth over such a long period. Set up in 1981 by two men working from home, the business has enjoyed a near doubling of turnover every year since. Today its sales are running at over $200 million per year, with profits of around $30 million.

This success is due almost entirely to one product. Despite valiant attempts to diversify, the dBase database manager still brings in more sales than the rest of Ashton-Tate's range put together. In 1986 those sales amounted to $133 million, against just $23 million for its other leading package, Framework. For many people, Ashton-Tate and dBase are virtually synonymous.

This is hardly surprising. Ashton-Tate did not actually write dBase, but it was set up with the specific aim of exploiting it and bringing it to market. Until Framework was launched in 1984, dBase was the company's only offering.

It was in 1981 that George Tate and dBase first came together. Tate's background was not in software — he had worked as a technician for a Californian stereo chain — but he did have business flair and a knack for selling. In the late 1970s he felt that he could make money in the emerging micro software market simply by applying better marketing techniques than those of the typically amateurish dealers of the day. In 1980 he went into business with an accountant named Hal Lashlee to form the Discount Software Group.

At the same time, Wayne Ratliff was struggling to sell a home-grown program called Vulcan. Vulcan's roots were in a data analysis program for the Univac 1108, called JPLDIS. Ratliff had come across it while working at the Jet Propulsion Laboratory in Pasadena. Its aim was to let the user design and manipulate databases, using English-like commands. Ratliff was convinced that he could create something similar — or better — on his Imsai 8080 micro, and that he could make money by selling it.

Unfortunately, Ratliff was the archetypal programmer-turned-entrepreneur. He set about writing Vulcan, often working late into the night and enjoying every minute of it. But he resented the time he would later be forced to spend on marketing and paperwork. By late 1980 he had sold only 50 copies of Vulcan — not enough to pay for his advertising. He was sick of the whole thing and was about to chuck it in when George Tate's company requested an evaluation copy.

That was the turning point. Tate saw the potential of the program. His advertising man, Hal Pawluk, suggested a new name: "dBase" because it sounded suitably technical; "II" because it suggested a new, improved version. Ratliff's awful manual was rewritten, money was raised for an advertising campaign and a new company was formed to publish the program. That company later became Ashton-Tate. Like dBase I, there was never an Ashton — the name was chosen to give the firm an established, conservative image.

Success was immediate for dBase II, which had two things going for it. First, it enabled dealers and consultants to build bespoke applications for their customers, without recourse to programming. That was something new in the micro world. Its second advantage was sheer marketing know-how. A key factor was the offer of a free-trial demonstration version. Provided you kept the full version in its sealed envelope, you could send the package back and claim a refund if you did not like it. Few people bothered to claim the refund.

In time, dBase II became dBase III and then III Plus. Wayne Ratliff continued to receive a per-copy royalty until this year, when he surrendered this right for an extremely large cash sum. Today Ratliff is a very rich programmer. Tragically, George
Tate did not see his company become the international giant that it is now: he died in 1984 at the age of 43.

For Tate’s successors, the main priority has been to diversify. Of all the software packages that were leaders of their categories in the days of the Z-80 standard, like WordStar, Supercalc and CP/M, dBase is the only one that still enjoys that lead today. But this cannot last. Newer, more sophisticated databases have emerged, and the sales of dBase are constantly under threat from its many imitators.

On the surface, diversification has not been very successful. True, Ashton-Tate now has four main groups of products: dBase, Framework, Multimate and the Graphics Master range. It also has non-American marketing rights to Javelin. But the dBase family continues to account for the bulk of the company’s turnover.

Of course, this is not necessarily a bad thing. Ashton-Tate’s UK managing director, Paul Sloane, is quick to point out that the company’s other products all have healthy sales in their own right. "It is the strength of dBase that makes us look like a one-product company, rather than any weakness in the rest of the range," he insists.

To support this, he points out that Multimate is one of the world’s half-dozen best-selling word processors. And in France, Framework outsells Lotus 1-2-3 by a factor of two to one. That said, a careful reading of the company’s accounts shows Framework’s sales growing much more slowly than any of its other products, despite the critical acclaim which it has received.

Whatever the company’s success so far, the policy of diversification will continue. "We aim to become a software conglomerate," Sloane told us, "and we are well on the way. We plan to have a presence in all major application areas and all types of machines."

This will almost certainly involve more acquisitions. Apart from Rapid File, none of Ashton-Tate’s current products was originally developed in-house. They were all obtained by purchasing the companies that wrote them: Multimate International for the word processor, Forefront for Framework and Decision Resources for the graphics family. The Multimate deal was, and still is, the largest takeover of its kind in software history.

This does not mean that Ashton-Tate is not in the business of software development. It has an aggressive policy of updating and enhancing its acquisitions and of producing versions for new hardware. This is especially true of the dBase family, where sales are at risk from a barrage of clones and compilers.

Of course, Ashton-Tate is not going to admit to such worries. "Imitators do not bother us too much," says Paul Sloane. "Provided customers stick to the dBase language, they will come back to us when we bring out new versions." Since it is Ashton-Tate that decides what is to go into those new versions, the clone makers will always be one step behind.

Sloane has a similar attitude to compilers. "Although we tend to frown on compilers, we recognise that they further the cause of the dBase language. Users of compiled applications often end up buying dBase as well. They already have their data in the right format, and they appreciate the value of interactive working."

The compilers have at least taught Ashton-Tate the need for improved performance. Although the company’s development plans are a closely guarded secret, my guess is that the performance issue is currently a major preoccupation. The argument for Ashton-Tate producing its own compiler must be irresistible, especially now that Nantucket and Wordtech have proved the market.

Other developments in the dBase area — or perhaps in a new generation of database products — will probably include a structured query language, micro-to-mainframe links and features to take advantage of the power of the 80386 processor. At the other end of the scale, the success of Rapid File will have encouraged the company to offer more enticements to the first-time user. Its recent announcement of First Framework is an example of this.

Whatever direction it takes, diversification is vital to Ashton-Tate. There is no reason for thinking that the rapid growth of the last six years will not continue, but it can do so only if the company can become a major force outside its traditional database arena.
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DATA PROTECTION

ARE YOU A GOOD USER?

The Data Protection Act could be only the start of many users' problems. Anne Staines looks at the pitfalls awaiting those who use electronic data.

In theory we are all good data users now. Or are we? It is almost impossible to be unaware of the Data Protection Act of 1984. After a slow start, applications to register under the Act have now topped 133,000 and are increasing at a rate of 900 a month.

According to the National Council on Information Technology (NCC) the good data user can be recognised by three practices: keeping data secure, keeping data accurate and limiting disclosure. The need to ensure accuracy presents users with a familiar problem: everyone makes a mistake from time to time. Security is proving a more difficult theory to understand, let alone to put into practice.

The problem stems from the Data Protection Principle number 8. The Principles are intended to provide a code of practice against which the behaviour of individual users can be judged. Their chief objective is to assure the data subject that his or her data will be treated correctly, and thus to inspire public confidence. Principle number 8 provides that: "Appropriate security measures shall be taken against unauthorised access to or alteration, disclosure or destruction of personal data and against accidental loss or destruction of personal data."

What is considered appropriate will vary according to the nature of the data and the number of persons having access to it. Viewed rationally, this requirement should present little difficulty to most users. But two factors are causing users to panic. One is fear of penalties imposed under the Act as the date approaches upon which the Registrar's powers come fully into operation. The other arises from the increasing number of security devices on the market. Advertising for some of them suggests that users who do not employ physical security devices are in breach of the Data Protection Act.

Users with sloppy security practices risk not only fines and other penalties but also civil proceedings by injured subjects. So far, 300 subject complaints have reached the Registrar and the number is rising rapidly. Complaints about lack of security, however, are uncommon. Most users complain about the presence of their names on direct-mailing lists.

The Registrar's office issues no general guide on security, although the Department of Trade and Industry is currently funding the NCC to put some guidelines together. In the meantime, many users are investing in fireproof safes and encryption codes. Whether this is really necessary remains open to doubt.

The NCC has always advocated that attitudes to security should be tightened up through staff training. All staff in contact with personal data should be instructed never to bypass security regulations, always to keep printouts locked away when not in use, to return old printouts for destruction, and not to discuss personal information with (continued from previous page)
unauthorised persons. Giving staff this type of training, says the NCC, is evidence that an organisation is taking reasonable care of its data.

Managers and DP staff should also be made aware of their responsibility for security through controlled access, sensible siting of terminals, organised collection and storage of printouts and control of media containing personal data. The NCC emphasises that the most any organisation can do is to take reasonable care to prevent disclosure.

Backup copies are kept in fireproof safes in the Registrar's office and this is a practice of which the Registrar generally approves. In many cases, however, it will be reasonable simply to lock discs, etc. in a drawer after use. The Registrar recommends that only users who hold what he calls 'pretty sensitive information' need consider encryption; most users do not.

Until recently many software houses attempted to protect their programs against casual copying by encrypting security codes on to the medium. In 1985 a survey was carried out which revealed that over half the users who had these devices, users with "pretty sensitive" data, simply to lock discs, etc. in a drawer after use. The Registrar recommends that only users who hold what he calls 'pretty sensitive information' need consider encryption; most users do not.

Security measures
may think twice about the level of security they guarantee.
It is possible to insure against claims for compensation arising from unauthorised disclosure, and this is becoming fairly popular. It is worth bearing in mind, however, that users cannot insure themselves against the Data Protection Act's criminal penalties. In most cases, precautions that are adequate to secure the user against action by the Registrar should also secure the data subject against the user.

As a result of the Data Protection Act's publicity campaign users are generally more aware of the threats posed by insecure office management. They may also be conscious of the risk of hacking and other forms of misappropriation of data. Guarding against these risks makes users better stewards of their data.

Surprisingly few users are good owners, and they are likely to run into a whole series of problems; the Data Protection Act is only a start. For example, personal data for many businesses means information about their customers, which they invariably regard as their confidential property.

Automating customer lists may involve a simple transfer of information from a manual file on to disc. In many cases, however, personal data will be input directly into the computer, without having appeared in a fixed form before. Thus it is only when stored in memory that it becomes intellectual property and thus capable of attracting copyright protection. Whoever has the copyright in this material has control over it. He or she can copy it or sell it, and can prevent others doing so without authority.

Clearly, the copyright owner should be the data user. But if the system is under licence from a supplier who retains copyright in the software, it can be difficult to separate the data from the program. Wide-ranging provisions of this type are more common in bespoke than off-the-peg software, and are unusual at that.

However, as copyright laws receive wider interpretation, some contracts are being used to see how far they can be pushed. The effect of provisions of this nature is far from clear. Yet it is comparatively simple to deal with this problem before the contract is signed by distinguishing between two sources of information and providing for each separately, retaining copyright and confidentiality for the user's data. This is an additional type of security device that is all too easily overlooked.

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**DATA PROTECTION**

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### SOFTWARE SPECIALS

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<tr>
<td>PRECISION</td>
<td>- DS £23.90</td>
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### PRACTICAL COMPUTING

**August 1987**
LASERS TAKE OVER

With laser printers becoming commonplace, Ian Stobie looks at how the specific needs of different types of users are being met.
Laser printers are becoming commonplace. No longer an expensive and exotic alternative to the daisy-wheel they are coming to be an increasingly normal part of the ordinary office. Laser printers are now second only to matrix printers in the amount of money that is spent buying them.

At the same time the laser market is becoming fragmented. There is no longer a single kind of laser printer, but several different categories designed to match the needs of different kinds of user.

The base-line laser printer is probably now best represented by machines like the Epson GQ-3500 and the Oki Laserline 6. Both these machines are aimed at the mass office market, as adjuncts to stand-alone PCs. They cost around £1,800. Compared to earlier laser printers they are very compact, taking up no more desk space than a standard AT, and weighing about 35lb. Their speed is rated at six pages per minute, though as we explain on page 92 the speed claims of all printer manufacturers should be taken with a pinch of salt.

Slightly higher in both specification and price are the new machines from the companies that led the first wave of laser printers, Canon and Hewlett-Packard. Bulkier and heavier at about 50lb, these machines cost over £2,000 — with the HP the more expensive at just over £2,600. They are rated at eight pages per minute rather than six, and come with slightly larger standard paper trays that hold 150 sheets rather than 100.

All these machines — both the compact Epson and Oki offerings and the new Canon and HP models — are more than simple daisywheel replacements. They have 512K of memory as standard, which gives them considerable graphics capability. You can generally print a full page at 150 dots per inch (dpi) resolution, or smaller areas at the full 300dpi limit of the engine. All laser printers cope well with overhead-transparency film as well as with ordinary A4 office stationery and photocopier paper.

A bigger jump in capability occurs when you go up above the £3,000 mark to machines like the Mannesmann-Tally 910.

**CITIZEN OVERTURE 110**

Like Epson, which is part of Seiko-Epson, Citizen is an offshoot of a watch company. Its first laser printer, the £1,995 Overture 110, shows evidence of a determination to push into the laser market, as it offers a very good specification for the money.

It is a fairly compact machine, despite its 70lb. weight, and it fits neatly on to a desk alongside an AT. Citizen has used a 10 page per minute engine made by Mita, an established photocopier maker. But the most pleasing thing about the Overture 110 is that it really is quick. A 15-page report took 1 minute 33 seconds, which works out at 9.68 pages a minute. On a 25-page document the machine slightly exceeded its rated 10 pages a minute.

Of course, on more typical, shorter documents the average page speed goes down, but it is still good — faster than the more expensive HP Laserjet, for instance. The first page takes about 16 seconds, corresponding to a rate of 3.75 pages per minute. Our various three-page benchmarks average out at about six pages per minute.
and the Kyocera F-1010. These machines are rated at 10 pages a minute, and they are noticeably faster. But probably their main distinguishing characteristic is their improved paper handling. At least one 250-sheet paper-input tray will be included in the price, often two. Other options are usually available too, including collating output stackers.

Above this £3,000 price level also come

<table>
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<th>SUPPLIER</th>
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<td>Xiton</td>
<td>Lasermaster Turbocharger</td>
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<td>Protra</td>
<td>PS-Jet</td>
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Print enhancement boards are designed to increase the performance and range of fonts available from basic laser printers. They go inside your computer rather than the printer, taking the form of a full-length PC or AT expansion card containing a fast processor and usually a great deal of memory. You connect them via a cable directly to the engine, bypassing the printer's own built-in controller. The enhancement board then takes over the job of preparing the full 300 dpi page image needed for printing. This approach is well worth investigating if you already possess one of the older generation of laser printers and now want to do DTP or graphics.

Two things let the machine down. Its running costs are rather high and it has a shoddily constructed and badly thought-out front panel. When you average out the costs of the various things you have to replace periodically, such as toner, drum and fuser, the cost comes to 3.13p per page. This is more than most other laser printers.

The front panel takes the form of a flat membrane touch-panel rather than proper keys, along with a two-digit display. You set parameters by pushing the key areas marked out on the membrane till the right numbers come up on the display. On our machine the top plastic layer was already coming away from the rest of the panel.

An equally serious problem is that the whole system is logically rather confused, making it difficult to figure out what is going on. We still have not discovered how to force a page throw, for example. This kind of system need not be difficult to use. The Epson GQ-3500 also makes do with a two-digit display which works in a similar way, but by contrast to the Overture 110 it is a triumph of clear design. Using the Epson is very straightforward as a result. Citizen must improve this aspect of the machine.

Unfortunately the Citizen works quite well in the default settings it assumes at power-on, so you do not need to have frequent dealings with the front panel. Three emulations are offered as standard: Epson FX, IBM Proprinter and Diablo 630. Unless you tell it otherwise, the Overture 110 pretends to be an Epson FX-series printer. In this emulation, print quality is not up to the very high standard set by HP and Canon, but all laser printers are pretty good and you would need a critical eye to tell the difference. The typeface is more pleasing in Diablo mode.

Despite its few rough edges, the Overture 110 is a real breakthrough in price terms — a genuinely fast machine at a budget price. All things considered it is hard not to recommend it. It is particularly suitable for anyone who produces fairly long documents to a tight schedule and we have found the ability to produce quick drafts of 20- or 30-page documents extremely useful.
YOUR DESKTOP PUBLISHING SOLUTION...

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### SCANNERS

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<td>Hewlett-Packard ScanJet</td>
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<td>Microtek VS330A</td>
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<td>Jetsetter</td>
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<td>Pagepoint 2</td>
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<td>Ventura 1.1</td>
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### Page Set-Up Software

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<td>AST Premium/286 40Mb HD, 10MHz, 1MB, EGA card, EGA Mono Monitor &amp; Microsoft mouse</td>
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<tr>
<td>Laser Printer—AST Turboscan</td>
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ALTERNATIVE TECHNOLOGIES

Laser printers are quieter than most other kinds of printer, print well on ordinary A4 office stationery and have the ability to handle a wide range of typefaces and graphics. But they are still expensive, the cheapest machine being in the £1,500 to £2,000 price bracket. This leaves a gap for other print technologies which are capable of producing good letter-quality output.

The most attractive alternative options are ink-jet, thermal transfer, dot matrix with 18 or 24 pins, and that old faithful, the daisywheel. The first two technologies in this list — ink-jet and thermal transfer — share one of the laser printer's most attractive characteristics, that they are quiet. Matrix and daisywheel machines offer a benefit none of the others do, that you can use carbon paper and print on to multi-part forms. All four non-laser technologies are superior to the laser in that you can get wide-carriage models at little extra cost.

Ink-jet printers are enjoying something of a resurgence. They are quiet, and the more expensive models are fast too. In the past they have been plagued by an inability to print on ordinary office paper, but this has now almost been licked, at least on the more expensive machines. The Epson SQ-2500 at £1,345 and the Siemens PT-88S at £735 are examples of this new omnivorous breed. As we go to press, Siemens is about to launch a higher-spec machine which competes more directly with the Epson offering. Other major ink-jet players are Hewlett-Packard, Canon and Diconix.

Speed obviously depends on price, but the fastest ink-jets are already up there, but the lasers when printing short documents. Unlike a laser printer, ink-jets give you at least two quality levels, so you can run off draft documents more quickly than final output. Laser printers still offer better print quality than an ink-jet, even in its top-quality mode. But with 24 nozzles in the print head, machines like the Epson SQ-2500 can produce output which is completely acceptable for business use.

Thermal transfer is a technology which has promised great things for several years, but many of the major printer manufacturers, including Epson, have stepped back from it recently. Only IBM has really committed itself to thermal transfer for the general office market. This is because IBM has probably the only thermal-transfer printer worth considering. The £1,070 Quietwriter III is the latest in a line of machines which uses a unique proprietary variant of thermal technology, with a special type of ribbon. The machine has 40 elements in its print head, so the print quality is good — almost as good as a laser printer, in fact.

IBM itself is scrupulously honest in its speed claims for the Quietwriter, qualifying all the figures put forward as burst speed, Shannon speed or whatever. We have therefore been a little unfair in our Credibility Gap chart on page 93, but the 160cps draft figure is sometimes used by dealers. Real speed at our tests is still fairly high for the price and print quality involved: about 40cps in draft mode and 50cps in letter quality. This is far below a laser's speed, of course.

The real problem with the Quietwriter, and with most other thermal-transfer printers, is running costs. Ribbons do not last long and cost about £15 to replace. On the basis of 250 words per page in light correspondence use, the running cost works out at about 8p a page. This is far more expensive than a laser printer, so the Quietwriter only makes sense for low-volume use.

Matrix printers have obvious drawbacks in noise and print quality, but they are cheap and increasingly fast. Few matrix printers manage to get much quieter than 55 dB(A), so they are on the negative side the running costs are not low.

Citizen has one of the most interesting new entrants, the Overture 110, which is based around a new engine from Mitax. This machine is rated at 10 pages a minute but is priced at only £2,000. The standard model has a single paper-input tray, but it takes 250 sheets. These features would suggest that it is targeted at users with a fairly high-volume requirement, but on the

Brother's HR-40: one of the few remaining top-end daisywheels.

the margins of acceptability in an office, though better than the typical daisywheel. The big progress in matrix printers has been in print quality. The 18- and 24-pin machines taking over at the top end for word-processing use offer much more acceptable results than the traditional nine-pin models. Leading manufacturers in the 24-pin stakes are Epson, NEC and Toshiba. Oki and several non-Japanese manufacturers favour 18-pin models, but they are generally more expensive.

A typical 24-pin machine is the Epson LQ-800, which costs £625. It has a pleasing letter-quality typeface and turns in fairly respectable speed figures in both draft and LQ mode, of 60cps and 35cps respectively in the Worldwide test. As a general workhorse machine the wide-carriage LQ-1000 version is probably a better bet. With daisywheel printers the big problem is noise. In this respect they are worse than matrix printers, and for a normal office an acoustic hood is virtually obligatory. Daisywheels also have very limited graphics capability, and do not allow you to use more than one font on a page unless you are prepared to go to the trouble of changing the printwheel by hand. You are obviously limited to the 100 or so characters on the printwheel, and the maximum fount size is also severely constrained.

This formidable list of drawbacks ought really to knock the daisywheel off anyone's shopping list, but the machines refuse to die. This is partly because of people's desire to print on to multi-part stationery and the availability of wide-carriage machines, though these advantages are shared with impact dot-matrix printers. But print quality comes into it too. A good daisywheel fitted with a carbon ribbon actually gives better print quality than a laser at straightforward correspondence work, although whether the average reader can tell the difference is another matter.

What seems likely is that daisywheel printers will linger for a long time at the very low end of the printer market. Here many people are looking for the best possible quality at the lowest possible price, probably just for occasional low-volume letter-writing applications on home machines. The high-end daisywheel market is already shrinking, and as it does so Brother is becoming increasingly dominant within it. On page 93 we chart the speed of its newly launched HR-40 office daisywheel. At 20cps for nearly £1,000 it is not a very impressive performer in terms of speed. In the office, the days of the daisywheel must surely be numbered: the other options are better.
**PRINTERS**

**Apple Laserwriter Plus.**

**GRAPHICS APPLICATIONS AND DESK-TOP PUBLISHING**

Desk-top publishing (DTP) is one application area that could hardly exist without laser printers. Computer-aided drafting (CAD) software also works well with lasers, although here plotters are available as an alternative output medium. But both these areas require laser printers with quite different characteristics from an ordinary office printer, and until recently, getting a machine for serious desk-top publishing or graphics use meant laying out nearly £6,000 on an Apple Laserwriter. Apple had a dominant position as the supplier of printers equipped with the Postscript page-description language, with few effective high-volume competitors.

Three developments have changed this. First, the graphics capability of the general-purpose office laser printer has improved. Ordinary office lasers now nearly all come with 512K as standard, and you can quite often upgrade them to over a megabyte and in some cases a good deal more. In DTP or CAD use you need the extra memory to hold a full page at 300dpi, which requires about 1.2Mbyte.

Memory is also useful for holding extra soft fonts which can be bought on disc and downloaded into the printer. A beefed-up standard laser will meet many people's desk-top publishing and graphics requirements, particularly if they are not interested in unorthodox text effects and are prepared to stick to a small number of fonts.

Secondly, Apple now has several competitors offering Postscript machines at lower prices. The price of Postscript lasers has fallen to around the £4,500 mark, with the Qume Scripten and QMS PS-800 among the better-value machines.

Postscript still has its attractions for desk-top publishing though, as it offers very great fount flexibility. Not only can a large number of different fonts be obtained for any Postscript laser, but once you have such a font you also possess it in all its variations. For example, if you buy Times Roman in 12 point, most desk-top publishing software can simply blow it up to 48 point without it looking unsightly. With the right software Postscript allows all sorts of creative effects: merging images into each other or into text, rotating or smearing text across the page, and so on.

Postscript or any other page-description language works by describing the objects on a page in a vector form. Fonts too are held as vectorised descriptions. This is why it is so easy to manipulate a font, expanding it, rotating it, and so on. A Postscript font is defined by the manufacturer, but fonts supplied are electronic, and can be manipulated in any way the printer allows.

### PRINTERS

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<td>£18,950</td>
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<td>£1,795</td>
<td>low-volume use</td>
<td>6ppm</td>
<td>Ricoh</td>
<td>150</td>
<td>2.5p</td>
</tr>
<tr>
<td>£3,234</td>
<td>medium-volume use</td>
<td>10ppm</td>
<td>Hitachi</td>
<td>250</td>
<td>2.3p</td>
</tr>
<tr>
<td>£2,618</td>
<td>low-volume use</td>
<td>8ppm</td>
<td>Canon</td>
<td>200</td>
<td>2.25p</td>
</tr>
<tr>
<td>£3,395</td>
<td>medium-volume use</td>
<td>10ppm</td>
<td>Kyocera</td>
<td>2 x 250</td>
<td>2.8p</td>
</tr>
<tr>
<td>£3,395</td>
<td>DTP</td>
<td>8ppm</td>
<td>Canon</td>
<td>100</td>
<td>2.86p</td>
</tr>
<tr>
<td>£3,195</td>
<td>medium-volume use</td>
<td>10ppm</td>
<td>Kyocera</td>
<td>2 x 250</td>
<td>2.3p</td>
</tr>
<tr>
<td>£1,810</td>
<td>medium-volume use</td>
<td>8ppm</td>
<td>Tec</td>
<td>250</td>
<td>2.4p</td>
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<tr>
<td>£1,899</td>
<td>low-volume use</td>
<td>6ppm</td>
<td>Ricoh</td>
<td>150</td>
<td>2.9p</td>
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<tr>
<td>£2,105</td>
<td>low-volume use</td>
<td>8ppm</td>
<td>Canon</td>
<td>100</td>
<td>2.3p</td>
</tr>
<tr>
<td>£4,595</td>
<td>DTP</td>
<td>10ppm</td>
<td>Hitachi</td>
<td>250</td>
<td>2.58p</td>
</tr>
<tr>
<td>£5,195</td>
<td>DTP</td>
<td>8ppm</td>
<td>Ricoh</td>
<td>250</td>
<td>3.03p</td>
</tr>
</tbody>
</table>

**NOTES**

SPEED is quoted in pages per minute and is the theoretical maximum speed claimed by the manufacturer. PAPER FEED is the maximum number of sheets that the input paper tray(s) will hold. RUNNING COST is given in pence per page. RESOLUTION is 300 dots per inch vertically and horizontally in all cases unless otherwise stated. PAPER SIZE is A4 in all cases unless otherwise stated. NOTE This list is not comprehensive. We have concentrated on the likely brand leaders and technically interesting machines.

---

Hewlett-Packard Laserjet II: lighter and more compact than its predecessor.
rotating it, distorting it. The vectorised description is not turned into a bit image until it gets into the printer, where a powerful processor takes the Postscript code and expands it. The alternative is to hold your founts from the start as bit images. This has been done for years in matrix printers and screen displays, and of course is the approach used in ordinary office laser printers. What now makes it viable for the much more demanding task of DTP is to prepare the page image on your PC, bit image, not inside the printer but in the PC. The printer comes with a card which you plug into your PC. It will generally contain a fairly powerful processor such as a 68020. The main reason for adopting this solution is that most of the founts you will be using will be based on your PC’s hard disc. They are bulky in bit-image form, so transferring them across a standard serial or parallel link to the printer would be very slow. Doing most of the work in the computer also means that the printer itself can be kept simple.

## LASER PRINTERS

<table>
<thead>
<tr>
<th>OTHER FEATURES</th>
<th>COMMENT</th>
<th>OTHER MODELS</th>
<th>SUPPLIERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>400dpi resolution; Postscript compatible; 73 fonts standard and only built-in hard disc; weighs 190kg; HPGL compatible</td>
<td>higher quality and speed means a big jump in price and sheer size which will only be worthwhile for ambitious DTP users; Agfa’s printing engine uses an LED array rather than a scanning laser</td>
<td>none</td>
<td>Agfa-Gevaert</td>
</tr>
<tr>
<td>1.5Mbyte RAM</td>
<td>for fast printing in DTP and graphics applications; uses bit-image as opposed to PDL approach; controller comes on a separate card which you plug into your PC</td>
<td></td>
<td>AST</td>
</tr>
<tr>
<td>—</td>
<td>Canon’s second-generation machine, similar to the HP Laserjet II but with a different controller</td>
<td>older Series 1 Canon machines may still be on sale, often at very good prices</td>
<td>Canon</td>
</tr>
<tr>
<td>fairly compact</td>
<td>Centronics has recently been acquired by Genicom, and the PP-8 is being sold off cheap; check on the availability of consumables</td>
<td>see Genicom</td>
<td>Tektronix</td>
</tr>
<tr>
<td>12 month on-site warranty in price</td>
<td>brand new with very high spec for the price</td>
<td>DTP version likely by end of year</td>
<td>Citizen</td>
</tr>
<tr>
<td>Postscript, high duty cycle</td>
<td>double the normal paper size; fast; resolution is the usual 300dpi</td>
<td>£2,995 LZR-1230 12ppm general-purpose A4 printer without Postscript</td>
<td>Dataproducts</td>
</tr>
<tr>
<td>weighs only 16kg; HP and Diablo emulation available</td>
<td>very compact, good-value office laser designed for general-purpose low-volume use</td>
<td>some machine with HP emulation is £3,560</td>
<td>Genicom</td>
</tr>
<tr>
<td>weighs 38kg</td>
<td>similar specification to Qume’s Laserten Plus, but more expensive</td>
<td>Laserjet 2000, £16,500, is high-volume 20ppm printer whose paper-handling options include 2,500-sheet paper feeders; older Series 1 Laserjets still on sale</td>
<td>HP</td>
</tr>
<tr>
<td>weighs 23kg; 12 months on-site warranty</td>
<td>successor to the successful Laserjet and Laserjet Plus; well supported by HP, but not starting value for money; extra memory to 4.5Mbyte</td>
<td>Laserjet 1100, £3,495, is competitively priced for a Postscript printer, and is built around the original Canon engine</td>
<td>Mekom</td>
</tr>
<tr>
<td>weighs 25kg; emulates wide range of other printers</td>
<td>good all-round printer; well suited for higher-volume users</td>
<td>F-2020 has twin input trays and an output roller, NCR, Unisys, Hermes and various other companies after their own version of Kyocera machines</td>
<td>Xlan</td>
</tr>
<tr>
<td>weighs 25kg</td>
<td>cheap, fast printer for DTP and graphics applications; uses a similar approach to the AST Turbolaser, with a separate controller card which you plug into your PC, but image, not Postscript</td>
<td>Lasermaster RX, based on Ricoh engine and will print hand-drawn and a similar spec to the AST Turbolaser, costs £4,100</td>
<td>Mekom</td>
</tr>
<tr>
<td>weight 20kg; emulates wide range of other printers</td>
<td>good all-round printer for higher-volume users</td>
<td></td>
<td>Mannesmann-Tally</td>
</tr>
<tr>
<td>weights 23kg</td>
<td>high duty cycle for the price</td>
<td>Silver Express, £2,181, has its own built-in PDL, called Express; the £5,528 Oasys 1510 is rated at 15ppm</td>
<td>Pragma</td>
</tr>
<tr>
<td>weighs only 16kg; standard memory now 512K, equaling its Epson rival</td>
<td>similar to new Epson — neat and compact, and well suited for general-purpose low-volume use</td>
<td>QMS Smartwriter, £2,683, supports more fonts and emulates more printers; QMS PS-800, £4,342, is a competitively priced Postscript printer aimed at DTP users</td>
<td>Pragma, Headway</td>
</tr>
<tr>
<td>Postscript support; weighs 37kg; 1.5Mbyte RAM</td>
<td>competitively priced for a Postscript printer, and quite fast</td>
<td>£2,683 Laserten Plus is Qume’s non-Postscript offering, intended for less ambitious office use</td>
<td>IIT-Qume</td>
</tr>
<tr>
<td>emulates HP plotters as well as other laser printers; weighs 35kg</td>
<td>for both DTP and graphics applications; Postscript gives more font flexibility than a bit-image approach, but makes it slower</td>
<td>Ricoh Postscript 15, rated at 15ppm</td>
<td>Aptec</td>
</tr>
</tbody>
</table>

In speed terms, the performance of these board-based systems is very good; indeed for most DTP or CAD work they are faster than the Postscript alternative. Where you might wait 10 minutes for a Postscript laser to print a complex graphic image, a bit-image machine such as the AST Turbolaser might do it in just over a minute. Many simpler images will print at close to the maximum...
speed of the laser engine. This machine is particularly suitable for graphics.

At £3,200, the AST Turbolaser looks like a pretty good deal. What is more, there are even cheaper options open to you if you are already one of the older laser printers based on Canon or Ricoh engines. Since the bit-image approach uses a separate board that goes into your PC and takes much of its resources from the PC, it is fairly easy to make it available as an upgrade board to boost the performance of an existing laser printer. You plug the speed-up board into your PC and then connect it directly to the engine of your old laser printer, cutting out its built-in controller.

Postscript retains one big advantage over the bit-image approach and it is one which may be decisive for some users: it is device-independent. This means that the same Postscript file you use to drive your 300dpi Apple or Qume printer will also drive the Agfa at 400dpi or even a Linotronic typesetter at a full 1,200dpi. It will do this unchanged, giving exactly the same image at higher resolution. This allows you to use your cheap desk-top laser in the office and then send a disc out to an external typesetting company which has full-scale kit.

With bit images you cannot do this. Your founts are held at 300dpi and there is nothing you can do to change that, so the bit-image approach is not much use if you know you will want to use higher-resolution devices at some stage. Postscript is probably worth the extra money and the probable drop in speed. CAD as well as DTP users are affected, as CAD users often want to hold drawings on file for several years, by which time printer resolution will have changed.

But even here there is a way out. Some packages—Ventura Publisher is one—will support several different output devices at the same time. This allows you to print to a bit-image printer such as the AST Turbolaser or J-Laser, and also prepare a Postscript file for sending on to your typesetter.

All the machines discussed so far, whether they use bit-image founts or Postscript, are similar in that they have a resolution of 300dpi and print on to A4 paper. To get the ability to print on to larger paper sizes or at higher resolution involves considerably more expense. A3 printing is really a minority requirement for ambitious DTP users, but if you need it you can get a laser to do the job as long as you are prepared to pay £15,000 or more. Higher resolution starts at about £19,000, the cost of Agfa's 4000dpi machine.

One day higher resolution will doubtless come to the general office market, though it is not yet clear what the new standard will be. It may not be a symmetrical 400 by 400 dots like the Agfa, as an asymmetric 300 by 480 or 300 by 600 could be technically easier to achieve. But for the time being A4 and 300dpi look like being a sufficiently good platform from which DTP and graphics applications can take off.

Postscript allows text and graphics to be manipulated with ease.
HOW FAST DO THEY REALLY GO?

Manufacturers usually quote their machines' printing speed, but establishing their true performance is no easy task. Ian Stobie explains what to look for when assessing competing models.

 Manufacturers usually quote their machines' printing speed, but establishing their true performance is no easy task. Ian Stobie explains what to look for when assessing competing models.

 to be a pretty snappy performer for a Postscript laser printer, but even it took three minutes to print a complex sample from Hewlett-Packard.

 It is worth remembering that dubious speed figures do not arrive with the laser printer. They have long been part of the manufacturer's armoury. Take the characters per second (cps) figures quoted for daisywheel, ink-jet and dot-matrix printers. They again are wildly optimistic in the manufacturers' favour.

 The figure normally given is the speed of the print head, ignoring all line skips and page throws. In effect, it tells you the speed the printer could achieve if it were printing an infinitely long line. Needless to say, this is not a very useful piece of information in practice.

 Printer distributor Worldwide Computers recently published its own speed figures for a number of popular daisywheel and dot-matrix printers. The standard document used for these tests was a one-page business letter just over 300 words in length. In all cases the manufacturer's claimed figures grossly overstated the printer speed. On the basis of Worldwide's results you would need to halve or even quarter the claimed cps figure to get a real indication of throughput for these kinds of serial printer.

 Another dubious practice to watch out for is the instant gain of 20 percent in the apparent printing speed when you assume that an unqualified cps figures refers to 10cpi printing, because this is what they normally use most of the time. This gives the more unscrupulous vendor scope for a bit of modest deception.

 Of course, none of this statistical chicanery is likely to be illegal. With all the types of printer we have mentioned there is always at least a tenuous basis in fact for the numbers quoted, however much they may appear to be misleading. The problem is that to the average punter the figures do not mean what they appear to mean.

 These machines usually print at 10 characters per inch (cpi), which is 80 columns across standard paper. But many of them can also print at a more compressed 12cpi, which gives you 96 characters on a line. The point is that with this technology it takes about the same time to print a line either way.

 So by working out the cps figure at 12 characters per inch instead of 10, you get an instant gain of 20 percent in the apparent speed of the matrix printer. Most people assume that an unqualified cps figures refers to 10cpi printing, because this is what they themselves use most of the time. This gives the more unscrupulous vendor scope for a bit of modest deception.

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 It is interesting to note that in the line-printer market, manufacturers' quoted speeds seem to be more accurate. This could be because the technology makes it easier to find a less arbitrary speed measure. But it also probably has a lot to do with the nature of line-printer users. The machines are normally purchased by technically sophisticated DP department staff who have the means — and probably the inclination — to check up on speed claims before they
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<table>
<thead>
<tr>
<th>Qty (packs)</th>
<th>1</th>
<th>2</th>
<th>5+</th>
</tr>
</thead>
<tbody>
<tr>
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<td>11.26</td>
<td>10.98</td>
<td>10.69</td>
</tr>
<tr>
<td>D2Q D/S 96 tpi (silver)</td>
<td>13.00</td>
<td>12.68</td>
<td>12.35</td>
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<tr>
<td>D2HD D/S 1.6 Mb (white)</td>
<td>26.04</td>
<td>25.39</td>
<td>24.74</td>
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<tr>
<td>DM1D S/S 0.5 Mb (blue)</td>
<td>17.35</td>
<td>16.92</td>
<td>16.48</td>
</tr>
<tr>
<td>DM2D D/S 1.0 Mb (blue)</td>
<td>21.70</td>
<td>21.16</td>
<td>20.62</td>
</tr>
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</table>

Letter opener (one FREE with every ten pack)

<table>
<thead>
<tr>
<th>Goods Total exc VAT</th>
<th>U.K. Delivery (see below) exc VAT</th>
<th>Sub Total exc VAT</th>
<th>VAT @ 15%</th>
<th>Value of cheque payable to Disking</th>
</tr>
</thead>
</table>

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Address:
Tel. No:

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Lasers and Ink-Jets – Speed at First Page

Test Data: Practical Computing one page letter

<table>
<thead>
<tr>
<th>Printer Type</th>
<th>Pages per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Siemens PT-88S ink-jet</td>
<td>8.60</td>
</tr>
<tr>
<td>Epson SQ-2500 ink-jet</td>
<td>9.16</td>
</tr>
<tr>
<td>Epson GQ-3500 ink-jet</td>
<td>2.42</td>
</tr>
<tr>
<td>HP Laserjet II</td>
<td>2.75</td>
</tr>
<tr>
<td>Citizen 110 laser</td>
<td>3.05</td>
</tr>
</tbody>
</table>

AnyONE interested in buying, say, a letter-quality office printer could choose between at least five fundamentally different types of printer – laser, daisywheel, 18- or 24-pin matrix, ink-jet or thermal transfer.

The problem with most of the benchmarks that are in common use is that they really belong to an engineering rather than a user-orientated tradition. They tend to measure fairly specific technical features, and the results can be very hard to interpret. Put alongside manufacturers' bold claims, they are not sufficiently simple.

Worldwide Computers' test has the virtue of being simple, but it only relates to one sort of application – printing letters. You can learn a good deal from it, but different types of printer are good or bad at different things. You also need to see how printers do at things like spreadsheets, listings and longer reports.

These problems have led us to develop our own tests, which we have been using in Practical Computing printer reviews in recent months. We have not got the formula quite right at the moment, but we are moving in the right direction.

The most urgent need now is to be able to compare between different printer types.

SHANNON TEXT

One figure you sometimes see on specification sheets is a cps value for Shannon text. This is a benchmark of sorts, although it is only of much relevance to daisywheels. Daisywheels print characters one by one like a typewriter, rotating the relevant character into position before whacking it down through a ribbon. As a result, it is far quicker to print a string of the same character repeated several times than it is to print a real word of the same length. Different real words take different lengths of time, even if they have the same number of characters.

Shannon text is a nonsense sentence originally devised in 1949 by Claude Shannon, one of the key figures responsible for laying the theoretical groundwork for modern computing. At the time he was interested in designing telegraphy systems rather than benchmarking printers. The text is composed of words which are supposed to embody commonly occurring letter sequences:

The head on in frontal attack on an English writer that the character of this point is therefore another method for the letters that the time of whoever told the problem for an unexpected.

The Mathematical Theory of Communication
Claude Shannon, 1949

For daisywheels, the Shannon sentence is a convenient, short speed test, although you probably get a better measure of real throughput by putting a few genuine documents through and timing them. Speed is not affected by the particular characters you print on most other types of printer, so Shannon text is now little more than a curiosity.
SPEED TESTS

Ink-jets are the obvious machines to compare with laser printers because they are equally quiet. The longer the document the better the relative performance of the laser, or the average speed of a laser goes up while that of ink-jets remains the same. Here the test data takes the form of three pages of letters, two one-page spreadsheets and a continuous listing about three pages long. The ink-jets still do reasonably well considering their lower price: £735 for the Siemens PT-88S and £1,345 for the Epson SQ-2500. But with really long documents of 10 or 15 pages or more, the lasers would begin to get close to their claimed speeds of six pages per minute for the Epson, eight for the Laserjet II and 10 for the Citizen.

The typical report page is fuller than a letter and often has something printed at the top or bottom, so you get less benefit from the serial printer’s ability to skip rapidly or eject the page early. Reports often have words or headings picked out in bold or underlined characters, or some other effect which requires double striking, and while lasers take these features in their stride they can slow a serial printer down.

On our reviews we typically quote a time in seconds for printing a longer document. Usually this will be the text of the review itself, printed in a double-spaced report format with header and footer at top and bottom. This is not a proper benchmark, as the task obviously differs for each printer. But we think it is worth doing as people can easily see how much work the printer has got through in the time. In future we hope to introduce a proper report benchmark, expressed in pages per minute, based on a standard 15-page report.

There are enormous practical difficulties in benchmarking printers. For example, most printers now have fairly large memory buffers. This means you cannot time the printing job accurately from a computer, because the printer hands back control before physical printing is complete. You cannot simply set the benchmark running and walk away; you have to stand over it with a stopwatch.

This reduces the attractions of using a Basic program to run the tests. You might as well use an appropriate software package. There are pitfalls in this approach — the aim is to test the printer, not the software or the computer it runs on. We run our tests from an 8MHz AT and use PFS Professional Write, but we have not found significant difference using faster or slower PCs or changing word processor.

But a standard setup becomes vital if you want to benchmark graphics or desk-top publishing applications. Here the power of the PC and the efficiency of the software can make a tremendous difference to the speed. The obvious setup here is to use an AT again and Aldus Pagemaker or Ventura Publisher. But the speed of printing will depend on the version you are using. We plan to use Ventura as our desk-top publishing benchmark once version 1.1 comes through.
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Circle 113 on enquiry card
The Microsoft disc operating system (MS-DOS) software is the nearest thing to a universal standard that we have in the microcomputer industry today. The IBM PC and the hordes of clones that followed it provided an enormous user base for the various versions of MS-DOS. The fact that this one software package has survived and grown over the past few years is a tribute both to the concept and the original authors. Remember that 99 percent of all the software that you see running on these machines uses the MS-DOS environment and you will begin to appreciate the size of the achievement.

Since different users require different facilities, a thriving market has grown for producing add-on software that will improve the performance of MS-DOS in various areas. For instance, new users might need software that gives them instant access to the more common DOS functions without the need to learn the sometimes cumbersome syntax involved. Technical users might require more intricate control of the capabilities of DOS, and others will want enhancement of specific functions that they use a lot.

These widely varying requirements are being met by a growing number of utility programs, and it is becoming difficult for the average user to decide which are best for their own purposes. Utility programs either add a totally new function to DOS or provide a useful improvement to an existing function. They fall broadly into two categories — resident and non-resident. Resident programs should sit quietly in memory, interfering as little as possible until their function is called — either by the operator or by a special condition being met during operation. Non-resident programs are usually loaded as required to complete their function and are then discarded.

Most of the successful resident utilities provide instant access to just one extra facility, although one or two — like Borland’s Sidekick — supply a range of convenient functions. Experienced users generally avoid the multi-function resident programs, since there is more chance of software conflict when a number of such utilities are loaded simultaneously. It is now possible to set up a customised environment using a number of different resident utilities that provide just the facilities that you require and no more.

Non-resident utilities are usually run from the DOS prompt and offer almost unlimited variations on the themes of file, disc, screen, keyboard and printer management. Programs that offer facilities to undelete files, protect files, modify dates, sort directories and so on will invariably rewrite sections of the disc directory and sometimes the File Allocation Table.

These areas of the disc are fundamental to data storage and recovery, and if data become corrupted for any reason, some or all of your data may be lost. Reasons for corruption can be anything from a simple power failure to downright bad software. Unfortunately, it is not unknown for areas, these programs are certainly the best I have encountered.

The printer-control utilities Metatext and Nuepson both allow instant control of printing modes. I have found this type of control to be essential if your computing involves producing much printed output. Metatext is obviously much more sophisticated in allowing different types of, as opposed to on-demand, whereas Nuepson is limited to the standard Epson typefaces. In general control programs come in two flavours — resident and non-resident. Sidekick and One-Key DOS are the resident programs, designed to provide maximum access and convenience to a range of functions, regardless of what other software you may currently be using. I have included Popdrop in this group because if you start using a lot of resident programs, some type of efficient memory management will become essential.

The non-resident programs. Util, Norton and Palomar, are really sets of programs which provide more intricate control and information from within the MS-DOS environment. Some of their facilities are so good that you end up wondering why they were not included in MS-DOS in the first place. Others are less useful but can provide interesting information about the workings of your machine.

My last two choices, Fastback and Microcache, produce such time savings in important areas of operation that they had to be included in order to complete the overall picture of just what a boon good utility programs can be. All of these programs are well written and well behaved, easy to use and good value for money.

**SUPPLIERS**

**Fastback** Riva Terminals, 9 Woking Business Park, Albert Drive, Woking, Surrey GU21 5JY. Telephone: (04862) 71090.

**Norton Utilities** Softsell, Softsell House, Syon Gateway, Brentford, Middlesex TW8 9DD. Telephone: 01-226 9092.

**Microcache** Microcosm Research, 26 Donbury Street, London N1 8JU. Telephone: 01-226 9092.

**Norton Utilities** Softsell, Softsell House, Syon Gateway, Brentford, Middlesex TW8 9DD. Telephone: 01-226 9092.

**Nuepson** bulletin boards. Telephone: 01-943 4366.

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

**Popdrop** Infostructures Inc., PO Box 32617, Tucson, AZ 85751, USA. Telephone: (US area code 602) 323-4600.

**Sidekick** Borland International, 1 Great Cumberland Place, London W1H 7AL. Telephone: 01-258 3797.

**Util** Mutant Software, PO Box 765, Bellevue, TX 75741, USA.
THE Norton Utilities have become established as the standard set of extras that all serious users of MS-DOS should have around. It covers simple functions like changing screen colours or listing system information as well as the more serious applications like recovering deleted files or testing your discs for potential errors. This group of programs is now essential equipment; the latest release is version 3.10. The utilities are all well written, well behaved and easy to use. Each one is a stand-alone program in its own right. Utilities are used either directly in the MS-DOS environment or from within batch files. The program that allows you to recover deleted files and directories can easily recoup the cost of the package the very first time that you need to use them.

PRICE: £62

FOR: Ease of use. Good value for money.
AGAINST: Not much.

MICROCACHE

DISC CACHING works by keeping copies of the most frequently accessed parts of disc files in RAM buffers. This allows an application program to read from RAM on the second and subsequent data accesses, thus improving access speed. Microcache is one of the better implementations of this technique, although its price is a little high. It is extremely efficient, and produces noticeable speed improvements on most disc-intensive applications. An added bonus is the ability to set
extremely large cache buffers using up to 4Mbyte of additional memory. Microcache supports boards meeting the IBM XM, AST and LIM standards. It is most useful for heavy users of large database or accounting programs.

**PRICE:** £125

FOR: Good performance. Easy to use.
AGAINST: Price.

**NUEPS0N**

A LITTLE gem of a program, this resident printer control utility is the best advertisement for the Shareware concept that I know. Nuepson is a true pop-up program that enables you to change the print mode of your Epson printer from within an application program. Once installed, the program waits for you to press the Alt and Caps Lock keys simultaneously. It then pops up on your screen as a little box prompting you to select compressed, double-strike, emphasised, italic, tiny or wide print. You can also elect to throw a full page up in the printer, move a single line up or select unidirectional printing. It does not seem to be possible to configure Nuepson for any other printers, but you can send your own sequence of Escape codes to the printer. It is absolutely essential if you do a large amount of printing, and I do not know a program that is easier to use.

**PRICE:** shareware

FOR: Ease of use. User supported.
AGAINST: Only supports Epson printers and compatibles.

**ONE-KEY DOS**

IF you have ever needed to format a disc or check a directory while you are in the middle of something else, then you will appreciate One-Key DOS. It is an excellent resident utility program that puts some of the DOS commands at your fingertips from within most applications programs. Once installed, One-Key DOS can be quickly activated to freeze the operation of the program you are currently using and allow you access to many of the usual DOS commands like Dir, Format and so on. You can even run small utility programs like Find and Sort. Typing Exit returns you to your program at exactly the point where you left it, leaving One-Key DOS still waiting in memory for the next time you require it. Its biggest drawback is that it is copy protected, making installation difficult and time consuming.

**PRICE:** £14.95

FOR: Easy and convenient to use. Good value
AGAINST: Copy protected. Documentation not too good.

**PALOMAR UTILITIES**

THERE are two collections of DOS-enhancement utilities from Palomar, respectively called the Disk Utilities and the File Utilities. The Disk Utilities include programs for protecting files from accidental deletion, globally searching and disc indexing. There is also an excellent backup utility for the hard-disc user, and a host of other useful facilities. The File Utilities give you a high degree of control over your files, including the ability to encrypt, protect, hide, undelete, redate, change attributes or even completely annihilate any files. These are very comprehensive utility collections representing excellent value for money.

**PRICE:** £17.35 per set

FOR: Easy to use. Good value
AGAINST: Nothing much.

**SIDEKICK**

SIDEKICK was the first commercial pop-up utility to catch the imagination of MS-DOS computer users. It is a true pop-up program, in that it can be called to the screen at any time. Sidekick provides a calculator which can convert between hexadecimal, binary and decimal as well as offering all the normal calculator functions. The program’s on-screen notepad will also function as a text-file editor, and there is a calendar with appointment-logging facilities. An autodial facility is available for use with a modem and serial port. Sidekick is extremely easy to use. Its comprehensive on-line help facility enables even novice users to make the maximum use of its capabilities.

**PRICE:** £69.95

FOR: Easy to use. Good value
AGAINST: Only available in the US.

**UTIL**

LIKE Nuepson, this first-class utility is available from bulletin boards. Util is run from the MS-DOS prompt to provide enhancements to the standard DOS prompt. Several features are available, the most useful being the ability to display a sorted directory listing. Once the listing is displayed, the sort criteria can be changed by a single keystroke; file names can be marked individually or collectively for deletion or copying. It is also possible to display text files on-screen and send selected sections to the printer. The program makes clever use of the Set environment in MS-DOS and can easily be configured to allow text files to be edited on your favourite word processor. Util is a joy to use, though there is one minor bug when copying files: no error is given when the floppy disc is full, and subsequent files are not copied. Instructions are contained in a 70K document file.

**PRICE:** user-supported; $20 fee

FOR: Range of Features. Easy to use.
AGAINST: A few bugs.
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Tel: (0494) 32751-9. Telex: 838882 MATRIX G. Fax: (0494) 33757

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CD-ROM 2 covers some of the same ground as its predecessor, especially where it outlines what a CD-ROM does, but because it is more recent it provides a useful update. The book is primarily devoted to ways of using CD-ROMs in publishing and gives information on preparing text, images and sound, producing the information on preparing

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Perhaps the best is a series of supplementary chapters which provides an introduction to the main generic packages: spreadsheets, word processors and the like. Again, for the sceptical professional, they provide a handy glimpse of what is possible and available.

Another plus of the book's pedigree is that it is well written, managing to be simple without condescension; it is also very well illustrated, with colour diagrams throughout. Clearly, though, the book is limited in its applicability. Experienced PC users will find little of interest — apart from a picture of the very first bug, found by the Cobol pioneer Grace Hopper. It turns out to have been a moth.  

GM

HEALTH

VDU HAZARDS HANDBOOK

by Ursula Huws  Published by the London Hazards Centre Trust  £4.95  ISBN 0 948974 02 8

AFTER the London Hazards Centre opened in 1984 it became apparent that a significant part of its work would involve dealing with requests for information about the health effects of working with new technology, particularly the hazards of VDU work. The VDU Hazards Handbook is a response to this and covers implications for the employment, health and safety of VDU workers.

The book is sub-titled "A worker's guide to the effects of new technology". It is primarily concerned with keyboard operators doing a large amount of repetitive work and being subjected to scrutiny about their error rates, hours worked and so on. This is because these workers are at most risk. But it also takes into account anyone who may have to spend a long time staring at a monitor as they rush to meet deadlines.

The book has a left-wing flavour to it. The author champions the rights of women and black workers and strongly advocates trade unions as organisations people should go to for help and support with any problems. However, this does not dominate the book; it does not scaremonger but gives a lot of sensible advice. Haws looks at the social aspects of people's jobs because she is aware that you cannot divorce a job from the social climate the employee works in. For example, it may contribute to stress and make people less likely to ask for fair working conditions.

The book is easy to understand and contains a wealth of information on what the possible hazards are, and how to go about redesigning your job and physical working conditions to avoid them. It gives legal advice on workers' rights along with addresses of equipment suppliers and details on trade unions.

The VDU Hazards Handbook combines a lot of useful information in one place. It has a campaigning tone to it, which is no bad thing in an area where a lot of research still could be done. At only £4.95 it is certainly worth a read.

CH

Reviewers this month: Carol Hammond, Glyn Moody, Jack Schofield and Ian Stobie.
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Much has been said of the capabilities of the IBM's PC series of machines and I have no wish to become involved in arguments for or against them. I am, however, acutely aware that one of their most annoying peculiarities is the absence of any indication of the status of the lock keys. This has been rectified on later machines — as well as on most clones — by the addition of lights inside the particular keys on the keyboard. There are nevertheless many machines in use which still suffer from this problem and so this month I have provided a resident utility program which gives an indication on-screen of the status of these keys.

I have called this program Keylites. It simply displays the letters I, C, N and S on the right of the bottom line of the screen when the Ins, Caps Lock, Num Lock and Scroll Lock keys are active. You can change the position of the letters on the screen by altering the relevant equates in the assembler listing. The program checks the hardware on which it is running, and functions equally well with monochrome or colour monitors. To avoid conflict with those programs that display text information in exactly the same position as Keylites I have provided a key combination that turns off the program output.

You may recognise many similarities between Keylites and the Clock program listed in the May issue of Practical Computing. Once again it looks into the interrupt 8 vector, and examines the condition of the Control Keys byte, both for producing program output and for toggling it on and off. Since Keylites is a resident utility, the installation section is similar to that of the Clock program. If you do not have access to an assembler you can use the data in listing 2 in conjunction with the Basic Loader program, also published in the May issue.

The status of the Control, Alt, Caps Lock, Num Lock, Insert, Scroll Lock, and right and left Shift keys is stored in one byte located near the bottom of the PC's memory at location 00:0017 hex. Within this one byte, the state of each of the eight keys is indicated by the setting of one bit. The mapping is as follows: bit 0 represents right Shift, bit 1 represents left Shift, bit 2 represents Control, bit 3 represents Insert, bit 4 represents Scroll Lock, bit 5 represents Num Lock, bit 6 represents Caps Lock and bit 7 represents Insert. The adjacent byte at 00:417hex carries the same mapping for the high four bits, but in this case the indication is simply whether the key is pressed or released.

Keylites functions simply by checking the setting of the individual bits in the Ctrl_Keys byte and displaying the results accordingly. I have split the equates section of the assembler listing into two parts. The first part allocates names to the locations in segment 0 of RAM that the program will need to access. Int8_Off and Inst8_Seg are addresses where the relevant parts of the pointers to the current interrupt 8 routine are stored. Ctrl_Keys is the name given to the address of the keyboard status byte. The second part of the equates section names the screen locations where the displayed letters will appear. To keep the

**LISTING 1. KEYLITES**

### DATA AREA

<table>
<thead>
<tr>
<th>EQUATES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FLG1: DB 0</td>
<td>; Flg1 Indicates Key status</td>
</tr>
<tr>
<td>FLG2: DB 0</td>
<td>; Flg2 Indicates Program Status</td>
</tr>
<tr>
<td>STATUS: DB 0</td>
<td>; Holds current CNS Status</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NEV_INT8:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MOV AX,OFFH</td>
<td>; Save registers</td>
</tr>
<tr>
<td>MOV AX,AH</td>
<td>; and Flg6</td>
</tr>
</tbody>
</table>

### CODE SEGMENT

<table>
<thead>
<tr>
<th>MAINPROC FAR</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ORG 180h</td>
<td>Must be 180h for .COM file</td>
</tr>
<tr>
<td>NUM:CODE,DS:CODE,ES:NOTHING</td>
<td></td>
</tr>
</tbody>
</table>

| BEGIN: | |
| JMP START | |

---

**Jim Bates** describes a utility that makes up for the lack of key-status indicator lights on the IBM PC and certain compatibles.
code simple, I have made no attempt to cater for 40-column or graphics screen displays.

Each character on a text screen occupies two bytes in memory. One represents the character itself while the other defines its attributes— that is, whether it is bright or dim, its colour and so on. The character bytes are the even-numbered ones, counting the top left-hand corner as bytes 0 and 1. For a standard 80-column, 25-line screen a total of 4,000 bytes is required. All these addresses are used as offsets into the screen RAM segment. The address of the screen RAM segment varies depending upon whether colour or monochrome output is in use.

The code section proper begins with a jump to the Install section. As usual with resident utilities, the code simple, the code is in use.

Upon whether colour or monochrome monitor is in use. If a monochrome monitor is being used, then no change is made. Otherwise the segment address of colour RAM is inserted into the program code at label RAM, making the instruction at RAM read MOV AX,08000H.
The final step is to put the start address of the New_Inst8 routine into the correct memory area. This is done using the 25hex function call into interrupt 21hex.
The Install routine now displays the 'Installation Complete' message and exits to DOS via the Terminate and Stay Resident interrupt, which invokes protection of the memory area up to the address placed in DX and returns to DOS. The program is now installed and functions every time interrupt 8 is called.

Interrupt 8 is called by the processor around 18 times per second, regardless of whether the program is toggled on or off. This means that Keylites is constantly monitoring the state of the keyboard and, if toggled on, will display the relevant letters when required.

The new interrupt routine first saves the registers and then collects the contents of the Ctrl+Keys byte in low memory. This byte is checked to see if the Alt and left Shift keys are pressed. If they are, the Flag1 byte is checked to see if the keys have been released. When this key combination is first pressed, Flag1 will contain 00 and the program will immediately return to the program quits straightaway.

The program continues by checking the Flag2 byte, which will be either 00 or OFFhex, depending upon whether the program is toggled on or off. Anything other than 00 in this byte will result in a jump to quit, thus disabling any further processing. If the program

(continued on next page)
is toggled on, the next step is to compare the state of the bits in the Ctrl__Keys byte — which is now in BX — with the status byte in the program. The two will only be different if one of the lock keys has been pressed since the last time that the routine ran. If there is no change then the program exits.

If there has been a change, the program must find it and display the appropriate letter — or a blank if the key has been deactivated. It prepares for this by setting the segment address of screen RAM into the DS register. Remember that this address may have been modified by the Install routine.

The program will now check the settings of the bits in BH using the Test instruction. It is only necessary to check the high bits, but I have included a test of the two low bits so that the Caps Lock and either Shift key will cause the C to be displayed. The first test is for these three bits, and if any one of them is 1 the result of the Test instruction will not be zero. The result will be to insert character 34hex — capital C — into the Caps position on the screen. If the Test instruction does produce a zero, a space will be inserted into the Caps position. Checks for the Num, Scroll and Insert keys continue in a similar way, although only one bit is checked at a time.

The final step, at label Update, is to place the current value of Ctrl__Keys into the program's own status byte, thus providing a reference when the routine is next called. This prevents the program continually updating its display when in fact there has been no change. The registers and flags are restored before the routine returns control to the original interrupt 8 routine.

Keylites will only update your screen display when any of the specified keys are pressed. The display will be lost if another program changes the screen areas that Keylites uses. Thus if you are in DOS and type in Dir to display a directory on-screen, then the Keylites letters will scroll up the screen and will not be replaced. When this happens you can restore the correct display by tapping one of the non-locking control keys to update the display without changing the current settings.

The Keylites program may be toggled on or off by pressing Alt and Left Shift simultaneously. Any status letters displayed when the program is toggled off will remain on the screen until another program or function removes them. Some software may read the state of the lock keys in a reverse sense to conventional programs. Thus you might find, for example, that Keylites indicates that you are in Insert mode while the application you are running insists that you are not, and vice versa. If this does happen, it is comparatively easy to change the relevant JNZ__Off instruction to JNZ, but remember that other applications could then be back to front.

**LISTING 2. KEYLITES DATA**

<table>
<thead>
<tr>
<th>Line</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CALL 135, 4, 4, 4, 03, 08, 01, 02, 72</td>
</tr>
<tr>
<td>2</td>
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