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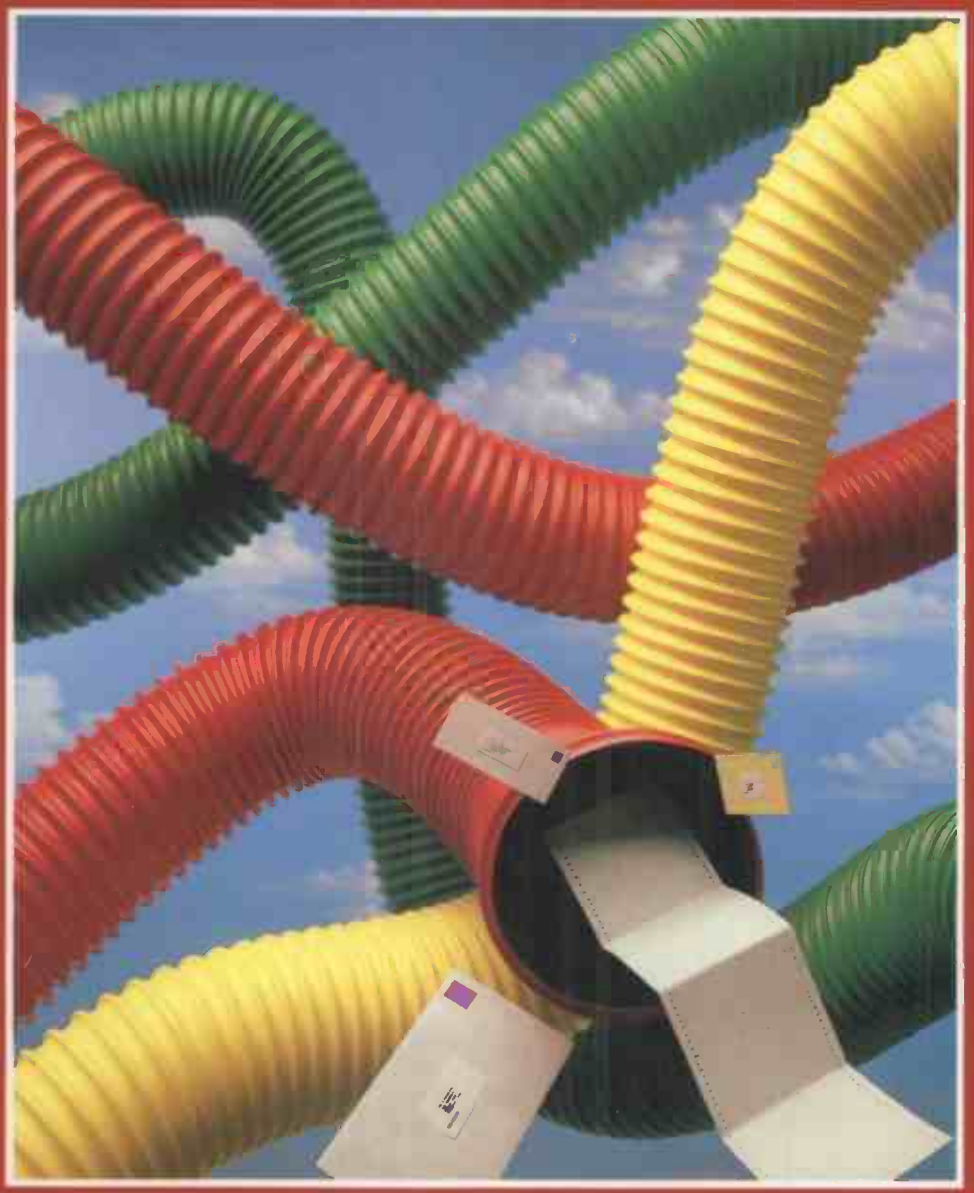

THE NETWORK EFFECT

SPECIAL The 68020 colour Macintosh II

HARDWARE Nimbus VX-386 • Husky Hawk

SOFTWARE Write Now • Smalltalk AT

FEATURES Do dealers play fair?

£20,000 COMPETITION
ENTRY FORM INSIDE

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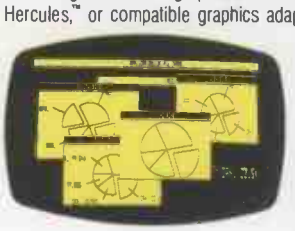

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Step-by-step tutorial, demo programs with source code included!

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You can expect at least the same impact from Turbo Prolog because while Turbo Prolog is the most revolutionary and natural programming language, it is also a complete development environment—just like Turbo Pascal.

Even if you've never programmed before, our free tutorial will get you started right away

You'll get started right away because we have included a complete step-by-step tutorial as part of the 200-page Turbo Prolog Reference Manual. Our tutorial will take you by the hand and teach you everything you're likely to need to know about Turbo Prolog and Artificial Intelligence.

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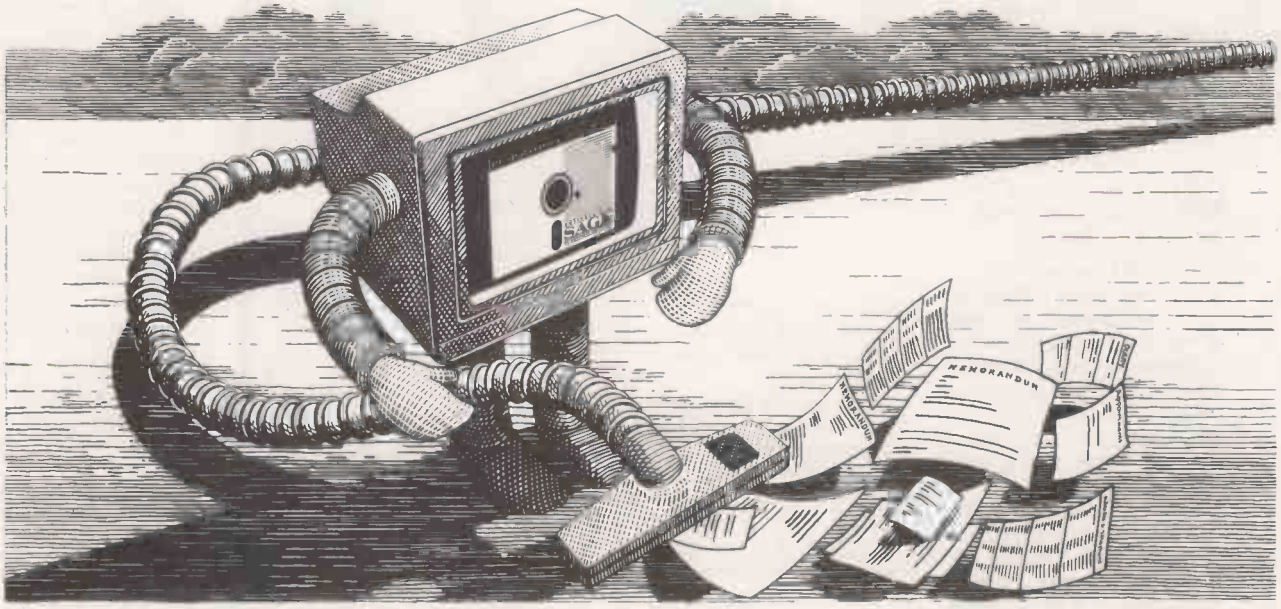

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PRACTICAL COMPUTING

APRIL 1987 **CONTENTS**

COVER FEATURE

THE NETWORK EFFECT

Once again, this is supposed to be the year in which networks finally take off. If this time they really do it will be because a standard is emerging at last. We look at that standard, how it is built up, and how other manufacturers are learning to live with it **85**

INSIDE

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AT clones Three cheap IBM compatibles — page 46.

Husky Hawk — page 53.

Mac II & Mac SE Additions to the Apple family — page 34.

NEWS

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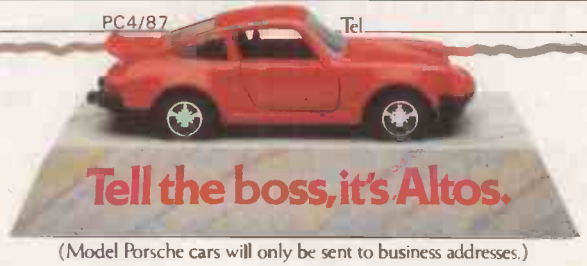

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·EDITORIAL·

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ENTER THE WORK STATION

There will be a new buzz phrase around in 1987: the work station. The term itself is not new, of course. It has already been commandeered many times by maufacturers desperate to gee up their boring terminals or salvage yet another ineffectual attempt at office automation. But the latest incarnations will be different and will be more like the highly successful CAD work-station systems from Sun and Apollo. More important, the name on the badge will be that of leading players like IBM and Apple.

The reason for the new phrase is the usual one: linguistic devaluation. When the term "personal computer" was first coined — by Apple, even though IBM got the most mileage out of it — it was a concept. It summed up perfectly the leap the first micro pioneers had made. It implied that this was your computer — not the company's, not the DP department's, but your very own. To have one was to be singled out.

Things have moved since then. An eight-bit 64K personal computer is not as impressive as it once was; even the IBM PC, especially in its guise of the Amstrad PC, is beginning to look a little cheap. It no longer has the cachet which made ambitious executives fall over themselves to be seen using one. And the success of the PC has proved its downfall from the viewpoint of the manufacturers. The more PCs sold, the more competition there is, the lower the price and the lower the profit margins all round.

In response to this, micro manufacturers have resorted to a classic marketing ploy: bring in a whole new range of models above the old ones. To a certain extent this is what successive upgrades were meant to be, but they failed because there was insufficient differentiation between the machines. The market perceived no radical shift, and so would not tolerate any great hikes in price. The lack of any radical changes also ensured that it was simple for the competitors to move in and undercut the new models just as easily as they undercut the old ones.

Enter the work station. This is not the result of mere tinkering with the casing, but signals a genuine change of approach. The name itself bespeaks the altered climate. None of the "personal" nonsense; these are work stations and the emphasis is on work and business. The key to the work-station concept is the integration of your work with the company's business. Correspondingly, at the heart of the work station lies a new generation of powerful processors like the 80386 or 68020, driving high-resolution colour graphics interfaces together with extensive communications links to larger systems.

In the case of IBM's work stations, it is likely that the new micros due out this year will show just such a shift towards user-friendly power in the form of advanced graphics and mainframe connectivity. IBM will benefit from this in a number of ways. Apart from the new emphasis on serious, high-level, high-cost computing, work stations will allow the incorporation of proprietary elements like IBM micro-to-mainframe comms software, held in ROM as standard. This would go a long way to shutting out the clone makers. It also has the enormous plus of moving the micro back into the domain of the DP manager. The decline in IBM's dominance of the computer market has gone hand in hand with a similar weakening of the traditional DP fortress. It is in both their interests to fight back, and a work station approach could be the weapon to do it.

Like IBM, Apple has a lot to gain from the work station approach of power plus connectivity, and the powerful new Apple Macintosh II previewed on page 34 of this issue will help it on its way. Its open architecture will allow third-party manufacturers to produce a range of communications cards, making it ideal for hooking up to bigger systems. And already Apple has announced that an add-on allowing data compatibility with MS-DOS disc drives and an Ethernet card are under development.

The Mac II proclaims Apple's seriousness. There are still some executives who see the Macintosh as little more than a very neat toy: the Mac II work station will dispel this impression once and for all. It is an interesting coincidence that Hewlett-Packard has announced a minicomputer which uses the same 68020 processor, which runs 50 percent faster, but costs some 400 percent more. By emphasising links to large systems Apple will lock the new machines into the grown-up corporate computing world.

Connectivity to IBM systems will obviously be a vital part of this. But even more interesting is the possibility that these Apple work stations will find their way into DEC installations. DEC is growing rapidly and broadening its corporate base. The only thing it lacks is a totally user-friendly image for its machines. Apple, on the other hand, has user-friendliness in abundance. But is does lack the deep penetration of major corporate accounts achieved by DEC. Put the two together and you have quite a devastating combination and perhaps the definitive work-station solution for the 1990s.

5 YEARS AGO...

Commodore Business Machines is about to upset the microcomputer applecart with the introduction of a "universal microcomputer". The new machine will be capable of running software originally written for rival machines.

The universal microcomputer will initially be able to emulate the Apple, Tandy and IBM microcomputers, thus opening up the machine to a large sector of the microcomputer software market. It will feature as an option on the Commodore 64, using plug-in modules. The beauty of the move is that it means Commodore users will now be able to implement packages developed by rivals, after they incurred the expensive development costs. The target price of this machine will be under $1,000, grossly under-cutting the opposition.

PC Volume 5 Issue 4

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NEXT MONTH

HARDWARE

IBM portables are definitely the flavour of the month, so we look at several of the latest. And while ink-jet printers have had a chequered past they have recently taken on a new lease of life. Can they work with ordinary paper, and will they supplant other technologies? We assess the latest models.

SOFTWARE

As the boundaries between desk-top publishing and word processors become blurred we review Lotus Manuscript, one of the new breed of document processors. We also take a look at Foxbase, a low-cost dBase III clone with additional features.

PROGRAMMING

We start a new series presenting a set of free utilities for you to use. Over the coming months we will be offering pop-up notepads, calculators and a host of other useful programs.

FEATURES

Hot-line services: are they worth the money? Find out how much hand-holding you get and how useful it is.

SPECIAL SECTION

MICRO-TO-MAINFRAME LINKS

The micro is growing up and DP departments are having to come to terms with it. We explain the various techniques for hooking up your micro to the corporate mainframe, and the implications and issues this latest development in connectivity raises.

TOP 10

BUDGET SOFTWARE

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PRACTICAL COMPUTING

On sale at W H Smith and all good newsagents after 15 April.

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

Toshiba

THE articles on Toshiba products published in your January issue have generated some welcome enquiries, but unfortunately they have been directed to the wrong address. In the feature on lap-top computers, Toshiba's address is given as Frimley. Toshiba has in fact moved from Frimley, and the correct address is now: Toshiba Information Systems (U.K.) Ltd, International House, Windmill Road, Sunbury-on-Thames, Middlesex TW16 7HR.

In the article on 12in. Worm drives you did give the Sunbury address, but any enquiries for these products should in fact be directed to: Office Electronic Products Group, Toshiba Europa (I.E.) GmbH, Hammer Landstrasse 115, D-4040 Neuss 1, West Germany.

GILES FRASER,
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London EC4.

Looking ahead?

IN CONVERSATION with a professional using a word processor I asked how she got on, staring at a VDU all day. She replied that she rarely looked at the display except to make occasional checks: her eyes were occupied mainly with her input source document. I realised that the case was very similar with me, as indeed it must be with the majority of users.

Yet so many system designs give pride of place to the VDU by placing it on top of the system box, a few inches from the operator's nose! How much more sensible it would be to have the space immediately about the keyboard available as a repository for the working document. The only penalty would be in having to have the screen a few inches further away, or slightly angled to one side.

M J HOSKEN,
Bury St. Edmunds,
Suffolk.

Portfolio

I READ with interest the article on the Portfolio program in the February issue of your magazine.

For those readers who are too lazy to load the program or who are not using a PCW-8256 compatible machine, but possess a spreadsheet program, a simpler and quicker method exists.

I have been using Supercalc 2 and an Apricot Portable to update my portfolio daily. This takes me about 10 minutes and consists of entering the previous day's closing share prices. For me this is about 30 entries, the date and the Financial Times 30 Index, together with the previous value of my holdings.

The column headings are:
Share
Number
Price each
Cost
Current Price and Value
Dividend
Yield
Gain or Loss
% Return
This nicely fills an A4 sheet.

The cells contain the formulae to calculate the new total value of each holding, or to subtract the cost from the new value to give the gain, etc.

My bottom lines tell me how much I have made or lost in the 24 hours, the total paper value, my overall percentage return and some indices showing how I have performed against the FT 30 Index.

The beauty of a spreadsheet is that it can be tailored to fit your needs, throwing up the parameters that are selected. Another spreadsheet maintains a weekly record of the share movements and also calculates 13-week moving averages. These I plot manually. A third spreadsheet contains a record of all my transactions complete with gains or losses and running totals.

R L WEAVER,
London N14.

In our Feedback columns readers have the opportunity of bringing their computing experience and problems to the attention of others, as well as of seeking our advice or making suggestions, which we are always happy to receive. Make sure you use Feedback — it is your chance to keep in touch.

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KERMIT WORLDWIDE

IT HAS been gratifying to see the increased awareness of the Kermit file-transfer system following the various articles and letters in *Practical Computing*. However, to avoid disappointment, I would like to remind people of the distribution position.

We act as the U.K. distribution centre and we are very happy to supply Kermit on tape and — for a small range of machines — on disc to people in the U.K. and Eire. However, we do not undertake to supply it to anyone outside these countries because we just haven't the manpower resources to do so. Anyone wanting Kermit in the rest of the world should contact the main distributors in New York: the address is Kermit Distribution, Columbia University Centre for Computing Activities, 612 West 115th Street, New York, NY 10025.

That said, there are two exceptions. Anyone can use our on-line service by dial-up or network. Also as we originated the Kermit for the BBC Micro, we'll supply this version only to anyone in the world, but we have to charge for handling and media. Those interested should write for details or phone us on (0524) 65201, extension 4881; no telex messages please.

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Lancaster LA1 4YW.

Commissionaire

WE READ with interest your review of the Comart Quad and Bromcom QC in the January issue but were disconcerted to see that you wrongly attributed Commissionaire to Digital Research, when it is a product of Intelligent Micro Software Ltd.

We do not know when you previously came into contact with our product but if your previous experience was with version 1 then we would draw your attention to the new facilities offered by Commissionaire version 2, especially the multi-site mail facility and the new diary.

D CROCKER,
Intelligent Micro Software,
Byfleet,
Surrey.

A blank line with Echo

A BLANK line in MS-DOS 3.1 and 3.2 can be obtained with the line

ECHO.

There must not be a space between the letter O and the full stop. This works from the console or with any word processor I have so far tested.

COLIN BRUNGER,
Brunei.

VP-Info

AS A bespoke software house specialising in database applications, ICS has recently been involved in the evaluation of a number of database programming languages. Our method of evaluation does not rely on straightforward benchmarking, but consists of taking an existing dBase II application and translating it to the language under test. We then make comparisons on the basis of ease of development and maintenance, speed of operation, etc.

Applying this method to VP-Info, our initial results were in direct contradiction to your own: skips forward and backward were almost instantaneous, as were amendments, finds and additions to a 1,000-record file with two indexes. In particular, the speed when rewriting the screen was quite incredible.

We then transferred our test program from the Future FX-50 on which we had been working under C-DOS to a North Star Dimension. The results were quite the opposite at first, until we tried the

SET SNOW ON

command. It would appear that VP-Info detects the presence of a graphics adaptor and, on the assumption that it is of the type which generates snow, implements its own method for synchronising video updates. If you are prepared to live with video snow, or if your graphics adaptor does not have this problem, using the Set Snow command makes a tremendous difference to the performance.

ROGER ASH,
Ideal Computer Systems,
Kingston upon Thames,
Surrey. PC

WHICH COMPUTER? SHOW REPORT

THIS YEAR's show at Birmingham's National Exhibition Centre clearly demonstrated the shift up-market which has occurred over the past year. Even low-cost PC clones were notable by their absence. The exception, of course, was the Amstrad PC, which occupied one of the prime positions in the hall. Taking their place were a number of AT clones, along with the first smattering of 80386 machines.

Printers followed the same pattern. Everyone, it seemed, had a laser printer on display, most of them costing around £2,000. Several scanners were in evidence, reflecting the gradual emergence of complete text input and output systems.

In contrast to all the new hardware, there was little software on view. This reflects the current state of the industry, which is waiting for developments on the hardware front to settle down before the next big wave of software comes through. All in all the show confirmed that 1987 should be a year of solid achievement for the micro industry.

AMIGA A-2000

ONE OF the machines hidden away from the prying eyes of the general public was the first of the next generation of Amigas. Interestingly enough it still uses a 68000 rather than a 68020 as its base processor; however, the machine is designed to be easily upgraded. There will also be an A-2020 model which will have the 68020 as standard.

RAM starts at 1Mbyte, and can be expanded up to 2Mbyte on the motherboard and 8Mbyte with cards. There is room for two 3.5in. drives — floppy or hard — and one 5.25in. drive. The dual Amiga/IBM approach is further reflected in the internal slots: there are three Amiga slots and four eight-bit IBM slots.

This hybrid approach is clearly aimed at allaying fears about the lack of general applicability of the Amiga A-2000 in business. At the same time it preserves the machine's advanced graphics capabilities. Co-processing is very much the order of the day, and Transputers are another possible future enhancement. Commodore says that it will be possible to cut and paste between the Amiga and IBM environments.

Perhaps the most impressive feature of the machine is the likely price. At the time of going to press this was thought to be about £2,000 for a system including a hard disc.

Commodore was also showing a range of video products. A genlock device for use with interactive video was on show from Ariadne Software. The cost is £430; a frame grabber costs £699. Details are available on 01-960 0203. Also on show was an Amiga linked up to a Polaroid Palette presentation system.

Lasers at lower cost

EPSON is launching its first laser printer, the GQ-3500, in May. At the show the machine was hidden away inside the Epson stand, probably to prevent it diverting attention from products that are immediately available.

Aimed primarily at word-processing users, the GQ-3500 is a very compact machine with a maximum speed of six pages a minute. The price is still to be announced, but is likely to be very keen — possibly under £1,500. For more information contact Epson U.K., Dorland House, 388 High Road, Wembley, Middlesex, UB8 2XW. Telephone: 01-902 8892.

Citizen's Overture 110 goes on sale in April and costs £1,995. It is faster than the Epson offering, with a maximum speed of 10 pages a minute, and has a 250-sheet paper tray as standard against the Epson 150. Further information is available from Citizen Europe, Wellington House, 4-10 Cowley Road, Uxbridge, Middlesex UB8 2XW. Telephone: (0895) 72621.

Among the more expensive laser printers at the show were two from Texas Instruments, the Omnilaser 2108 and 2115. Both these machines are Postscript compatible so they would be well suited to desk-top publishing applications. They also support HPGL, making them capable of emulating plotters for CAD/CAM work.

The Omnilaser 2108 costs £5,195 and has a maximum speed of eight pages a minute, while the £7,195 Omnilaser 2115 can get up to 15 pages a minute. They come complete with the appropriate interfaces to enable you to connect them to either IBM or Apple Macintosh systems.

Contact Texas Instruments at Manton Lane, Bedford MK41 7PA. Telephone: (0234) 270111.

Amstrad PC add-ons

TWO new peripherals from Amstrad were of particular interest. The first is the DMP-4000 wide-carriage printer. It claims 200cps in draft mode and 50cps when printing NLQ. It is 136 characters wide, comes with tractor and friction feed, and uses a standard parallel Centronics interface. The cost is £349.

Also launched at the show was the PC Card Modem which, as its name suggests, is an internal modem card. It provides both V-21 300/300 baud and V-23 1,200/75 baud standards. It has autodial and auto-answer and is Hayes compatible.

The software which comes with it is Datatalk, offering viewdata, a telephone directory for up to 128 numbers, Xmodem and Kermit protocols. The modem is fully approved and costs £149. Details from Amstrad, Brentwood House, 169 Kings Road, Brentwood, Essex CM14 4EF. Telephone: (0277) 230222.

Sinclair on the move with Z-88

SIR CLIVE SINCLAIR has bounced back into the limelight with a lap-portable computer.

Priced at a few pennies under £200, the Z-88 measures approximately 12in. by 8in. by 1in. It is based around a CMOS Z-80 eight-bit processor and contains 128K of ROM and 32K RAM, expandable to 3Mbyte.

The display consists of an eight- by 80-character LCD featuring the latest super-twist technology. The interfaces provided with the machine are three cartridge ports, a Z-80 expansion bus and an RS-232 port for printer connection. No disc-drive option has so far been announced.

The operating system for the Z-88 is proprietary to Cambridge Computer and is called C-DOS. Also bundled with the machine is a suite of applications including spreadsheet, word processing, database, diary/calendar and calculator. BBC Basic is also built-in. All software is held in ROM.

The Z-88 is to be sold by mail order. Cambridge Computer says that it will begin shipping machines to customers from the beginning of April.

For further information contact Cambridge Computer, Sidney House, Sussex Street, Cambridge CB1 1PA. Telephone: (0223) 312216.

APRICOT JOINS THE 386 CLUB

APRICOT has launched its IBM-compatible 80386-based micro. The new machine, called the Xen-i 386, is expected to become available in the early summer.

The new micro will be available in two versions. The Xen-i 386/30 is fitted with a 30Mbyte hard disc and 1Mbyte of RAM as standard. This is the base configuration costing £2,999. The only other model so far announced is the Xen-i 386/45. It has a 45Mbyte hard disc drive and comes with 2Mbyte of RAM as standard. The 386/45 model is priced at £3,999.

At first glance, the system unit looks identical to that of the earlier Xen-i models. But where the 80286-based Xen-i machines had an external power supply the new models have an internally fitted unit. The keyboard has also been altered and is now compatible with the IBM ATE layout. Apricot has finally abandoned the micro-screen; its functions are now supported by a pull-down window on the main screen. Two floppy-disc options are available: a 1.44Mbyte 3.5in. unit or an AT-style 1.2Mbyte 5.25in. drive.

The Xen-i 386 series retains the half-height backplane expansion configuration pioneered by the Xen-i. By using its full expansion capabilities memory can be expanded to 8Mbyte.

In order to make use of the extra memory Apricot is to supply Microsoft's new expanded memory manager, known as EMM/386. As well as providing the usual bank-switching techniques, the system uses the advanced 80386 memory-management unit and the chip's Virtual 8086 mode to provide an extended DOS area to 846K. Like Compaq, Apricot has provided a utility on its 80386 machine to copy the BIOS ROM into fast RAM.

In a bid to move the Apricot brand name further up-market, the company has also announced the Apricot VX — not to be confused with the Research Machines 8036 machine of the same name — based around the Xen-i 386. An external sub-system provided with the VX series supplies either 70Mbyte, 157Mbyte or 268Mbyte of hard-disc capacity. Up to four sub-systems can be daisy-chained together, giving a maximum capacity of 1.8Gbyte. The VX sub-system can also be configured to support a variety of LANs via the Apricot Network pack. They include Xenix-Net, Token Ring and Ethernet .

Further details are available from Apricot plc, 111 Hagley Road, Edgbaston, Birmingham B16 8LB. Telephone: 021-456 1234.

SCANNERS

SEVERAL new input scanners were in evidence at the show, designed for handling both graphic images and text. Hewlett-Packard introduced its Scanjet, a £2,000 flat-bed A4 scanner intended mainly for desk-top publishing applications. The flat-bed design means that artwork is not damaged by being fed past rollers, and also makes it possible to scan images from bound books.

The HP Scanjet can scan at the same resolution as most laser printers, 300 dots per inch, and will turn continuous-tone images such as photographs into 16 levels of grey. The HP stand was decked with slogans announcing the formation of an HP alliance with Aldus and Microsoft to attack the IBM desk-top publishing market, and the Scanjet was in use with Aldus PC Pagemaker. For information on the Scanjet contact Hewlett-Packard, Enquiry Section, Eskdale Road, Winnersh Triangle, Wokingham, Berkshire RG11 1DZ. Telephone: (0734) 696622.

Canon is releasing optical character recognition software for its existing roller-fed IX-12 scanner. This enables you to read typewritten documents directly, converting the page placed in the scanner into a WordStar, Word Perfect or ASCII file for subsequent word processing or desk-top publishing use.

With the OCR software the IX-12 will cost around £1,550 when it goes on sale in March or April; the scanner on its own is £1,100. The conversion process takes about two or three minutes per page. Small-size typeset material cannot be read accurately, but most common typewriter founts are supported. For details refer to Canon (U.K.), Canon House, Manor Road, Wallington, Surrey SM6 0AJ. Telephone: 01-773 3173.

Compact Compaq

COMPAQ COMPUTER unveiled its new Portable III machine on the first day of the show. Three versions have been announced. The model 1 has no hard disc and is priced at £3,250, while the model 20 features a 20Mbyte hard disc and costs £3,950. The final version in the range is the model 40, which has a 40Mbyte hard disc and a £4,395 price tag.

The Portable III measures 8in. by 10in. by 16in. and weighs 18lb. The 80286 processor is clocked to run at 12MHz. Compaq has fitted the machine with 640K of RAM, expandable to 6.6Mbyte on the motherboard. Also provided as standard across the range is a 5.25in. floppy-disc drive.

The most striking feature of the Portable III is the built-in plasma screen. Compatible with the IBM Colour Graphics Adaptor (CGA), the screen is claimed to be the first to support shading and highlighting of text.

Further details from Compaq Computer Ltd, Ambassador House, Paradise Road, Richmond, Surrey TW9 1SQ. Telephone 01-940 8860.

Software roundup

THIS YEAR'S SHOW was not particulary notable for software launches, with most of the major packages on display having already received coverage in the computer press. What activity there was took place mostly on the spreadsheet front.

Lifetree Software, the company responsible for the Volkswriter word processors, launched Words & Figures. At £99 this package provides a spreadsheet closely compatible with Lotus 1-2-3 along with a built-in word processor. Details are available from Lifetree Software (Europe), Lowndes House, The Bury, Church Street, Chesham, Buckinghamshire HP5 1HH. Telephone: (0794) 772422.

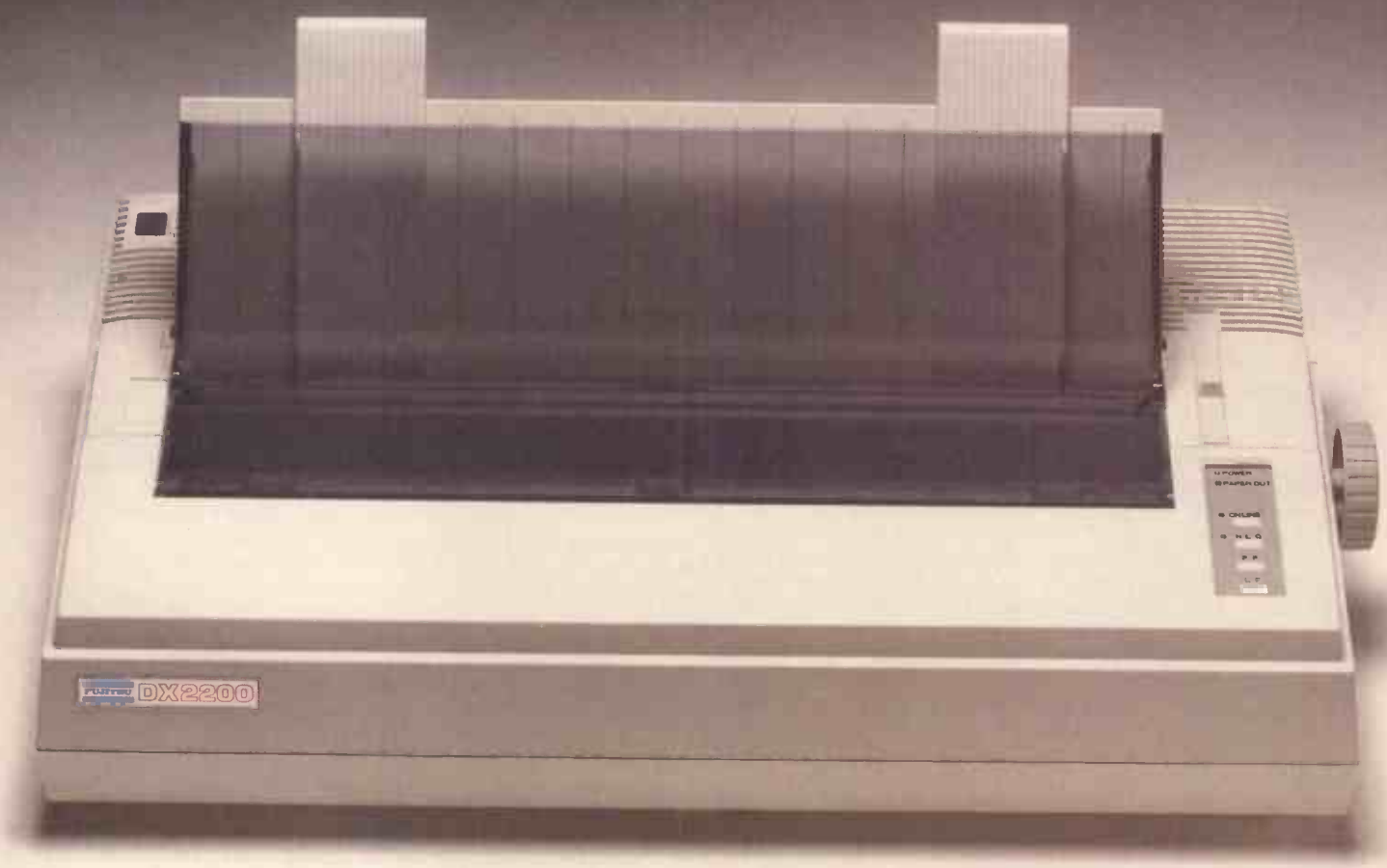
CSD launched Silk. This £295 spreadsheet is again compatible with most Lotus 1-2-3 commands, but aims to be easier to use. Formulae can be specified with keywords rather than cell ranges, for example. Further information can be obtained from CSD, Unit B11, Armstrong Mall, Southwood Summit Centre, Farnborough, Hampshire GU14 0NP. Telephone: (0252) 522200.

Integrated 7, a seven-function all-in-one package which itself incorporates a good Lotus-style spreadsheet, is now being imported by Neric Automation. Priced at under £80, Integrated 7 offers good graphics and a powerful database function. Contact Neric Automation, Gunsell Lodge, Wood Lane, Tugby, Leicester LE7 9WD.

Software Publishing was showing off its new PFS Professional Plan spreadsheet, along with the latest version of Harvard Project Manager. PFS Professional Plan costs £299. It can read Lotus files and has things like keyword formulae and the usual high-grade easy-to-use PFS interface. Harvard Total Project Manager II costs £475. For further details contact Software Publishing Europe, 85-87 Jermyn Street, London SW1Y 6JD. Telephone: 01-839 3864.

Tekware had several CAD and presentation-graphics packages on display, among them the new Graph Station. This £560 package will read Lotus files directly, and lets you quickly regraph data when you make alterations in the underlying spreadsheet. Details from Tekware, Palladium House,139-141 Worcester Road, Hagley, West Midlands DY9 0NG. Telephone: (0562) 882125. PC

Whatever the make of your computer, a Fujitsu printer will power it up.



Just plug in and begin.

Fujitsu printers are hardware and software compatible with almost every single computer system on the market today.

Which means that when you buy a Fujitsu printer, all you need do is plug it into your computer, and then plug it into the wall. And off you go. Nothing could be simpler.

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Fujitsu printers are not only plug-compatible with any computer you might find, they're also the highest quality and most reliable printers you can buy.

That's because they're made by Fujitsu, which is the largest and most respected computer maker in Japan.

To learn more about the surprising quality, reliability – and variety – of Fujitsu printers, please send in the coupon below. Or write to: *Fujitsu Europe Ltd., Royal Trust House, 54 Jermyn St., London SW1Y 6NQ, England.*

Japan's No. 1 computer maker

FUJITSU

DL2400 DX2100 DX2200 SP320 DPL24

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Please send information on the following:

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- ☐ **DL2400** (24 pin dot-matrix)
- ☐ **DL2400C** (24 pin dot-matrix, colour)
- ☐ **DX2100** (9 pin dot-matrix, 80 col.)
- ☐ **DX2200** (9 pin dot-matrix, 136 col.)

Name: _____

Title: _____

Company: _____

Address: _____

City: _____ Country: _____

Phone: _____ Fax: _____

Fujitsu Europe Ltd. Royal Trust House, 54 Jermyn St., London SW1Y 6NQ, England. Phone: (44-1) 408-0043

Transputer for IBM

INMOS, the Transputer-manufacturing subsidiary of Thorn EMI, is reported to have won a $21 million contract from IBM. The order is said to be for the G-170 graphics-based version of the Transputer.

The normal price for these devices is in the region of £50 each. Translated into the size of the order, this means that at least 274,000 G-170s would have been ordered; with the big discounts IBM is sure to have obtained even more devices will have been involved.

Neither IBM or Inmos is willing to comment on the deal or what it means for future IBM products.

Intel launches 80386 board

INTEL has released the Inboard 386/AT, an accelerator board which puts the power of an 80386 processor into a standard AT. The chip runs at 16MHz and has sockets for both the 80287 and 80387 maths co-processors.

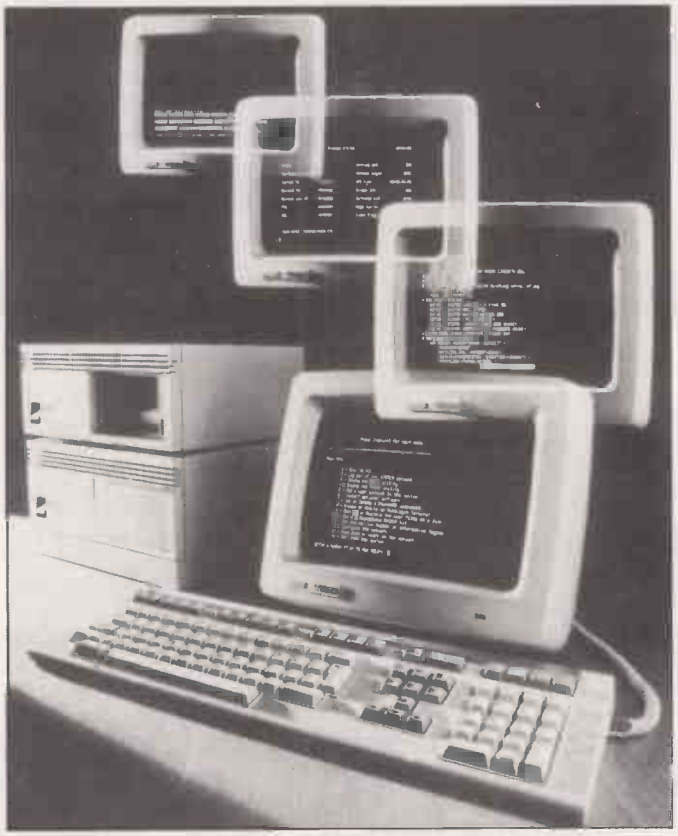
To boost performance, Intel has fitted high-speed cache memory on to the board. The Inboard 386/AT can be fitted with up to 1Mbyte of 32-bit RAM. Up to 3Mbyte can be supported by using piggybacked RAM boards.

Extra extended memory is utilised by MS-DOS via the Intel Expanded Memory Manager, developed by Microsoft. It is essentially an 80386 version of the LIM EMS specification which has proved popular for the PC and AT ranges; it allows additional memory to be banked into DOS's 1Mbyte address space.

Also bundled with the card is control software to allow the user to take advantage of the chip's virtual 386 mode.

Prices for the Inboard start at £1,740. With the additional 1Mbyte memory the price rises to £2,230. The prices do not include the necessry cabling to the 80286 socket on the motherboard, which costs an extra £195. The piggyback RAM boards cost an additional £630 for 1Mbyte and £1,110 for 2Mbyte.

For details contact First Software, Intec 1, Wade Road, Basingstoke, Hampshire RG24 0NE. Telephone: (0256) 463344.



DEC'S MINI ON A DESK

IN RESPONSE to the upward migration of microcomputers to the minicomputer arena, DEC, the minicomputer giant, has fought back with a four-user version of its popular Microvax range priced at under £10,000.

The Microvax 2000 is a reduced-capacity version of the Microvax II. It uses the same processor and floating-point chip set as the Microvax II but can only support up to 6Mbyte of RAM and 142Mbyte of disc storage. The machine has a 5.25in. 1.2Mbyte floppy-disc drive and a 71Mbyte hard disc built-in. Hard-disc capacity can be doubled by the use of a second external 71Mbyte hard disc.

The price of the Microvax 2000 is £7,571 for the hardware. The cost together with a four-user VMS licence at £2,080 brings the cost to £9,651. The price does not include terminals. Further details from Digital Equipment Company, DEC Park, PO Box 110, Reading, Berkshire RG2 0TR. Telephone: (0734) 868711.

IBM increases memory and speed of RT/PC

IBM HAS announced a series of enhancements to its Risc-architecture machine, the 6150, otherwise known as the RT/PC. The company claims that the new features double the amount of possible memory and run the machine two to three times faster.

There are three models in the new range: the 115 desk-top and the 125 and B-25 floor-standing machines. Each of the new machines contains the Advanced Processor Card, which utilises direct memory access, buffering and an improved hard-disc format which speeds transfer between the disc and main memory. Also included is a 20MHz Motorola 68881 maths co-processor and 4Mbyte of memory. Total memory expansion for the new models now goes up to 16Mbyte.

The new systems will also feature Aix version 2.1, IBM's proprietary version of Unix. Further details from IBM (U.K.), PO Box 31, Birmingham Road, Warwick CB34 5JL. Telephone: (0926) 32525.

HARDWARE SHORTS

- Olivetti has reduced the prices of its range of PCs. At the top of the range, the reductions are up to 15.5 percent. Details from 01-785 6666.
- The first Concurrent DOS 386 products are beginning to emerge. Among the first in the field is Technology Concepts Limited, which is offering the operating system with its multi-user systems for between four and eight users. Details on (06333) 72611.
- Cambridge Computer Graphics has claimed a first by incorporating the new Texas Instruments 34010 32-bit graphics chip into a PC card. The card will be known as the Xcellerator. It has a resolution of 1,024 by 768 pixels and a palette of 16 million colours. Details on (0223) 214444.
- Xitan has begun distribution of Torrington's three-button cordless mouse. The Manager Mouse uses an infrared link with a PC and uses small wheels instead of the conventional ball. Further information from (0703) 871211.
- Pronounce is a voice-input system which is designed to replace up to 255 keystrokes with a single word from a 128-word on-line vocabulary. Phone Electrone on 01-429 2433.

Canon AT compatible

CANON has added an AT compatible to its range of products. The A-200EX HD-40 follows the valued-added route taken by most Japanese manufacturers. The A-200EX is equipped with 640K of RAM, a 1.2Mbyte floppy-disc drive and a 40Mbyte hard-disc drive. The machine has a switchable clock speed, enabling the machine to run at either 6MHz or 8MHz.

Fitted with serial and parallel ports as standard, the A-200EX HD-40 has six AT expansion slots and two PC slots. The computer is available with either monochrome or colour monitors, and prices start at £4,250. For further details contact Canon (U.K.), Canon House, Manor Road, Wallington, Surrey SM6 0AJ. Telephone: 01-773 3173.

BORLAND SPRINT

BORLAND took the unusual step of announcing a half-finished product during a visit by Philippe Kahn to steady the nerves of market analysts. Even more unusual is the fact that the new Sprint is a mainstream word-processing product. It is notable for its ability to mimic other popular word processors like WordStar and Word Perfect. Although the interface remains different — obviously with an eye to avoiding "look and feel" legal battles — the command structure can be mimicked.

Sprint also offers some features of its own. For example, multiple files, multiple windows and multiple rulers can be opened simultaneously on-screen. Up to 24 files can be accessed at once.

Sprint automatically saves documents as you work on them, using the periods when you are not typing. This means that if the power suddenly fails you lose at most a few seconds' work. The program also has extensive support for laser printers, including the Postscript language. Subject indexes, tables of contents, footnotes and cross references are all standard features.

If any of these features sound familiar it is because Sprint has been written by the authors of the venerable Final Word package, which had a number of similar abilities. Sprint is expected in the second half of the year, and will cost $195. No U.K. price has been announced.

Borland also gave some details of its upgraded Sidekick Plus, as well as releasing a Toolbox for Turbo Prolog. Other releases include version 2.0 of Sidekick for the Macintosh, which now includes an outline processor and spreadsheet. Both products cost £69.95.

For more information on all Borland products contact Borland International (U.K.), 1 Great Cumberland Place, London W1H 7AL. Telephone: 01-258 3797.

SOFTWARE SHORTS

- Version 3.1 of Smart has been released. It includes multi-user capabilities. Details on 01-223 3876.
- A utility called Glue allows you to transfer graphics between Mac packages. The cost is £49.95. More on (0706) 217744.
- Adobe Systems has announced a new range of downloadable founts, making a total of 111 typefaces now available. Details on 031-558 3333.
- dBase II is available for the Amstrad PC. The cost is £119, and it is available from First Publishing on (07357) 5244.
- RM/Cobol-85 has been released for MS-DOS. It costs a mere £1,155. More information on (0992) 24981.
- Springboard Publisher is a desk-top publishing program for the Apple II family. It costs £129.95, and is available on (05806) 4278.
- An interface to link BOS/Writer with the Liberator lap portable has been announced. The price is £100. Details on 01-831 2926.

Digital Research first with 80386 DOS

DIGITAL RESEARCH has won the race to get a version of DOS for the 80386 processor out to the customers. The new version, known as Concurrent DOS 386, is already with some equipment manufacturers and has been demonstrated on a number of 80386-based machines. Among the firms who have adopted the new operating system are Jarogate and Comart.

Concurrent DOS 386 retains many of the features of the earlier version of Concurrent DOS. It is compatible with MS-DOS version 2 and Concurrent CP/M formats and supports multi-tasking and multi-user activities. It also supports the LIM EMS expanded-memory specification.

Beyond that, Concurrent DOS-386 can directly address 4Gbyte of memory, within which each 8086 application can be assigned up to 1Mbyte of RAM. Digital Research says that use of the 80386's internal registers to keep track of pages of information leads to no reduction in processor speed even if the pages are distributed throughout memory. Up to 255 tasks can run concurrently in this way, although for the present limitations will be imposed by the hardware.

Further information from Digital Research, Oxford House, Oxford Street, Newbury, Berkshire RG13 1JB. Telephone: (0635) 35304.

dBase III Plus add-ons

ASHTON-TATE has announced a series of add-on products for dBase III Plus. They are dBase Programmer's Utilities, dBase Tools for C Programmer's Library, dBase Tools for C Graphics Library, and dBase Tools Pascal Programmer's Library.

The Programmer's Utilities include over 35 dBase and DOS utilities, including programs for dBase database repair, recovery and analysis. The C programs allow compiled C functions to be called and executed, including those for producing graphical output. The Pascal library performs similar functions for that language.

All four products are priced at £89 each and can be purchased from Ashton-Tate dealers.

Security software

THREE packages dealing with data security have been announced. Maint is a disc organiser with optional encryption. It also offers positive file deletion: that is, files are overwritten, not just removed from the directory. The cost is £49.50, or £99.50 with encryption. More details from Sophos Partners, 20 Hawthorn Way, Kidlington, Oxford OX5 1EZ. Telephone: (0865) 853668.

Datalock comes from Ferranti and offers passwords, audit trails and encryption. The cost is £65, or £145 with encryption. More details from Ferranti Computer Systems Limited, Wythenshawe Division, Simonsway, Wythenshawe, Manchester M22 5LA. Telephone: 061-499 3355.

Protec is a similar package offering access control and encryption. The cost is £170, and it is available from IPE Corporation, 37b New Cavendish Street, London W1M 8JR. Telephone: 01-794 8343.

Ingres for PCs

INGRES is one of the most popular relational databases for minis and mainframes. A version has now been released for micros which allows information to be swapped across easily between different levels of systems.

The publisher of the program, Relational Technology International, claims that Ingres Release 5.0 is the fastest full-function relational database available.

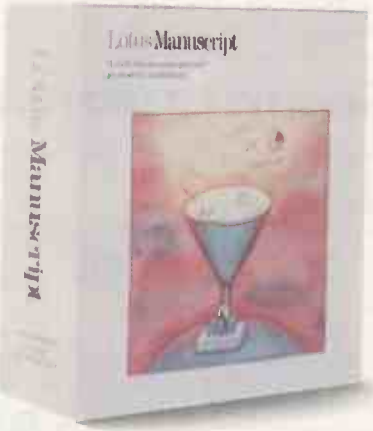
To run Ingres on a PC or compatible you need at least 640K RAM and 5Mbyte of non-volatile storage. The package costs £850.

More details from Relational Technology International, Anchor House, 15-19 Britten Street, London SW3 3TY. Telephone: 01-351 7722.

PCW-8256 Menu Mate

MENU MATE is a keyboard template which fits over the Amstrad PCW-8256 keyboard and provides a list of option abbreviations, special key combinations and copy, cut and paste instructions. The cost is £6.99 including VAT, plus £1.25 for postage and packing. More details from Richman Software, 14-16 Little Walk, Harlow, Essex CM20 1HY. Telephone: (0279) 25401. PC

Manuscript. How to proces



You may be content with your present word processor. And it's easy to understand why.

Even the clumsiest word processor is light years beyond the electric typewriter, the accepted standard only a decade ago. However, just the term word processing conjures up a rather modest expectation. The ability to process words.

But, the mere processing of words is hardly the challenge today. When you're creating a 20-page report, an 80-page proposal, a 200-page specification, or just a 2-page letter, you often have to work with graphics, equations, tables and more.

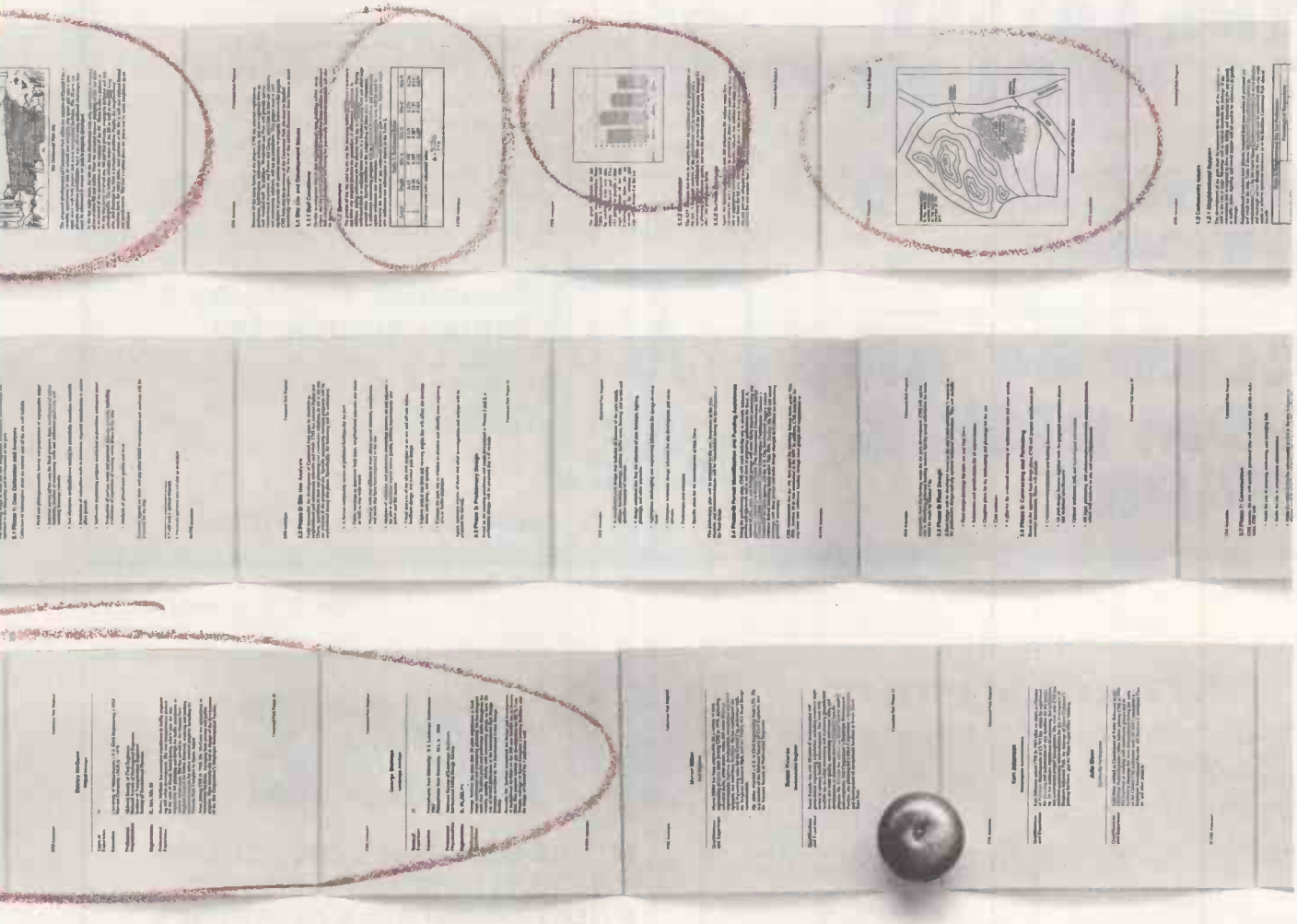
That's simply too much to ask of a product designed to process words. But, that's exactly what you can expect from Lotus Manuscript, it provides a complete document creation system for business and technical professionals.

Very often documents require the mixing of text and graphics on the same page, for example, graphics from Lotus 1-2-3, Symphony and Freelance Plus. With Manuscript you can import spreadsheets and charts, as well as diagrams and scanned images.

Another feature that goes beyond conventional word processing is Manuscript's integrated Outliner. When you reduce the document to a series of headlines, you're able to navigate more easily than wading through the entire piece. You can move a page, or even an entire chapter with just a few keystrokes.

Because Manuscript understands the structure of your docu-

s documents, not just words.



ment, you can globally format an entire document or format by individual sections. Imagine changing all headlines from 14 point plain text to 16 point bold, by a simple menu selection.

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BY JACK SCHOFIELD

FIGHTING A LOSING BATTLE

BRITISH TELECOM'S PIECEMEAL APPROACH TO DATA COMMUNICATIONS MAY LEAVE THE U.K. VULNERABLE TO ATTACK BY ITS INTERNATIONAL COMPETITORS.

Since privatisation British Telecom has pushed ahead into computerisation and data services. This is more than updating its vast number of ancient mechanical telephone exchanges with System X digital switches. BT is trying new markets at last.

For example it has bought the international Dialcom electronic-mail network, following its success with Telecom Gold. It is trying to start a value-added services network, Vascom. It has produced a decent reasonably priced telephone work station, the Qwertyphone, to supplement the Tonto, which came out of the Sinclair QL via ICL's One Per Desk. It is computerising its directory-enquiries system. Most recently it has opened an on-line version of Electronic Yellow Pages, and launched a Photo Videotex system. It is pioneering in both the new X.400 message-handling systems, and Integrated Services Digital Network. It is going to pioneer the use of credit-card sized optical storage using the Drexler Lasercard.

With all these developments BT is mobilising its resources, like an army marching off to war. This commercial war will be fought over the international communications arena. Its foes are AT&T and the Bell operating companies, Ericsson, ITT, the European telecomms suppliers, Japan's NTT and many more, all competing in various shifting alliances. All seek world domination.

From this point of view it isn't very important whether BT engineers work a nine-day fortnight or who pays for the 999 service. These questions seem vital to unions and politicians whose views stretch little further than Tower Hamlets, but if this view prevails then U.K. Ltd really is done for.

International communications, data and value-added services are the next big thing. If BT loses the way the Rover Group lost to Ford and General Motors, or the way ICL lost to IBM, then you can forget about Britain holding its position as a nation in the middle of Division Two.

The problem with marching an army off to war is that the first batallions are well down the road before the ones at the back are even called to attention. BT has just this problem, which is why certain areas of apparent inactivity should not bother us much. What is of more importance is whether the batallions at the front are marching in the right direction. I'm not sure that they are.

While BT is entering new markets, offering new services and pushing forward with new ideas, I cannot understand what its strategy is. Is it simply hoping that lots of minor successes will somehow add up to a viable share of the market? Or is it still working on a grand design?

It seems that the French have a grand design, expressed through a series of concrete aims, and that these aims are right while BT's are wrong. First, the French recognise that data communications are the highways of the future, so France has built an integrated highway system called Transpac. Second, people need terminals to access Transpac, so it is installing them in homes at a rate of over 1,000,000 a year. Third, there has to be some sort of application to bring the system into use.

The French answer for the general public is the directory-enquiries service. People with Teletel terminals can use them to look up phone numbers. Businesses use the system for local government and commercial communications. In some areas you can fill in financial statements and various application forms on-line, instead of using paper.

None of this is as unprofitable as it might sound. Directory enquiries are free, but when you use Transpac for other services the charges appear on your telephone bill. The calculation is that within four years these pay for the cost of the terminal.

Of course there are vast savings on the cost of printed directories, which provide a long-term benefit even after the system is running profitably. There are further savings on directory-enquiries staff. With the government services, the data entered by business users can go straight into databases, instead of having to be typed in. Experiments have also shown increased efficiency as fewer forms are filed late or filled in incorrectly. The exercise is also valuable in building up computer literacy.

Installing vast numbers of terminals means they can be produced very cheaply. Having millions of users creates a huge market for on-line services: the French system is growing by an average of three a day. This is building up a strong group of information-technology suppliers, hardware manufacturers and software firms who can compete on the world market.

By contrast, BT has Prestel, a videotex system which assumes the user has a modified television set and a keypad telephone. Prestel has failed. Second, it has Telecom Gold, which is an ASCII service licensed from Dialcom. While this is accessible via Packet Switch Stream (PSS), the U.K. equivalent of Transpac, the provision of PSS ports in most parts of the country is lamentable at best. Third, it has just started the Electronic Yellow Pages, but this is shackled to the Prestel format, and although it is free it does mean phoning a computer in Reading. Fourth, BT has a range of network services, but if you know the difference between PSS, IPSS, Multistream, — Bpad, Epad, Rpad, Spad, Tpad, Vpad, Kilostream, Megastream, IDA, ISDN and Vascom then you probably work for BT. Fifth, BT is spending over £80 million on directory-enquiries computers, complete with data lines from four main computer centres, but only its own operators have access so you phone the operator who asks the computer and then tells you the answer!

Now the better informed can argue that the French system is not as simple as I've made out, while BT's systems are not as confusing. My point is slightly different: the French present a clear strategy, while BT does not present anything clearly and does not appear to have a strategy at all.

Nor am I suggesting that BT should suddenly start installing millions of free terminals in people's homes. My point is that it is clearly right to put the digital network at the centre of your communications strategy, and it is wrong to put a lot of separate computers at the centre of their own restricted networks, especially if they cannot even talk to one another. If both government and industry are going to have their own separate networks too, this just makes it even worse.

If an army has a winning strategy it can afford to lose some battles along the way. Not everything the French have done has been right. However, if an army's only strategy is to win by winning the minor battles it is likely to lose in the long run, because every defeat is a setback.

Looking at BT from this point of view is not reassuring. Prestel has been a flop. BT's directory-enquiries installation seems to have been a shambles. Telecomsoft spent a lot of money buying other software houses, like Beyond, without getting much in the way of saleable product. Hotline has adopted what I think is the wrong approach in charging a very high price up front and offering only a limited range of data. As for the Electronic Yellow Pages, this is the worst designed database I have ever accessed.

No doubt there are problems, waking up a sleepy old giant through privatisation. But if I knew where BT was going and what it was trying to do, I would feel more confident about the future. As it is, I fear the worst. PC

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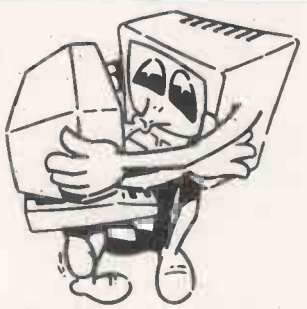

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BY MIKE LEWIS

A WAY WITH WORDS

BORLAND'S TURBO LIGHTNING AND WORD WIZARD PACKAGES CAN BE USED TO SIMPLIFY A LOT OF WORD-ORIENTATED PROGRAMMING TASKS.

Anybody trying to write a word-based program faces a major snag. Whether it is a simple word grid or a full-blown Scrabble game, the program needs some way of knowing if a given combination of letters makes a legitimate English word. Nobody has yet come up with a programmable method of distinguishing meaningless character strings from genuine vocabulary. To work properly, word-orientated software must have access to a dictionary.

Of course, there is nothing unusual about computer-readable dictionaries. Every spelling checker has one. The trouble is that it is not usually possible to get at them from within your own programs. The internal layouts of the dictionaries are not generally published. Because they come in a highly compressed form, rather than as straight ASCII files, there is no way that producers of third-party software can take advantage of them.

Recently, however, a number of products have appeared which aim to overcome this problem. The best-known is Borland International's Turbo Lightning. As well as a very respectable dictionary — up to 85,000 words, depending on disc space — this package also sports a sizeable thesaurus. But its most interesting feature is its open architecture.

Turbo Lightning is really three products in one. First, there is the software that is seen by the end-user: the memory-resident spelling checker and synonym finder. It is designed to work on top of other applications and is accessed via a set of pull-down menus and hot keys. Then there are the actual reference files — the dictionary and thesaurus — with hooks for any other lists that might be published in the future.

Between these two there is the layer of software that is of most interest to the programmer: the Turbo Lightning engine. This is the gateway through which ordinary programs can get at the Lightning reference files. The engine is memory resident and consists of 16 function calls for interrogating and searching the dictionary, for finding synonyms and sound-alike words, for working with word tokens, and quite a lot more.

Calling the Turbo Lightning engine is similar to calling the ROM BIOS. When Lightning is installed, it takes over interrupt 16 hex, the BIOS keyboard interrupt. To call the engine, you issue an Int 16H with a special signature in the AH and BH registers, and a function code in BL. To avoid interfering with normal keyboard operation, any calls that do not follow this pattern are forwarded by the engine to the BIOS.

For example, if you wanted to look up a certain word in the dictionary you would call the engine with function 01 specified in BL, and with DS:SI pointing to the word. If Turbo Lightning finds the word, you will get back its physical address within the dictionary and also its unique 24-bit serial number. These details are passed via an area of memory called the Data Interchange Table.

Not all programmers, of course, like working with registers and interrupts, even if their high-level language allows them to do so. To help them out, Borland has published Word Wizard, containing among other things a Turbo Pascal toolbox for calling the Turbo Lightning engine. It consists of around two dozen Pascal

(continued on next page)

WORD FINDER

```
program WordFinder;
  {Finds all words that can be made from a given word or phrase; needs Turbo
  Pascal, Turbo Lightning (TL), and Word Wizard - all published by Borland}

{$I ENGINE.WW                          the Word Wizard library for TL}

type
  Word=string[32];

const
  KeyWord: Word='SOFTWARE';            {the starting word - this is just an example}
  KeyLen=8;                            {length of the key word}
  MinLen=3;                            {minimum length allowed for derived words}

var
  DictWord: Word;
  KeyIndx: integer;
  DummyReply: boolean;
  CurrLetter: char;

function LettersMatch(test,target:Word): boolean;
  {returns true if the test word can be made from letters of target word}

var
  LetPos, j: integer;
  fail: boolean;
  ch: char;

begin
  j:=1; fail:=false;
  while (j<=length(test)) and not fail do
  begin
    ch:=upcase(test[j]);               {extract the next letter}
    LetPos:=pos(ch,target);            {look for it in the target}
    if LetPos>0 then
      target[LetPos]:=' '              {if found, delete it from target}
    else
      fail:=true;                      {otherwise, the test has failed}
    j:=j+1;
  end;
  LettersMatch:=not fail;
end;      {of LettersMatch}

begin     {main program}
  DummyReply:=LightningPresent;        {initialise TL work areas}
  DedicateLightning(true);             {stop user getting at TL directly}
  for KeyIndx:=1 to KeyLen do          {for each letter in the keyword}
  begin
    CurrLetter:=KeyWord[KeyIndx];      {extract the letter}
    DummyReply:=InitRangeSearch(CurrLetter,MinLen,KeyLen);
                                       {set parameters for TL search}
    repeat
      DictWord:=GetNextWordInRange;    {get next dictionary word that conforms
                                        to these parameters}
      if length(DictWord)>0 then
        if LettersMatch(DictWord,KeyWord) then
          write(DictWord:10);          {print if it can be made from keyword}
    until length(DictWord)=0;          {empty TL word means end of search}
  end;                                 {end of current letter}
  DedicateLightning(false);            {release TL for user}
end.
```

(continued from previous page)

functions and procedures which roughly match the tasks performed by the interrupt calls.

Word Wizard is also the main source of documentation for the interrupts. But you do not need to understand these details in order to use the Pascal routines, nor do you have to code in Turbo Pascal if you are happy to call the interrupts yourself.

To illustrate the use of the Turbo Lightning engine I decided to use the Word Wizard library to write a simple word-puzzle solver. The sort of puzzle I had in mind is a familiar one: given a word or short phrase you have to see how many words of three or more letters you can derive from it.

The obvious approach is to generate every combination of at least three letters that can be made from the starting word, then to check each of them against the dictionary. But this would involve some horrific programming. Just rearranging the letters in every possible way would require a complex iterative or recursive process, even before you consider the need for strings of different lengths.

There would also be the problem of running time. Suppose that you started with an eight-letter word and you generated every eight-letter combination; for each of these you then took the first seven letters, then the first six, and so on down to three. You would have ended up with nearly a quarter of a million words to look up, many of which would have been duplicated.

Fortunately, there is a better way. Given that there are around 85,000 words in the Lightning dictionary, it is faster to look up every one and to test it against the starting word than it is to attempt to find all possible combinations of the letters. It is also a good deal easier to program.

In fact you can do even better. The Turbo Lightning engine allows both direct and sequential access, as well as combinations of the two. Thus you can go straight to the first word that begins with a specified letter and proceed sequentially until this initial letter changes. You therefore only need to retrieve those words that start with each different letter from your starting word.

This is the strategy that I adopted for my word-finding program, the complete listing of which appears on the previous page. It uses just four of the 16 routines from the Word Wizard toolbox. The library itself is contained in a separate Include file named Engine.WW.

The first routine called is Lightning Present and simply performs internal initialisation. Init Range Search is used to establish the starting letter for subsquent lookups. The searches can be further refined by specifying a minimum and maximum word length. Get Next Word In Range then returns each word in turn that meets these criteria. When the search is complete the function returns a zero-length string.

Remember that Turbo Lightning is memory resident and is designed to be used at the same time as other programs. If the user of my program tried to get at Lightning directly, via its pull-down menus or hot keys, there would be a risk of the engine's internal pointers going adrift. To prevent this you have to call Dedicate Lightning to deny ordinary user access.

To test the program I chose the starting word "software." This resulted in 18,140 words being retrieved from the dictionary, 200 of which provided correct solutions to the puzzle. If any of the letters in my starting word had been repeated the program would have needed a test to prevent the same letter from being used twice to initialise a search.

Proper nouns are usually disallowed in these puzzles, but the Lightning dictionary has over 1,600 of them. My program found three, as well as quite a few abbreviations. The dictionary is of course American; words with British spellings would not be found.

The program certainly ran fast, taking less than one minute on my Olivetti M-24. Accessing the dictionary takes about two milliseconds, and you can do a sequential pass of the entire file in under three minutes. PC

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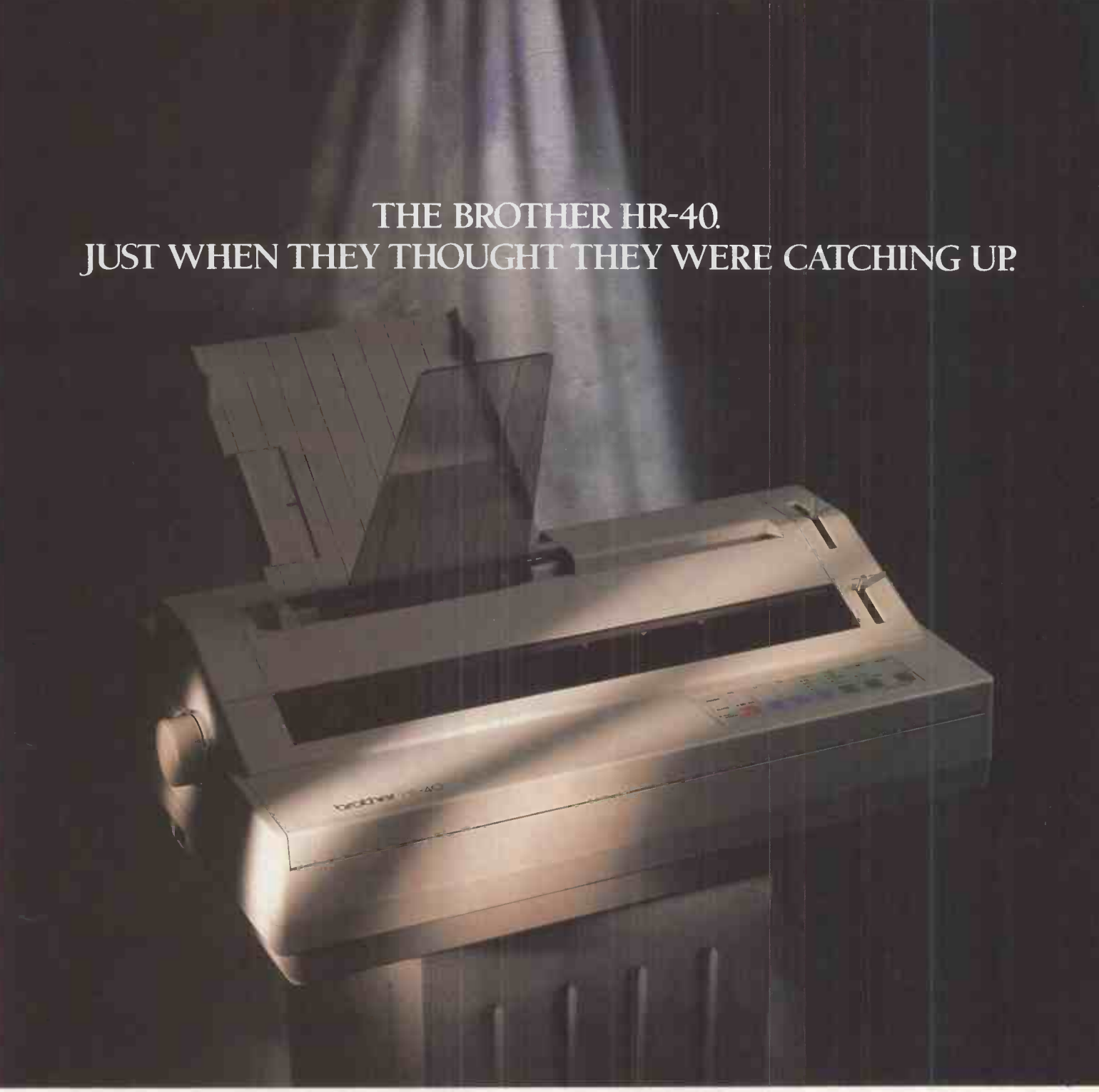

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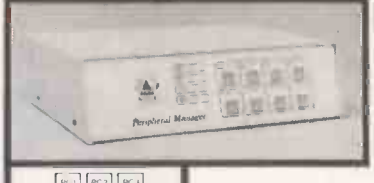

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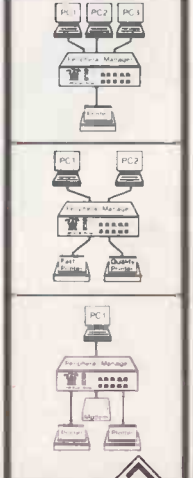

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BY RAY COLES

ANOTHER SPIN OF THE WHEEL

ALTHOUGH THE JAPANESE ARE CURRENTLY CLEAR LEADERS ON THE WORLD CHIP MARKET CONDITIONS ARE CHANGING IN A WAY THAT COULD FAVOUR THE EUROPEANS.

Japanese chip manufacturers now occupy the top three positions in a ranking based on annual semiconductor sales worldwide. This is worrying a lot of people in the U.S., not least those in the Pentagon. Expected soon is a high-level Defense Department task force report, whose findings, in standard defence industry fashion, have already been made widely known.

The report will warn that unless the U.S. semiconductor industry can find a way to regain its previous position of world leadership in the design and manufacture of advanced memory and microprocessor devices, then the whole basis of present U.S. defence strategy will be threatened. That strategy has traditionally been based on the reassuring assumption that the numerical advantage of certain potential adversaries can be more than offset by the technical superiority of U.S. weapons and equipment, a superiority based largely on advanced electronics and hence semiconductor leadership.

Already a high percentage of the semiconductor chips used in new U.S. military equipment is of overseas origin — mainly Japanese. Since Japan is now one of the United States' closest allies this may not seem like a particularly worrisome problem for the Pentagon, but unfortunately it is not quite as simple as that, as the report reminds us. Chip technology is the driver for all electronic design innovation. If American industry starts to lose revenue from the leading-edge technologies which it has dominated since the 1950s, then there will be a resulting lack of incentive and investment in vital downstream technology such as avionics, computers and telecommunications. In effect, the U.S. will become a follower, not a leader.

Over the last two years U.S. chip makers have sustained huge losses. Japanese manufacturers have virtually ousted their American counterparts from the RAM memory market and might before long achieve the same dominance in microprocessors.

The authors of the Pentagon report certainly have a valid case, but I think they may be in danger of overstating it. In doing so they are no doubt egged on by U.S. chip manufacturers: they have a lot to gain from any national initiative to regain leadership, especially one involving a healthy dollop of government funding.

Leaving aside the worries of the U.S. defence community, the performance of Japan's chip makers certainly appears spectacular. According to a recent Dataquest survey NEC's turnover increased by 33 percent in 1986, while Toshiba's rose by 54 percent and Mitsubishi's by 84 percent. By comparison Intel's three percent reduction and Motorola's 11 percent increase look decidedly tacky.

But there is a catch. During the year the value of the Japanese yen rose by about 40 percent against the dollar, which of course helped to push up the reported turnover figures for the Japanese companies as compared to their U.S. competitors. The rising yen has also triggered off a recession in Japan, and Japanese chip makers are now faced with fierce competition from Korea and Taiwan. Even U.S. and European manufacturers will find it easier in the future to sell their chips to Japanese equipment manufacturers if the yen continues to rise.

Japanese domination of the memory field over the past two years was achieved by ferocious price cutting, described as dumping by many critics. This strategy has certainly gained the Japanese market share, but only at a heavy cost in profitability. Now that the battle is over, the Japanese plan to make big profits from a monopolistic position has been thwarted by the dramatic rise in the value of the yen, and this could send the seesaw off in the other direction by encouraging competitors to re-enter the market.

In Europe there is already a renaissance underway, although it hardly poses a major threat to the Japanese at present. In 1986 the Japanese share of the European chip market was already beginning to decline, and there are signs of increasing optimism and determination among major European semiconductor manufacturers such as Siemens and Philips. The U.K. company Plessey, which up to now has been nothing more than a tiddler in the international semiconductor league, has startled many by opening a new £10 million sub-micron fabrication line which is aimed at taking a world lead in advanced CMOS chip technology.

Plessey has plans to beat the rest of the world into the use of four-level metal and trench isolation, coupled with one micron line geometries. By 1989 it plans to be manufacturing chips with gate densities of up to 6,000 gates per square millimetre and up to 250,000 gates per chip by 1989. Current CMOS technology manages about 50,000 gates per chip and uses only two layers of metal interconnect. The new fabrication facility at Plessey's Caswell Research Centre will be equipped with the latest in chip manufacturing equipment, including a £3 million Perkin Elmer Aeble direct-write-on-wafer E-beam machine, which will eventually allow geometries down to 0.7 micron to be achieved.

This impressive initiative from Plessey has, paradoxically perhaps, been made possible by its long-standing expertise in HF bipolar technology. While not itself the stuff of which headlines are made, this expertise has provided some of the necessary techniques to build tomorrow's world-beating CMOS chips with densities at least double those of other processes with the same feature sizes.

With 250,000 gates on a single chip, designing the chips themselves could become a major problem. The currently accepted throughput rate for computer-aided design is about 300 gates per person week, which would mean that a chip based on the Plessey technology could take over 15 person years to design. In a rare example of timely industrial and governmental co-operation, a project to increase dramatically CAD throughput to handle the design of tomorrow's big chips is soon to be announced as part of the Alvey Programme.

Plessey will have a part in this project, along with other major U.K. electronics and CAD companies. The aim is to develop a new computer-based design methodology called silicon compilation, which will be able to increase designer productivity to 10,000 gates per person week by 1989 — just in time, it would appear, to handle the first designs using Plessey's new CMOS process. This is all splendid stuff, and combined with the increasing acceptance of the Inmos Transputer as a world-class 32-bit processor family, it augurs well for a revival in the U.K.'s semiconductor fortunes.

But the recent opening of a new chip development facility at Caswell and the impending launch of a new CAD initiative are not enough in themselves. By 1989 all sorts of new delights may be available from Japan, and even the battered U.S. chip producers can be assumed to have a trick or two up their sleeves. The Plessey process may seem less than revolutionary when production wafers finally hit the streets.

Another danger is that the new technology will find a quick and lucrative market in advanced U.K. defence programmes, and this may be pursued to the detriment of any risky sales drive in the commercial sector which could put the U.K. back on the world semiconductor map. PC

BY ANNE STAINES

PAYING THE PRICE

LITIGATION IS SO EXPENSIVE THAT FEW IF ANY CASES CONCERNING SOFTWARE ARE COMING TO COURT. THE RESULTING UNCERTAINTY IN THE LAW IS BAD FOR SUPPLIERS AND USERS ALIKE.

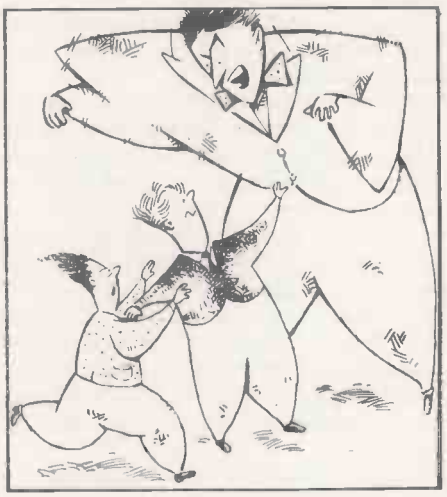
A Florida lawsuit in which the producer's liability for defects in his computer software was to be tested for the first time has been dropped, leaving users none the wiser on this important issue. Lotus Symphony user James Cummings had claimed that faults in the progam had cost his business $250,000; he has now withdrawn his action in negligence and breach of contract.

This news is not surprising. It was generally thought that Cummings had taken on a steep uphill struggle in suing Lotus. There appeared to be factual weakness of his own case, and many experts agreed that Cummings' problems with the software stemmed from uneducated use rather than any intrinsic fault in the program. In addition, his chosen terrain was not only rough but totally uncharted.

Cummings had to establish three essential points. First, he had to establish that computer software is goods rather than services; the law in the U.S., as in the U.K., imposes a higher degree of care on providers of the former than the latter. Lawyers can argue this point until the cows come home. Then there was the question of the degree of perfection a user can reasonably expect of a software package. The concepts of merchantable quality and fitness for purpose are adopted as yardsticks by the Uniform Commercial Code in America, and in the U.K. by the Supply of Goods and Services Act 1982. They are notoriously difficult to apply to software.

Finally, Cummings had to rebut Lotus's claim that in any event the program was not covered by statutory warranties relating to quality or fitness for purpose, these having been expressly excluded by a clause in the shrink-wrap licence. So much doubt surrounds every one of these issues that it is small wonder Cummings withdrew.

Lotus's response to the news was characteristic of the company, which threatens to become as well known as an international litigant as it is as a software producer. "We spare no effort and never compromise when defending the quality of our products or protecting our legal rights." The words of Lotus's Vice-President are not just bravado. With a turnover last year of $225 million Lotus can arguably afford to treat this self-defensive legal policy — as well as its offensive counterpart — as an investment.



MIKE GORNALL

In pursuit of the latter, Lotus has just served one writ against a Vancouver software-rental company called Softsave Information Services Inc., alleging infringement of Lotus's copyright in 1-2-3 and Symphony. As reported last month in this magazine, it is also suing another U.S. software developer, Paperback Software. A significant feature of Lotus's success in its offensive legal strategy is its willingness to establish common cause with other software producers and trade organisations. For instance in its action against Softsave, co-plaintiffs include Ashton-Tate, Microsoft and Lifetree Associates. In the U.K. Lotus plays an active role in the Federation Against Software Theft.

Computers have introduced a completely new set of problems to the law. The uncertainties surrounding practically every aspect mean that simple cases are few and far between. In legal terms, of course, complicated means expensive, and consequently computer law is increasingly the sole preserve of the big guns. What chance has the individual or small-business user in this game?

In theory no user, however small, should be deterred from commencing or defending an action at law if they are sure that they are in the right. But between theory and practice lie months — or more probably years — of anxiety and expense. The result is legal stalemate and an increasing amount of uncertainty that can only be resolved through litigation.

Within the legal profession a consensus is growing that both users and smaller computer businesses need a cheap and cheerful legal service to conciliate and act as arbiter when disputes over computer law arise. In the U.K. the Society of Computers and Law, comprising mainly solicitors, is currently trying to organise such a scheme. But it seems to be attracting less financial support both from government and the professional bodies of the computer industry than it deserves. Quite independent of these moves, the Data Protection Registrar is espousing the same theory by stressing his role as Ombudsman, which he sees as a way of helping people resolve their data protection problems without the daunting and expensive experience of litigation. These are hopeful trends for computer law as well as for users. For everyone's sake, let's hope they continue. PC

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The Guardian – 26th JUNE 1986

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In conjunction with Altor Ltd, *Practical Computing* is organising the first British Turbo Pascal programming competition. The total value of the prizes will be £20,000, with a first prize of a week-long trip to California.

THE COMPETITION is open to anyone who has written software using Borland's Turbo Pascal language; professional programmers are not excluded. Any kind of program, old or new, may be submitted provided the copyright is owned by the entrant. This applies equally to commercial, published and unpublished programs.

The aim of the competition is to find the best example of programming in the Turbo Pascal language. A number of criteria will be used in the judging: the use of Turbo Pascal features; style of coding; performance and efficiency of the finished program; user interface; and the basic idea behind the application. The judges will also take into account any other aspects they feel important. Nevertheless, entrants are encouraged to submit programs of whatever kind, even if they might appear to be lacking in some of the above categories.

Programs do not have to be finished applications; useful routines and utilities are acceptable provided they can be tested by the judges on their own. Commercially available third-party toolboxes may be employed, but their use must be clearly signalled.

REQUIREMENTS

ENTRANTS must own the copyright of any programs which they submit. As well as a hard-copy listing, there must be a disc containing source files, executable programs and other relevant files. It must be accompanied by a hard-copy document not more than 500 words long describing the program, its aims, special features, etc. and specifying any sections of the program that are not the entrant's copyright. Entrants will be disqualified if their description exceeds the 500-word limit. Submissions must be complete Turbo Pascal programs which can be run as they stand by the judges — with the assistance of commercially available third-party toolboxes if necessary, though these must be clearly signalled by the entrant.

Copyright will remain with original owner, but it is a condition of entry that *Practical Computing* will have the right to publish illustrative portions of the winning entries.

THE PRIZES

First prize: A trip for the overall winner to Borland's headquaters in Scotts Valley, California. There the winner will meet Philippe Kahn, head of Borland. All travel and accommodation costs for the week will be part of the prize. The total value is approximately £5,000.
Second prizes: There will be 10 second prizes, some of which may be awarded by the judges for those programs which show particular merits in one or more of the categories mentioned above. Each second prize will consist of a complete set of all Borland products, for both the IBM PC and Macintosh. These are Reflex the Analyst, Reflex Workshop, Turbo Prolog, Turbo Pascal, Turbo Database Tutor, Turbo Graphix Toolbox, Turbo Tutor 2.0, Turbo Editor Toolbox, Turbo Gameworks, Turbo Lightning, Lightning Word Wizard, Sidekick, Travelling Sidekick and Superkey.
Third prizes: 50 Borland T-shirts and mugs.

£20,000 BRITISH TURBO PASCAL PROGRAMMING COMPETITION

THE JUDGES

THE FINAL stage of the judging will be carried out by four judges: Barry Clark, Mike Lewis, Iwan Williams and Ian Stobie. In all matters concerning this competition, the editor's decision is final.

DR. BARRY CLARK is a lecturer in Pathological Biochemistry at Glasgow University. He has specialist experience in fast-access multi-user databases, networking and laboratory-instrument interfacing, with emphasis on the user interface.

MIKE LEWIS is best-known to *Practical Computing* readers for his software reviews and Software Workshop column. He is also an independent computer consultant specialising in financial applications. He uses Turbo Pascal for about 30 percent of his work. He has been in computing since 1964.

IWAN WILLIAMS is an experienced PC user and software reviewer. He is in charge of the Special Projects Division of the Scottish Development Agency, which uses IBM PC and 3270 PC equipment. His particular interests lie in business-productivity software, and he has written extensively on such topics as word processing, financial analysis and corporate planning.

IAN STOBIE is Assistant Editor of *Practical Computing*. Before joining the magazine he was a professional computer programmer for five years, with experience of large DEC and IBM systems as well as PCs. One of his jobs on the magazine is selecting software packages for review, as well as regularly writing reviews himself.

£20,000

RULES

1. The competition is open to all readers of *Practical Computing* normally resident in the U.K., except for employees of Reed Business Publishing Ltd or Altor Ltd, the judges, or the families of any of these.
2. Each entry must be accompanied by an official entry form or photocopy, completed in ink and must conform to the requirements set out opposite.
3. Completed entry forms should be posted to the address shown on the entry form, to arrive not later than 31 May 1987. Envelopes should be clearly marked "Turbo Pascal Competition" in the top left-hand corner.
4. The editor of *Practical Computing* is the final judge of the competition. No correspondence can be entered into regarding the results, and it is a condition of entry that the decision of the editor is final.
5. The winner will be notified by post and the result of the competition announced in the first available issue of *Practical Computing*. Copyright remains with the holder but *Practical Computing* reserves the right to use illustrative examples from winning entries without payment. Entries and discs cannot be returned.
6. The first prize is a trip to California for one week for one person, including a visit to Borland's headquarters in Scotts Valley. Each of the 10 second prizes will consist of all the Borland International products current on 1 January 1987. Third prizes will consist of Borland T-shirts and mugs. Each prize will be awarded to the individual named on the relevant entry form. No cash substitutes will be offered.

ENTRY FORM

This entry form should be submitted with all discs and all relevant documents.

Name of program (if applicable):

Hardware required:

Declaration: I own the copyright of all the submitted programs except where specifically stated in the documentation accompanying this entry.

Signed

Name

Address

Return this form to **Practical Computing, Room L307, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.** Write **"TURBO PASCAL COMPETITION"** on the top left-hand corner of the envelope.

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At £199.95, the Z88 is supplied with 32K resident RAM. Extra 32K costs under £20 – extra 128K under £50!

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Though the Z88 is a powerful, full-facility, self-contained computer, it also acts as an extension of an office micro, connecting directly to allow exchange of text or data.

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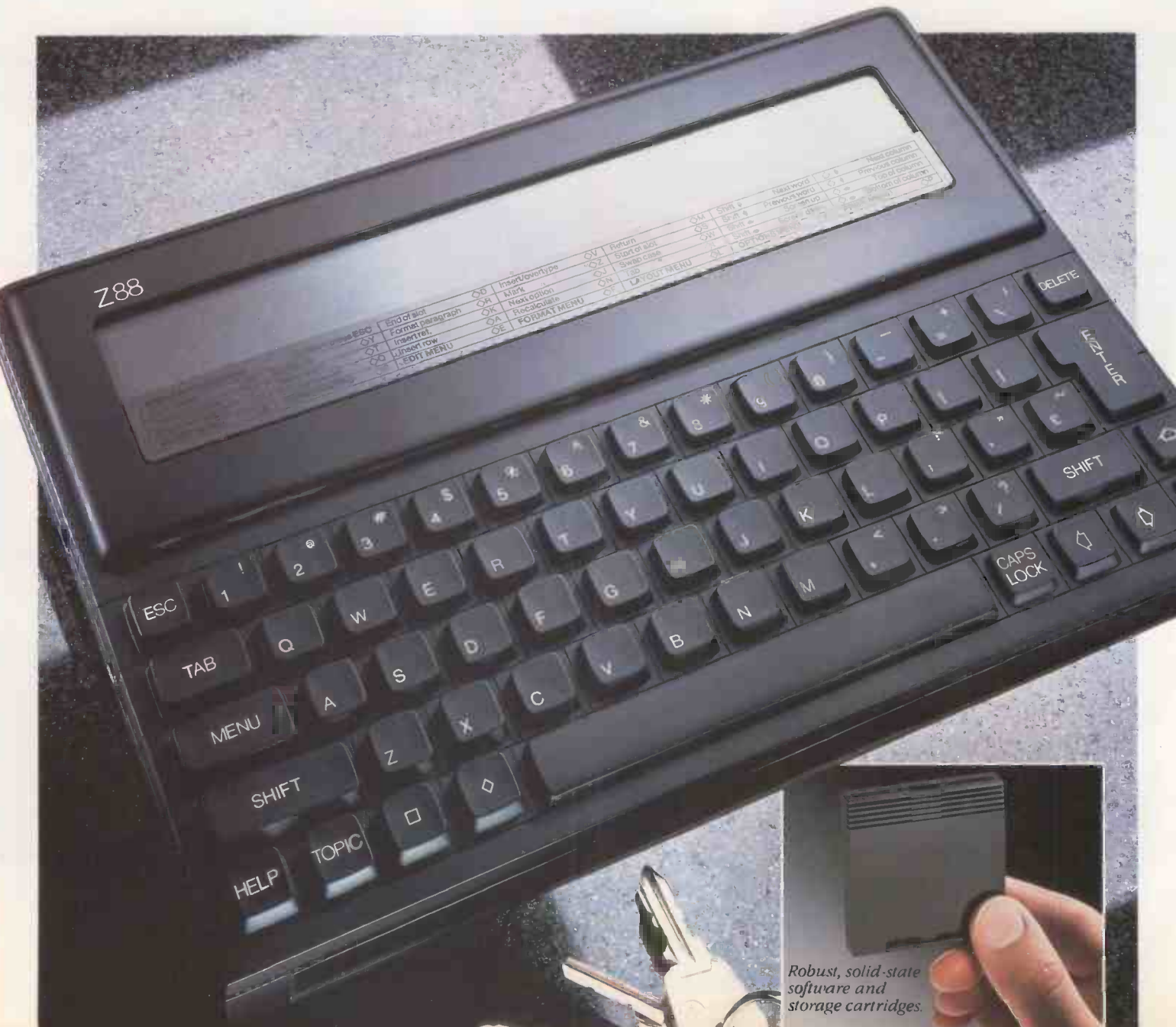

Robust, solid-state software and storage cartridges.

THE FACILITIES OF THE Z88

RAM Resident 32K, around 15K available (enough for around 2,000 words). Extra RAM available in 32K or 128K cartridges, up to three of which can be plugged into the Z88 to give a total of 416K (enough for a 200-page novel). 1 Mbyte cartridges available shortly. A built-in capacitor or the mains adapter preserves data in RAM while batteries are changed.

Permanent storage Where other machines rely on cassette recorders or disc drives, the Z88 uses solid-state EPROM – Erasable Programmable Read-Only Memory – cartridges, with very rapid electronic access and absolute reliability. Up to three EPROM cartridges can be plugged in: 32K and 128K cartridges and ultra-violet eraser are available now. 1 Mbyte cartridges available shortly.

RS232-compatible port offers:
Printing RS232 cable connects the Z88 to popular printers. Cables can also be made up for virtually any RS232-compatible printer.
Text- and data-interchange Resident software formats data for IBM-compatible micros with 5¼" or 3½" disc-drives. If your micro can run such popular programs as Wordstar, Lotus 1-2-3 or WordPerfect, you can exchange text and data between it and the Z88. Cable and software available now.
Modem allows text- and data-transmission by telephone.

Power supply Optional mains adapter, or 4 AA batteries. (CMOS technology allows about 20 hours active computing – or about a year of life for RAM if machine is switched off).

Dimensions 11½" x 8¼" x ⅞"; weight: under 2 lb.

Full QWERTY keyboard offers 'silent', moving short-travel keys. Foldaway foot raises the Z88 12½° for comfortable viewing and typing.

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The operating system of the Z88 is unique to Cambridge Computer Ltd, supporting as its main in-built software an advanced software package, adapted by Protechnic Ltd for the Z88.

The Z88 automatically preserves data in RAM when switched off.

The software is a set of **spreadsheet** and **word processing** applications, with a sophisticated **help** function, designed from the first as an integrated package which allows text to be run within a spreadsheet, or a spreadsheet to be run within text.

Word-processing facilities include multi-column layout, global search and replace, and embedded calculations, as well as all the normal word-processing activities. The display shows such commands as bold, italics, underlining, and page breaks. Spreadsheet includes text-handling and sorting.

Other built-in software includes **database selection; calculator;** free-form **diary, calendar, real-time clock** and **alarm.**

An outstanding feature of the Z88 is its ability to switch between tasks within an application, and between applications, without the need to save, exit the package, or restart on return.

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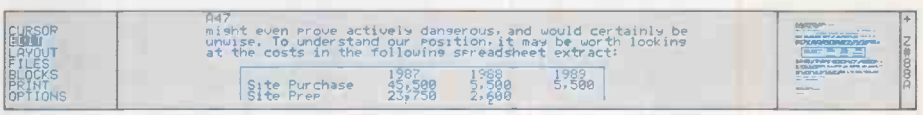

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The Z88 itself comes supplied with 32K RAM built in, a comprehensive manual, sectionalised to suit both novices and computer experts, and a carrying case.

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PREVIEW

MAC SE & MAC II
APPLE'S NEXT GENERATION

By Glyn Moody

With the Macintosh concept now securely established, Apple is moving forward with a further enhancement to the original machine and a brand-new version based on the powerful 68020 chip.

Apple has announced that it will launch more products this year than in the previous 10. No less than 30 products are currently scheduled for release; even allowing for some falling by the wayside this represents a huge shot in the arm for the company and, more importantly, for the Macintosh concept.

Some of the new arrivals will be little more than minor upgrades, like increased-capacity hard discs; there will also be notable omissions, such as the portable Macintosh, which is not likely to be released until at least 1988. But at the heart of this flurry of activity will be two key machines, the Macintosh SE and the Macintosh II. The first will eventually take over as the baseline Macintosh machine. The latter represents the first of the next generation of Macs.

The Macintosh SE — or System Expansion — is, as its name implies, a straight upgrade of the standard Macintosh Plus. It runs the same 68000 at 8MHz. The main external change, apart from details of styling and the new platinum colour scheme first used on the Apple II GS, is the twin disc drives. One of the drives can be a 20Mbyte internal Winchester. The mono screen size remains a true 9in. measured diagonally. There are two serial ports, an SCSI port for external hard discs and a new back-up tape streamer, a sound port, and a mouse port.

Some performance enhancement — Apple claims around 10 to 25 percent — has been achieved by the use of gate arrays. In all, 19 chips have been squeezed down on to one custom chip. The space saved is given over to perhaps the most important addition on the Mac SE: an expansion slot.

When the Macintosh was first launched in its impoverished 128K version it turned its back on the open architecture which had made such a big contribution to the success of the Apple II. Many of the Mac's early problems were to do with these inherent limitations, and much ingenuity was wasted on getting over these obstacles rather than extending the boundaries of the machine's

Left to right: Two generations of Macintoshes — the Mac Plus, Mac II and Mac SE. The inside of the two latest micros reveals their capacity for expansion slots unlike the closed architecture of the Mac Plus.

capabilities. With successive releases Apple has addressed most of the problems of the initial design: disc speed and capacity have been improved, memory greatly expanded, a hard disc was eventually launched, and new expansion ports allowed third-party manufacturers some scope to add features.

Now Apple has done the decent thing and gone a long way to helping such developments by adding a real expansion slot. The bus chosen is the Euro DIN bus; it uses a three- by 32-pin connector and ties in to the full bus of the 68000. This means that add-ons can if necessary take full control of the machine or carry out functions independently of the main processor. Apple justifies the apparent parsimony of providing only one slot by pointing out that the SE either already contains most options needed or has other means of satisfying them.

For instance, the hard disc plugs straight into the motherboard, and extra memory can be inserted into the special single in-line memory module (SIMM) slots. The machine comes with 1Mbyte RAM as standard, which can be upgraded to 4Mbyte once the price of 1Mbit RAM chips falls sufficiently. Memory will be increased simply by swapping in the new chips.

Apple says it will be encouraging third-party suppliers to produce a wide range of add-ons using the expansion slot. One product it will be bringing out itself is a card which will support a standard 360K 5.25in. IBM drive. This is the first tangible evidence of Apple's recognition of the opposing world of Big Blue. It does not intend to go the whole hog and offer full-blown IBM compatibility in the way that the Mac Charlie add-on attempted to do — see the November 1985 issue of *Practical Computing*. Instead it will content itself with data compatibility, where data from an IBM package can be pulled across and used on the Mac. Ultimately Apple intends bringing out a 3.5in. dual-format disc drive which can handle both Macintosh and IBM discs.

Not that Apple has set its face against full

(continued on page 37)

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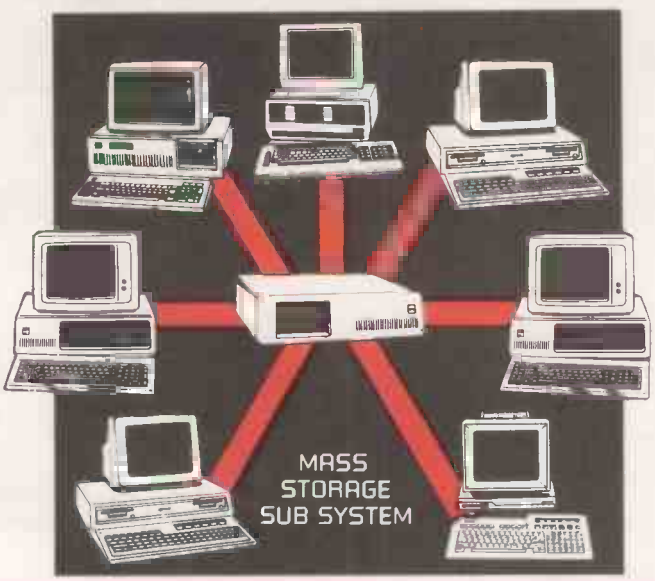

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Access VISA

(continued from page 35)

IBM compatibility. Already there is a third-party supplier working on an 8086 card which will plug into the expansion slot. The only disappointment is that it will take over the whole Macintosh environment: there will be no pull-down windows within DOS.

The ability to exchange data with different worlds is one of the key new features of the Mac SE. In addition to data compatibility with DOS and IBM there will be links available to Ethernet, thus linking up with the world of Unix and DEC. The serial ports now offer synchronous transfers, allowing very fast comms to a wide range of external systems.

All these changes and options indicate that Apple is targeting the corporate market more than ever. Backing this up will be additions to the Appletalk local area network. For example, a file-server system and a card to allow IBM PCs to be hooked on to the network have been announced. To take account of these developments there have been a number of additions and modifications to the Mac's Finder, including an option to signal the presence of a file server. Overall, the ROM has been doubled in size to 256K, and doubtless it contains other features which we shall learn about in due course.

Some of the additions surface in the Control Panel. To allow for the extra devices, some of the functions have been grouped together under new icons. Now you can install things like light-pens simply by dropping the appropriate item in to the system folder.

One benefit of this approach is that you can use different keyboards with the SE. The basic model is the same as that found on the Apple II GS. It connects to the Mac via the Apple Desktop Bus also used on that machine. The mouse can either be daisy-chained through the keyboard or plugged in at the back of the machine. The alternative keyboard is designed to cater for those who need something more IBM-like. It is based on the new RT-type keyboard, which itself is similar to the standard DEC terminal keyboard. It has 15 function keys, a cursor pad and a numeric pad.

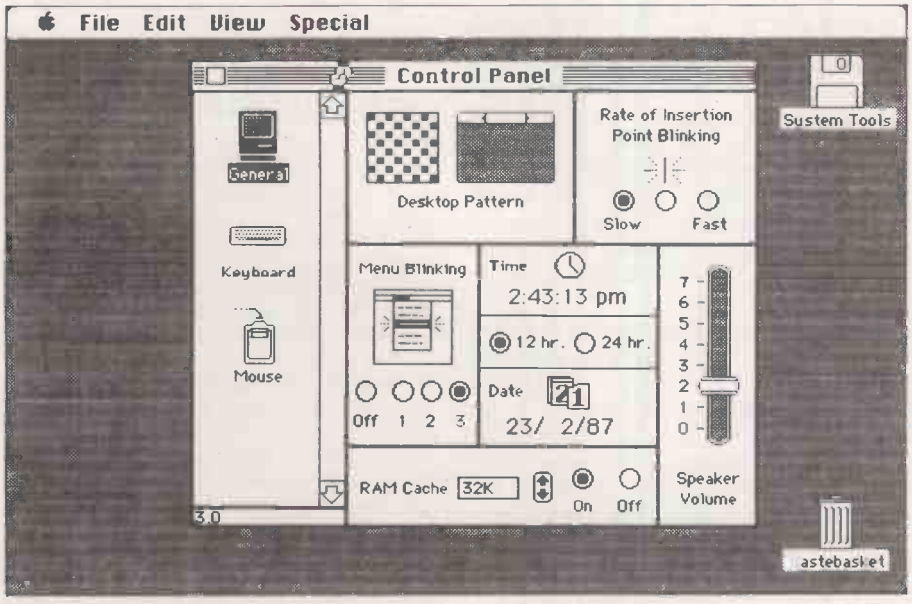
All in all the Macintosh SE offers few surprises. Even the price is pretty much par for the course: around £2,400 for the twin-floppy version, and less than £3,000 for the 20Mbyte hard-disc system are our best guesses at the time of writing.

To clear some space at the bottom end, the 512K Mac will be allowed to fade away and the price of the Mac Plus reduced to £1,995. It does not take clairvoyance to predict that the Mac Plus will eventually be dropped in its turn, leaving the Mac SE as the entry-level system. Apple expects the SE to inherit the increasing success of the Mac Plus, whose sales seem to be gaining in strength every month.

While this will almost certainly be true for personal and small-business users, I believe that in the larger companies its success will be eclipsed by that of its bigger sibling, the Macintosh II. This name was clearly chosen with care and bestowed with reverence by Apple. Just as the Apple II for so long formed the backbone of the company's product range and the mainstay of its finances, Apple must be pinning its hopes on the Mac II for the next five years.

Unlike the SE, the II is no mere upgrade but a radical redesign. Gone is the neat, upright design characteristic of the Macintosh. Instead Apple has produced a conventional three-box design of monitor, keyboard and system unit, though the resemblance to other conventional systems ends there.

The Mac uses a 68020 running at 16MHz; the 25MHz version now available was passed over because of the cost of support chips. The entry-level system comes with 1Mbyte of RAM, expandable up to 8Mbyte currently; larger memory chips will take this up to a maximum of 128Mbyte. One internal floppy disc comes as standard. Obviously with a machine of this power you would be crazy not to use a hard disc, and Apple offers 20Mbyte, 40Mbyte and 80Mbyte options.



Some of the additions to the Mac's Finder are apparent in the new Control Panel.

SPECIFICATION

MACINTOSH SE

CPU: 68000 running at 8MHz
RAM: 1Mbyte, expandable to 4Mbyte
ROM: 256K
Disc storage: one 800K 3.5in. floppy as standard; second floppy or 20Mbyte hard disc optional
Display: 9in. 512- by 384-pixel monochrome screen
Keyboard: choice of Apple II GS style or 105-key model with 15 function keys
Interfaces: two Apple Desktop Bus connectors for keyboard, mouse, etc.; two RS-232 ports; external disc interface; SCSI interface; sound port; expansion connector
Size: 345mm. (13.6in.) x 244mm. (9.6in.) x 277mm. (10.9in.)
Weight: between 7.7 kg. (17lb.) and 9.5kg. (21lb.), depending on discs installed
Hardware add-ons: external disc drives; IBM-compatible 5.25in. floppy-disc card
Software in price: none
Price: twin-floppy version £2,400; 20Mbyte hard-disc version, under £3,000
Manufacturer: Apple Computer U.K., Eastman Way, Hemel Hempstead, Hertfordshire HP2 7HQ. Telephone: (0442) 60244
Available: now

The entry-level hard-disc version comes with a 39ms. access 40Mbyte unit. The hard-disc system will cost around £4,500, and the single-floppy version £3,500.

Like the SE, the Mac II is notable for its expansion capabilities. There are six slots, which perversely use a bus and card design completely different from the other new model. The bus is based around the Nubus, also used by Texas Instruments for one of its Lisp machines. It has the same edge connector and allows a similarly complete control over the system as the Euro DIN bus on the Mac SE. So once more, processes can be underway in the background without the Mac II needing to be aware of the fact.

Apple has modified the Nubus standard slightly, and added what it calls a soft power-on feature to the power supply. That is, power to the machine can be switched on by software running on the machine itself. For example, with the mains power switched off a modem card with its own on-board battery power could listen along a wire until a triggering signal was received. When triggered, the software would switch on the power supply and then run the main part of the program; this might download a file to

(continued on next page)

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disc, for example. Once finished, the unit would power itself down.

To turn the machine off you choose the Shutdown command from the Special menu. Once the system has been shut down, it signals that the power may be removed. This kind of precaution is particularly important where hard discs are involved. A similar soft power on/off system is provided with the Mac SE.

In another move towards the standard PC-type design one of the Nubus slots is taken up with a video board. By slotting in different boards, both from Apple and third-party suppliers, a range of monitors can be supported, including larger screens and colour. There will be two standard Apple options initially: a 12in. monochrome screen and a 13in. RGB screen. Both will have a 640- by 480-pixel resolution compared with the Mac's current 512 by 384. This automatically allows more to be displayed on-screen, provided that the software has been written to the standard Macintosh rules.

The video cards come with their own video processor and RAM. With 256K of video RAM it is possible to have 16 colours, using four bits per pixel to represent the various combinations; an extra 256K provides four more bits per pixel and so 256 colours. The colours can be chosen from a total of over 16 million different shades. On mono screens the colours appear as the equivalent number of grey levels. An updated version of Quickdraw allows the number of bits per pixel to be set.

At the time of this preview, the only Mac II in the country was a mono version. However, judging by the Apple II GS — which is effectively a low-end colour Mac — the effect of using colour on a 68020 machine will be highly effective and totally addictive. In time, no one will contemplate using anything else.

Not content with turbocharging the graphical aspects of the Mac, Apple has gone on to include a new sound chip. For the present this does not do very much. But its specifications are such that it could be a key element of future Macintoshes — the Mac III and above.

The new custom chip, designed courtesy of Apple's shiny new Cray supercomputer, has four channels, stereo capabilities and an impressive 44kHz sampling rate. Apple's chip was made with speech in mind; the high sampling rate will allow very high-quality output. Now that the visual mouse and windows interface is firmly established, Apple clearly sees voice input and output as the next hurdle to clear.

More relevant to today's business users are the peripheral cards planned by Apple. Once again, there is an MS-DOS card, along with an Ethernet card. Apple says that it will be launching its own version of Unix System V version 3 to go with it, though the details of the interface have yet to be settled. Let us hope that, like Torch with its Triple X machine, Apple manages to salvage some of the Mac's user-friendly approach in the face of the user-hostile Unix. In addition to these options for connectivity, there are two RS-232 ports and an SCSI port. This is in addition to an internal port for a second floppy disc.

SPECIFICATION

MACINTOSH II

CPU: 68020 running at 16MHz; 68881 maths co-processor as standard
RAM: 1Mbyte, expandable to 8Mbyte on board; expandable to 2Gbyte using expansion slots
ROM: 256K
Disc storage: options include 800K 3.5in. floppy, 20Mbyte, 40Mbyte and 80Mbyte hard discs
Display: 12in. monochrome monitor, 640 by 480 pixels; 13in. colour monitor, 640 by 480 pixels; up to 256 colours or shades of grey from a total of 16 million shades
Keyboard: as for Macintosh SE
Interfaces: two RS-232 serial ports; SCSI port; two Apple Desktop buses; six Nubus internal expansion slots
Size: 475mm. (18.7in.) x 366mm. (14.4in.) x 140mm. (5.5in.)
Weight: 10.9kg. (24lb.) to 11.8kg. (26lb.) depending on configuration
Hardware expansion: external drives, Ethernet card, MS-DOS floppy-disc card
Software in price: none
Price: single-floppy version, around £3,500; with 40Mbyte hard disc £4,500
Manufacturer: Apple Computer U.K., Eastman Way, Hemel Hempstead, Hertfordshire HP2 7HQ. Telephone: (0442) 60244
Available: July

In operation the Macintosh II looks just like any other Mac, which is just as well. It is undeniably faster, especially in scrolling operations. Superficially it did not look quite as fast as the Prodigy 68020 board which we reviewed in February's issue of *Practical Computing*. Where the Mac II really scores is in computationally intensive applications.

A 68881 maths co-processor is included on the machine as standard. For packages which are written according to the Standard Apple Numerics Environment (SANE) the maths co-processor will automatically be invoked. Even greater performance gains can be achieved by writing specifically for the 68881, but this does lock the software into this implementation, whereas SANE is supposed to guarantee future upgradability. Apple will also offer the 68851 memory-management unit chip as an optional extra, which should also speed certain applications written specifically for it.

The Macintosh II is an exciting machine not so much for any technical innovations — most of it is pretty standard stuff — but simply because Apple seems to have got most things right. It is a significantly more powerful machine than its predecessor, it is open and it is reasonably priced. In particular, the cost differential between the Macintosh II and the markedly inferior SE is sufficiently small to be ignorable for corporate purchasers. I can therefore see many Mac IIs being sold to larger companies. The Mac II also overcomes two traditional objections to the earlier Mac range: that it was grossly underpowered and, less fairly, that its compact styling made it look like a toy. The more old-fashioned three-box approach may paradoxically endear it to the conservative business community far more than the earlier Mac's svelte lines.

Above all, the Mac II is exciting because it allows Apple to capitalise on its growing success with the earlier Mac line and to reinforce its position as a viable micro alternative to IBM. This is important not just for Apple but for the rest of us too. The stronger Apple becomes, the more fruitful the competition between the two architectures will be.

As well as offering a powerful work station with excellent connectivity for the corporate market the Mac II should prove attractive in a number of other areas. The Unix option and the sheer number-crunching abilities of the machine will make it popular in universities. It will be interesting to see what ex-Apple co-founder Steve Jobs produces for the same market.

Just as important for Apple will be the whole new world of computer-aided design and engineering applications. The 68020 with high-quality colour graphics makes it ideal for drafting work. The current leaders in this market, Sun and Apollo, both have machines which have much in common with the Mac II — except the price. Given the growth in this sector, there is probably room for Apple and the others, though Sun and Apollo will presumably need to move further up-market in the light of their lack of competitiveness.

CONCLUSIONS

- The Macintosh II is the first of the next-generation Macs. It is built around a 68020, offers colour, a bigger screen and six expansion slots.
- It is a high-performance work station with a maths co-processor as standard, and comes in the conventional three-box format.
- The Mac SE is an upgraded version of the Mac Plus, which it is likely to replace in due course.
- Apart from offering the facility to install two internal drives, including one floppy, the SE's main advance over the earlier machine is the provision of one expansion slot.
- The Mac II is likely to prove popular not only with general business users, but also with universities and those involved in CAD and drafting work.
- For Apple the prices are very reasonable; in particular, the 40Mbyte hard-disc version of the Macintosh II is very good value. PC

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PREVIEW

NIMBUS VX-386
GRADUATING WITH HONOURS

By Steve Malone

With its 80386-based micro, Research Machines is leaving behind the sheltered safety of the educational world to fight it out with the leading AT-compatible business machines.

Research Machines is a company that is little known outside the realms of education. Since its inception in 1977 it has developed a series of machines targeted mostly at academic needs. The kind of features required in education — graphics, networking and rugged construction — have all been met by Research Machines products, from the 380Z to the Nimbus PC.

Until now, none of the machines has been IBM compatible. With 70 percent of its business in the educational sector, Research Machines has escaped the dictates of the conventional business market and has still managed to sell machines. However, the IBM standard has now become so universal and the software base so overwhelming that it would be foolish not to launch an IBM compatible. Research Machines has therefore introduced the Nimbus X range.

There are currently two models in the series. The Nimbus AX-286 is an 80286 IBM PC/AT compatible. The second model, which we look at here, is the Nimbus VX-386. Both machines follow the same pattern of construction; the only difference between them is in the plug-in expansion cards on which the processors are situated. This makes it very easy for users of the AX model to upgrade to the VX, and presumably to even more advanced processors sometime in the future.

The VX machine we looked at for this preview was a pre-production model. As such, some of its detailed features may have altered by the time production versions become available. However, Research Machines says that barring any major technical hitches the current machine will be the one reaching the dealers in April, although by then the company expects to have optimised its performance.

THREE-BOX FORMAT

Following the vogue of the moment, the Nimbus VX-386 is an 80386-based IBM PC/AT-compatible computer. To the relief of its existing Nimbus user base, the company has made sure the X range is also Nimbus compatible. The Nimbus VX-386 is in the usual three-box format, with the system unit measuring 440mm. by 410mm. by 158mm. The demands of the AT standard mean that the VX-386 is considerably larger than the earlier Nimbus, but careful internal design has allowed it to be somewhat smaller than the standard AT clone.

At the back of the machine are the power-supply socket, the expansion slots and serial and parallel ports. The front of the machine sports the diagonal air vents characteristic of the Nimbus PC. There are also several indicator LEDs to signal power, hard-disc activity and clock speed. Customers will be offered a choice of disc drives. The VX-386 can be fitted with IBM-standard 5.25in. or 3.5in. half-height floppy drives. Adopting the 3.5in. drive will enable you to run Nimbus software and the increasing amount of 3.5in. IBM software that has been converted for the Toshiba 3100 and the IBM Convertible.

Because the Nimbus PC conformed to the MS-DOS disc format the machine is already data compatible with the Convertible. With the launch of the new machine, Nimbus data is directly usable by the new X range in IBM mode. The preview machine was equipped with both types of drive in a stack, at the bottom of which was a 40Mbyte hard disc. By stacking all the storage devices together Research Machines has been able to reduce the dimensions of the system box.

The keyboard is of the same manufacture and feel as the earlier Nimbus PC. Research Machines offers an IBM PC or PC/AT-compatible keyboard for the VX.

It is striking how empty the inside of the system unit appears. Behind the stacked disc drives is a 135W power supply. This is considerably less beefy than the 190W or 200W units that have become customary in AT compatibles. Research Machines says that the big power supplies are only necessary if you are using a lot of the expansion buses for things like the printer port and video circuitry. As most of this is fitted as standard on the motherboard, the potential drain on the power supply is that much less.

The left-hand side of the computer is given over to six full-length expansion slots. The motherboard, while running almost the full depth of the system unit, occupies less than half the width, with most of the circuitry hidden underneath the power supply. Mounted on the motherboard is the serial/parallel interface circuitry, the floppy-disc controller and a Paradise PEGA-2 video chip, one of seven custom chips fitted to the computer.

The PEGA-2 chip has been chosen by Research Machines for quite specific reasons. It is register programmable, which means that the programmer can set the resolution and character size of the chip. This enables it to emulate the Enhanced Graphics Adaptor (EGA), Colour Graphics Adaptor (CGA), Monochrome Display Adaptor (MDA) and monochrome Hercules graphics card. Just as important, the PEGA-2 can also be configured to emulate standard Nimbus PC graphics.

Research Machines sees computer-aided design (CAD) as a promising area for the X series. To exploit this potential it is intending to offer an ultra high-resolution display with the systems. It will include a separate video board and monitor which will support up to a 1,280- by 1,024-pixel display with either 16 or 256 colours.

CRAFTY PIGGYBACKING

Five of the six expansion slots currently provided with the Nimbus VX are of the 16-bit AT type, and one is an eight-bit slot. The phrase "currently provided" is important because Research Machines has done something rather crafty with the slots. At present there is no standard for 32-bit slots; nor is one likely to emerge until IBM releases its own 80386-based machine. Research Machines is acutely aware of the possibility of getting caught out by providing a non-standard 32-bit bus, and so only two of the 16-bit expansion slots are fitted on the motherboard itself. The remaining four are piggybacked on to the motherboard. This means that when IBM does release its machine Research Machines can implement the new standard with the minimum of fuss. Just as important, it means that users can too, simply by plugging in a new piggyback bus.

Two of the slots were occupied on the preview machine. One of the slots contained the hard-disc controller, which can support two drives. The other slot held the processor board. The 80386 processor runs at the standard 16MHz but can be switched down to 8MHz from software. The processor board is among the first to have an extra socket for the 80387 maths co-processor when it eventually becomes available in production quantities.

Four of the Nimbus VX-386's seven custom chips are proprietary Research

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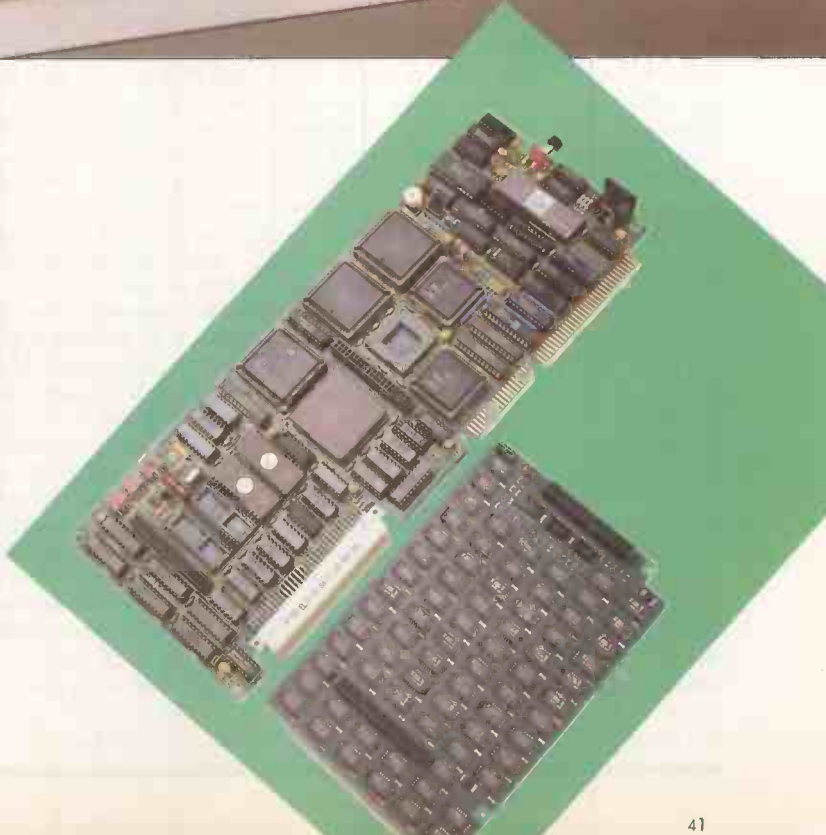

Above: Most of the circuitry is hidden under the power supply. Right: The motherboard houses a socket for an 80387. Four of the expansion slots are fitted on the daughter board.

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Machines gate arrays; two of the others are part of Faraday's IBM chip set. Research Machines says it chose the Faraday chip set rather than the more popular Chips & Technology set because the Faraday set uses fewer chips and runs at 12MHz rather than 10MHz.

The Nimbus VX-386 is equipped with 2Mbyte of RAM as standard, expandable to 16Mbyte. In the absence of MS-DOS 5.0, Research Machines has provided firmware support for the Lotus Intel Microsoft Expanded Memory Specification (LIM EMS). The memory chips are surface mounted on to a piggyback board which clips on to the processor board. Research Machines says it plans to manufacture 1Mbyte, 2Mbyte, 4Mbyte and 8Mbyte cards for the VX-386; it will be possible to stack three such boards sideways on to a single processor board.

Research Machines chose to use standard dynamic RAM (DRAM) chips in the construction of the Nimbus VX-386, rather than the faster static-column RAM chips favoured by Compaq. There are several reasons behind this decision, one of the most important being the price. Once you start fitting static-column chips in your computer you cannot then add ordinary DRAM chips, and static-column RAM chips are about five times the price of DRAM.

Using ordinary DRAM chips means introducing wait states into the system. This is where the processor is made to hang around while the memory accesses are completed. To operate without wait states access times need to be 55ns. or better; the Nimbus VX-386's DRAM, on the other hand, can only manage an access time of 120ns. In its defence, Research Machines told us that the Compaq Deskpro 386 does not run entirely without wait states either.

2K ROWS OF RAM

The Deskpro 386 achieves no wait states by holding 2K rows of RAM open to create faster access. Research Machines says that this is fine in theory, but in practice memory accesses are likely to be across the whole range of memory rather than in simple 2K rows. The company claimed that tests it has carried out showed the Compaq Deskpro 386 had a true wait state of about 1.7; Compaq says the figure is 0.8.

Intel was aware of the nuisance of wait states when it designed the 80386, and as a compromise incorporated within the chip the capacity to handle high-speed external cache memory. The idea behind cache memory is that 90 percent of processor time will be occupied running five percent of the code. Therefore, if you store that often-used code in very high-speed static RAM you will achieve marked increases in performance.

As far as we are aware, Research Machines is the first company to include the idea of external cache memory into the design of its 80386 computer. A 64K static RAM board will be interfaced to a 32-bit Research Machines bus running from the processor board; this was not available at the time of the preview, but the company says that the cache memory will have an access time of between 10ns. and 20ns.

SPECIFICATION

CPU: Intel 80386 running at 16MHz
RAM: 2Mbyte dynamic RAM piggybacked on processor card; 64K static RAM cache memory
Mass storage: 5.25in. half-height 1.2Mbyte floppy or 3.5in. 720K floppy; choice of 40Mbyte or 140Mbyte hard discs
Interfaces: one RS-232C and one parallel printer port; option for built-in networking
Display: compatible with Enhanced Graphics Adaptor, Colour Graphics Adaptor, Monochrome Display Adaptor, Hercules graphics card and Nimbus PC graphics
Price: £4,995 for 40Mbyte version, £7,995 for 140Mbyte version
Manufacturer: Research Machines, Mill Street, Oxford OX2 0BW. Telephone: (0865) 249866
Available: April 1987

If you are going to market an IBM-compatible computer you need an IBM-compatible BIOS. The Nimbus X series BIOS is Research Machines' own design. It needed to maintain compatibility not just with IBM but also with the Nimbus PC. We were unable to perform a complete set of software tests on the BIOS, but the computer does appear able to run both IBM and Nimbus software. Among the IBM packages we saw running on the VX-386 were Autocad, Lotus 1-2-3 and Sidekick.

While we were trying Sidekick it threw up a bug of which Research Machines was previously unaware. The program could be invoked by pressing Ctrl and Alt together but it would not respond to the double-Shift hot-key combination. This is a minor problem which Research Machines says will be fixed before shipments of production machines begin. Apart from that Sidekick behaved perfectly normally.

On production machines you will be able to choose whether you want the machine to run in IBM or Nimbus PC mode on power-up. The computer will configure itself to the mode of your choice under MS-DOS, and in order to allow this to happen Research Machines is having to write its own version of MS-DOS 3.2. The customised version of DOS was unfinished at the time of the preview so we booted the computer using a version of PC-DOS 3.1 to run some benchmarks.

The Nimbus VX-386 produced a Norton Sysinfo figure of 18.0 or 18.7, the two figures being thrown up at random during repeated runs of the program. Research Machines said this inconsistency was partly due to PC-DOS and partly because the machine sometimes encountered a page boundary which slowed things down. We were reminded once again that the machine had not yet been fully optimised. But even taking the lower figure of 18.0, the VX-836 is among the fastest performers we have encountered among AT compatibles.

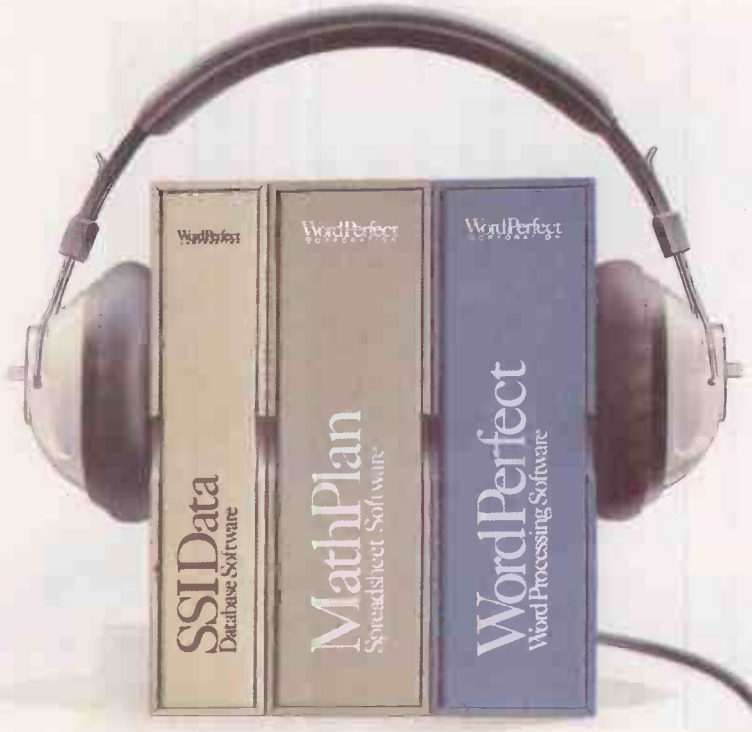
Bearing this in mind we ran the Basic Benchmarks. They came up with an average of 2.1 seconds, slightly behind the Compaq Deskpro 386 time of 1.9 seconds. When the cache memory is implemented there could be a dramatic improvement in benchmark timings too. We were unable to get any meaningful results from the Bagshaw Benchmarks as the disc drives had yet to be optimised.

With the Nimbus X series, Research Machines has moved away from its previous policy of only selling direct to customers. At the time of writing it was actively recruiting third-party dealers and VARs. This, more than anything else, indicates a willingness to move from a niche position in the educational market towards the sound of gunfire in the corporate marketplace.

How well Research Machines will do in this market is as yet unclear. On the day of the launch we would have predicted the machine would do very well indeed. The Nimbus X series maintains Research Machines' reputation for quality design and rugged engineering and is priced £500 below the Deskpro 386. But two days later Apricot launched its Xen-i 386 at under £3,000 for the entry-level system. This puts it some £2,000 below the announced price of the VX-386 — although without taking into account Research Machines' famous 30 percent educational discounts. This is a direct threat to RM's VX-386, as the new Xen-i is likely to compete for the lucrative local and national government contracts, where buying British is encouraged. From where we stand an all-British battle royal appears to be just over the horizon.

CONCLUSIONS

- The Nimbus VX-386 is an 80386-based micro. It represents Research Machines' entry into the IBM-compatible universe while maintaining Nimbus PC compatibility.
- While incorporating custom chips to keep costs down in the areas where it sees the standard surviving, Research Machines has left its options open concerning future moves by IBM.
- The card cage idea — shades of he 380Z! — whereby the processor is fitted on to a removable card, provides an upgrade path for users and an insurance policy for the manufacturer in the event of any drastic changes dictated by IBM.
- Research Machines is entering the big time. We wish it well. PC



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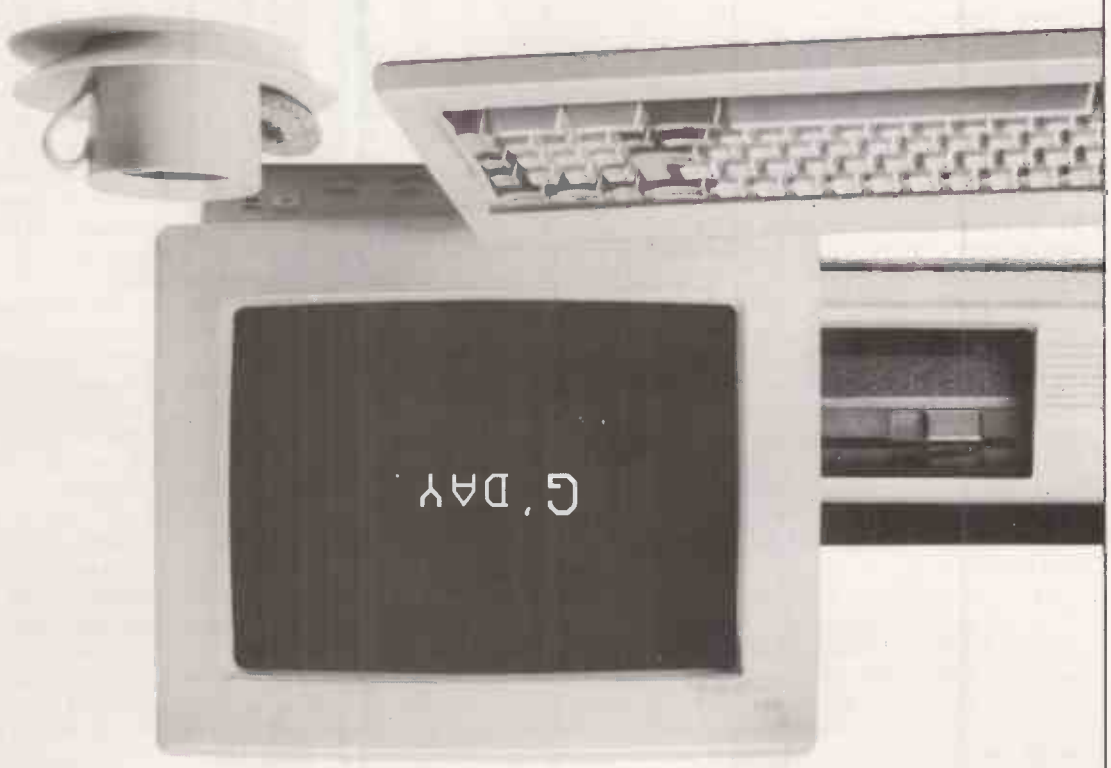


WCRS

CHEAP AT CLONES
WORTH TAKING THE RISK?

By Ian Stobie

AT clones are still a lot more expensive than a basic PC so there is much more at stake when you are thinking of buying cheap.

You can easily save £1,000 when buying an AT-compatible system. This is the kind of money you save by eschewing the big-name suppliers and going for a lesser-known brand. To find out whether the cheaper models are up to scratch we looked at three systems from Elonex, Bristol Micro Traders and Walters. They range in price from £1,295 to £1,790 for a working system with 20Mbyte hard disc and monochrome display.

Like the IBM PC/AT itself, all AT-compatible systems are basically card cages. By adding different cards you can get a wide range of different configurations. This flexibility is one of the advantages of the IBM standard, but it does make price comparison difficult. As our price reference point we decided on a general-purpose business system with monochrome monitor and Hercules-compatible display card, 640K of RAM, one 1.2Mbyte floppy, a 20Mbyte hard disc and MS-DOS. This setup would cost £1,790 from Walters, £1,596 from Bristol Micro Traders and £1,295 from Elonex.

Walters offers several AT clones, including a standard-sized desk-top machine and a transportable model. We looked at the latest, the Baby AT, whose main claim to fame is its small size. It is indeed a very compact unit, measuring 17in. wide by 16in. deep, which is a good deal less than the standard clone or the IBM PC/AT itself.

Like all the machines we looked, the Baby AT is assembled largely from Taiwanese componenets with the main board also from Taiwan. Build quality on the Walters seemed good, with the casing fitting properly round the machine and the disc drives and other components correctly assembled and working straightaway. Despite its small size there is room inside the system box for eight expansion slots and four drives. The power supply is rated at 192W, so it is not unreasonable to assume that you could have two hard-disc units and two floppies in the box. We had a floppy and one 20Mbyte hard disc.

Six of the expansion slots have the full 16-bit AT-standard bus, the other two being eight-bit PC/XT-style ones. This is also the case with the Elonex and Bristol Micro machines: the internal layout of all three AT clones is very similar. Normally you would use up two or three slots straightaway for a disc controller, a display card and output ports. All three clone suppliers offer monochrome display cards which are Hercules compatible, and this is well worth having as many graphics packages use the Hercules standard.

The Walters monochrome card has a parallel printer port on it too, so you only need two slots to take care of discs, display and printer. Of course, if you also need an RS-232 port for your printer or for a modem you would need to add another card. On our review system we in fact had an EGA-compatible colour-display card and a high-resolution colour monitor, which would together add £500 to the cost of the system.

The high-resolution colour monitor supplied by Walters with the EGA card is made by TVM in Taiwan. You can switch it between full colour and amber or green, which some people prefer for text work. There was slight barrel distortion at the edges of the tube, but in general the results looked very good with the graphics packages we tried. Rather unusually, there is a cooling fan inside the monitor which made a slight hissing sound. The fan inside the main system box was noisier, and seemed a bit worse than on some of the more expensive machines we see, but it was not unacceptable.

Walters and Bristol Micro Traders both supplied identical keyboards from the same Taiwanese supplier. The layout is not the new IBM type with 12 function keys along the top, but the older AT-style layout with 10 function keys arranged vertically at the left-hand side. It is a good keyboard, with a nice positive typing feel. It may not be very robust though: we managed to knock the right Shift key off the Walters keyboard within a few days.

Bristol Micro Traders quotes a price of £999 for its AT-compatible system, the Micro 286. However, this is for a single-floppy system with no display or MS-DOS; for our hard-disc based reference system the price would be nearly £600 more. Our initial impressions of the Micro 286 were not at all favourable. We were supplied with a unit with 20Mbyte hard disc and twin floppies. The two floppy drives were of different colours, neither of them matching the main casing, and one of them did not work at all. We regularly got error messages when using the other floppy drive, though it would usually work on the retry.

General build quality did not seem very good. When we opened up the system box, the combined parallel printer and Hercules-compatible monochrome display card seemed badly bent. However, it did work and Bristol Micro Traders sent us another one when we rang up. We had the monochrome display on our system, which provided satisfactory results. The parallel printer port, contained on the same board, also worked without trouble.

The Elonex machine, the PC-286 Turbo, was the cheapest of the bunch and it generally struck us as the best value of the three. The system box is about the same size as the Bristol machine or the IBM PC/AT itself. It is quite well styled, and build quality is as good as on the Walters and better than the Bristol offering.

The keyboard differs from the other machines. It has a shallower feel with less resistance in the keys, but it is not unpleasant to type on and seems fairly robust. The layout is again generally like the older IBM AT keyboards, but there is an extra set of cursor keys immediately to the right of the space bar.

We had a system with an EGA-compatible colour display and monitor, which costs an extra £395. This is less than Walters charges for the upgrade. In general not only are basic Elonex system prices lower, but the options also work out cheaper. On our system we had an extra 2Mbyte of RAM installed in order to run Smalltalk, which would set you back only £275.

The display looked fine. Elonex supplied an effective but rather bulky Casper high-

(continued on page 49)

WALTERS BABY AT

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	■	☐	☐
Ease of use	☐	■	☐	☐
Documentation	☐	■	☐	☐
Value for money	☐	☐	■	☐

☐ Compact and well built, but the hard disc is fairly slow. Worth a look.

SPECIFICATIONS

BRISTOL MICRO 286

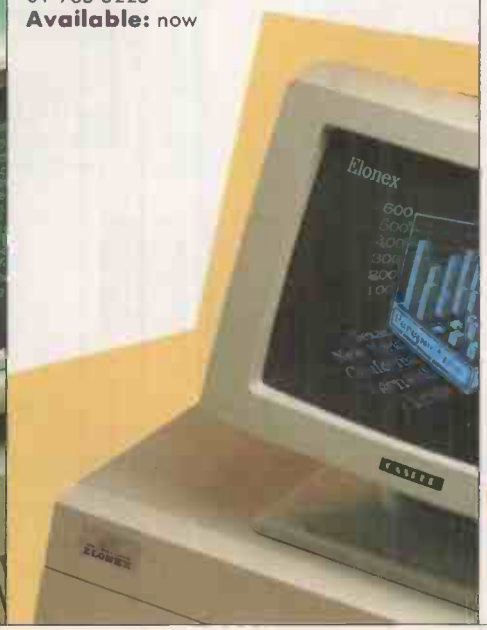
CPU: 80286 running at 6MHz, 8MHz or 10MHz; optional 80287 maths co-processor
RAM: 512K expandable to 1Mbyte on motherboard
Expansion slots: six AT-style slots and two PC-type slots
Discs: one 1.2Mbyte floppy as standard; system box has enough room to house four drives
Display: 12in. monochrome monitor with Hercules-compatible monochrome display cards costs £189; colour monitor with CGA-compatible card £368; high-resolution colour monitor with EGA-compatible card £648
Keyboard: early AT-style with 10 function keys
Interfaces: one RS-232C serial port and one parallel printer port
Dimensions: 533mm. (21in.) x 419mm. (16.5in.) x 152mm. (6in.)
Price: £999 for base system with 512K RAM, keyboard and one 1.2Mbyte floppy drive; MS-DOS 3.2 costs £59
Manufacturer: made in Taiwan
U.K. supplier: Bristol Micro Traders, Systems Group, Maggs House, 78 Queens Road, Bristol BS8 1QX. Telephone: (0272) 298228
Available: now

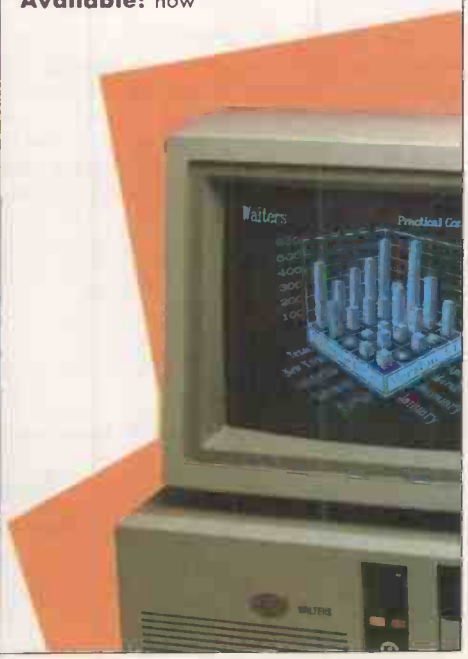
ELONEX PC-286 TURBO

CPU: 80286 running at 6MHz, 8MHz or 10MHz; optional 80287 maths co-processor
RAM: 640K expandable to 1Mbyte on motherboard
Expansion slots: six AT-style slots and two PC-type slots
Discs: system box can house four drives; typical configuration is one 1.2Mbyte floppy drive plus one hard disc of up to 80Mbyte
Display: 14in. monochrome monitor with Hercules-compatible monochrome display card; colour monitor with CGA-compatible card costs extra £175; high-resolution colour monitor with EGA-compatible card costs £395 extra
Keyboard: early AT-style with 10 function keys
Interfaces: two RS-232C serial ports and one parallel printer port
Dimensions: 533mm. (21in.) x 432mm. (17in.) x 152mm. (6in.)
Software in price: MS-DOS 3.2
Price: £1,295 with keyboard, 640K RAM, 14in. monochrome monitor, one 1.2Mbyte floppy-disc drive and one 20Mbyte hard disc
Manufacturer: made in Taiwan
U.K. supplier: Elonex (U.K.), Rays House, Stonebridge Park, North Circular Road, London NW10 7XR. Telephone: 01-965 3225
Available: now

WALTERS BABY AT

CPU: 80286 running at 6MHz or 8MHz; optional 80287 maths co-processor
RAM: 640K expandable to 1Mbyte on motherboard
Expansion slots: six AT-style slots and two PC-type slots
Discs: system box can house four drives; typical configuration is one 1.2Mbyte floppy plus one hard disc and up to 80Mbyte of hard-disc space
Display: 14in. monochrome monitor with Hercules-compatible monochrome display card is fitted as standard; CGA-compatible card and colour monitor costs extra £200; EGA-compatible card and high-resolution colour monitor costs extra £500
Keyboard: early AT-style with 10 function keys
Interfaces: one parallel printer port
Dimensions: 432mm.(17in.) x 406mm.(16in.) x 152mm.(6in.)
Price: £1,280 for base system with 640K RAM, keyboard, 12in. monochrome monitor and one 1.2Mbyte floppy drive; MS-DOS 3.2 with GWBasic £65
Manufacturer: made in Taiwan
U.K. supplier: Walters International, Matrix House, Lincoln Road, Cressex Industrial Estate, High Wycombe, Buckinghamshire HP12 3RD. Telephone: (0494) 32751
Available: now





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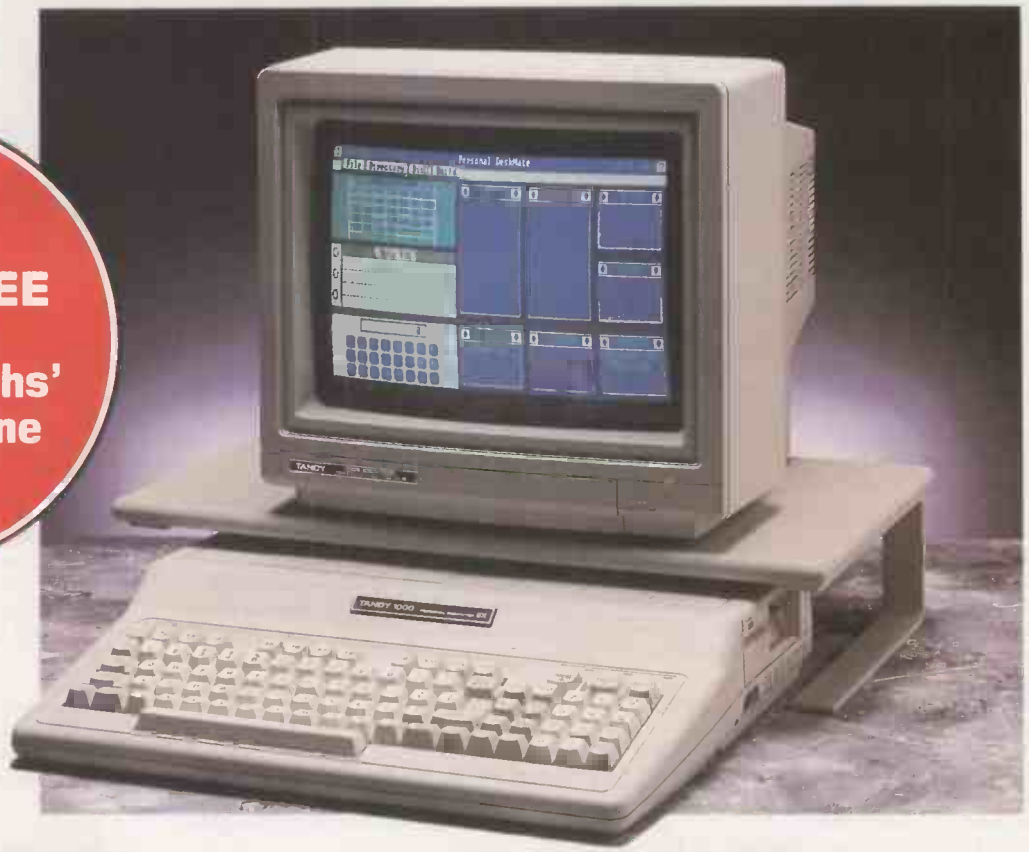

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(continued from page 47)

resolution monitor built in Taiwan. A parallel printer port is incorporated into the EGA board, and we had trouble getting it to work. But this problem aside, we were happy with the Elonex.

The Walters Baby AT offers you a choice of two processor speed settings, 6MHz and 8MHz. Both the Elonex and Bristol Micro machines offer an even faster 10MHz. The standard IBM PC/AT goes at 6MHz, and this speed is worth having in case of trouble with the faster speed, for instance when loading copy-protected software. On the Walters you switch between speeds using a button on the front of the machine, which seems to work even when the machine is running. We used the faster speed routinely, but did have problems printing. At 8MHz we would lose characters at random; switching to 6MHz when printing cured the problem.

The clock rate on the Bristol system can supposedly be set by the user from the keyboard. You are supposed to have a choice of 6MHz, 8MHz or 10MHz but how you actually achieved this was not documented; in general documentation was not one of the system's strong points. On ringing Bristol Micro Traders we were told how to do it, but were also told that our system was permanently set to 10MHz.

BENCHMARK RATINGS

All three machines did well on our standard Basic Benchmarks, which measure the speed of the system at running interpreted Basic programs. The Walters at 8MHz in fact turned in the same timings on all eight routines as the Bristol running at 10MHz, showing that clock speed is not everything. The average time for the Bristol and Walters machines was 3.4 seconds — faster than both the Compaq 286 and the IBM PC/AT itself. The Elonex was the quickest at this test, turning in a very fast 2.7 seconds.

With the Elonex you have the option of 6MHz, 8MHz and 10MHz clock rates, but you can also get the processor to operate with no wait states at the top speed for maximum performance. With most AT systems the processor periodically has to suspend its activities to allow the transfer of data to or from memory to be completed. This is a wait state. Obviously having zero wait states gives you better performance, but for this to be possible the RAM chips used in the system must be fast enough to keep up. The Elonex does use fast RAM, and we ran it successfully at 10MHz with no wait states with a wide range of software.

Another measure of speed is provided by the Sysinfo routine in the Norton Utilities package. It checks out the speed of registers and memory using machine-code routines, and reduces them to a single feature, scaled relative to the IBM PC. At their top clock rates both the Walters and Bristol machines turned in figures of 10.3, meaning that they are over 10 times as fast as the IBM PC at performing the Norton routines, and nearly twice as fast as the IBM PC/AT itself. The Elonex again proved yet faster, turning in 11.5.

The PC/AT runs at 6MHz, and if our clone machines work internally in a similar way then they too should return the same Norton Sysinfo figure when set to this speed. Both the Elonex and Walters did.

In most practical applications the speed of the discs matters more than the speed of the processor, so we used the Bagshaw Disc Benchmarks to check out the hard discs on the three machines. On this test the Bristol came out well, its figure of 54.5 seconds bringing it close to the PC/AT itself and within striking distance of some of the more up-market clones. The Elonex returned a respectable 61.9 seconds, while the Walters Baby AT proved a disappointment with a slow 116.5 seconds.

BRISTOL MICRO 286

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	☐	■	☐
Ease of use	☐	■	☐	☐
Documentation	■	☐	☐	☐
Value for money	☐	■	☐	☐

☐ A good spec let down by poor build quality. When you add everything up it is not all that cheap.

ELONEX PC-286 TURBO

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	☐	■	☐
Ease of use	☐	■	☐	☐
Documentation	☐	☐	■	☐
Value for money	☐	☐	☐	■

☐ Cheap, well built and a good performer.

We were able to run a wide variety of business software on all three machines, though it is always possible something we did not try would not run. The key component in ensuring compatibility is the BIOS software supplied in ROM, which clone makers usually buy in from a specialist supplier. On the Walters machine the BIOS was supplied by Phoenix, a leading American specialist which supplies the BIOS used by most up-market clones and virtually ensures compatibility. Bristol's Micro 286 uses BIOS chips supplied by Award Software, another well-known American BIOS maker, which is also a good sign.

It was not possible to tell who had written the Elonex BIOS. The two chips themselves were anonymous and the copyright statement which comes up when you boot the system appeared to have had the name blanked out. This doubtful BIOS is really the only black mark against the machine, although it should be stressed that in practice we had no trouble getting software to run on it.

The documentation supplied with the three machines varied widely. Bristol Micro Traders came off worse: you get slim technical booklets for the various option boards but no general setting-up guide or operations manual. Walters comes with a ring-bound user's handbook that covers setting up and DOS. Unfortunately it is written in bad Taiwanese English and is full of vague generalities.

However, both Bristol and Walters sell you MS-DOS separately, and although this means extra expense it also means you get Microsoft's professionally written guide for MS-DOS and Basic with these two systems. You still lack the hardware information, but for an experienced user who feels confident setting up the system without documentation this is not a serious disadvantage.

Elonex's documentation is probably the best. Here you get MS-DOS in the price, but not Basic. The MS-DOS manual is printed in Taiwan, but it appears to be properly licensed from Microsoft and includes the standard text. You also get a fairly substantial users guide; it wanders off into generalities sometimes, and describes the wrong keyboard most of the time, but provides correct and intelligible information on most aspects of the system.

If you can afford it you would probably do best to get your first AT-compatible machine from a major supplier — if not IBM then a good-quality clone manufacturer such as Apricot, Compaq, Epson or Olivetti. Once you have general AT experience the hardware quality of the best of the low-cost clones seems good enough to be worth giving them a try.

CONCLUSIONS

■ Walters' Baby AT is physically the neatest of the machines and comes from the best-known supplier. Apart from a problem with the printer card our machine worked very well. However, it is the most expensive of the machines tested, and in performance terms it was let down by a slow hard disc.

■ Bristol Micro Traders' Micro 286 was what we feared a low-cost clone would be like. Our machine was a mess to look at, it came with inadequate documentation and it had a serious hardware fault. We were not impressed with the presentation generally. However, the hardware itself is not bad: it has the fastest hard disc of the lot and a swift processor. A little more trouble on the part of the distributor could turn it into a good product.

■ Elonex's PC-286 was the best of the bunch, and the cheapest. It was the quickest, with an unusually fast processor, and gave acceptable hard-disc performance. Options such as the display on our review system are very keenly priced. Documentation and build quality were acceptable. Elonex's machine is worth the money, despite the problems noted in the text.

■ All these machines were weakest in things like documentation and their general presentation. Failings in this area could well reflect a generally poor standard in other aspects of support — something it is hard for a magazine to evaluate. PC

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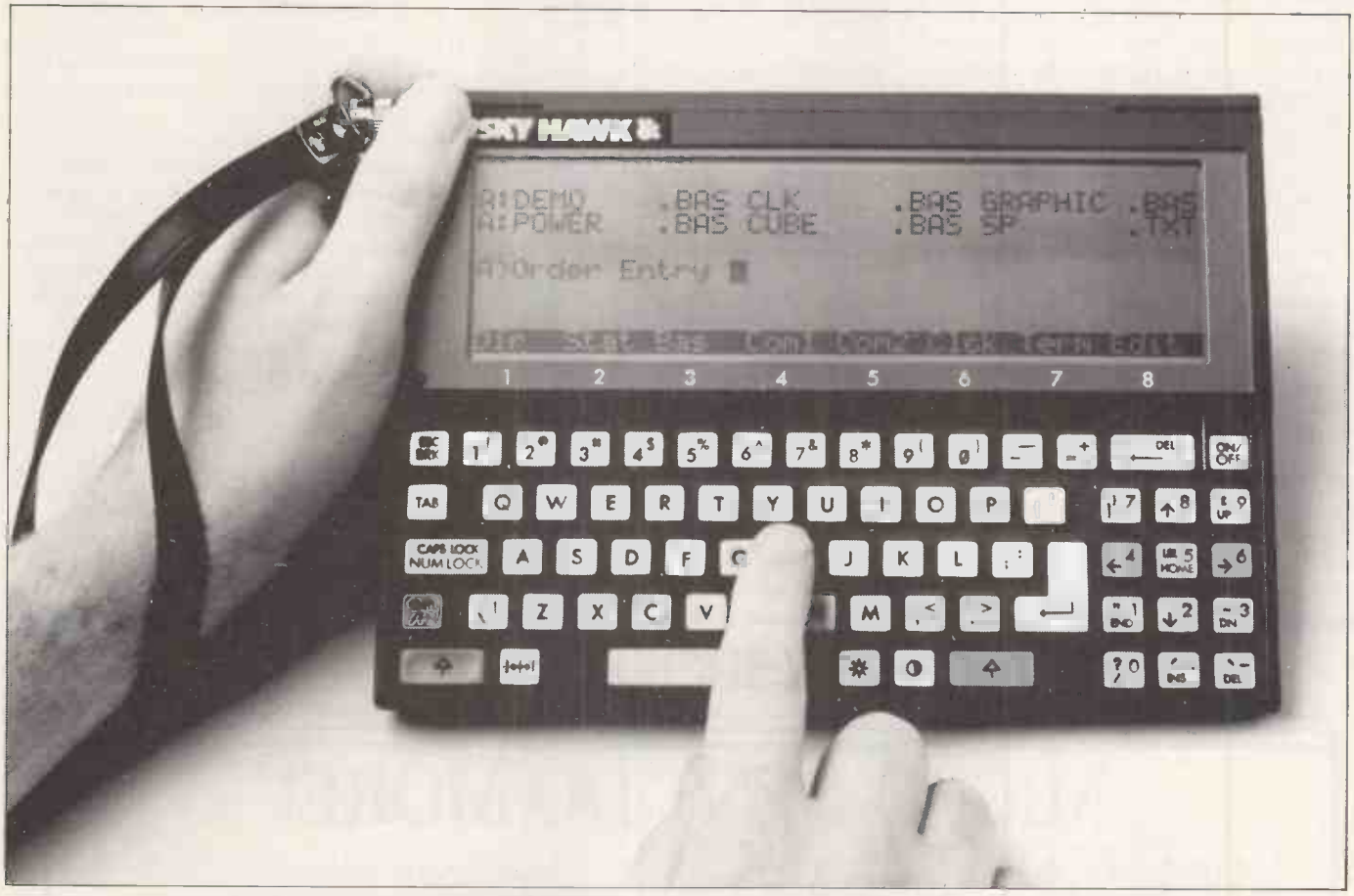
HUSKY HAWK
THE FIRST PICOCOMPUTER?

By Glyn Moody



This ultra-light hand-held portable packs a lot of power into a very small space.

Husky Computers might almost be the paradigm of a moderately successful high-tech British company. It is content to remain small, and to produce specialist products which serve its niche market well — in this case that of lap portables for use in hostile environments.

But even companies with well-established successes need follow-ups. Apart from continuing tweaks to its long-standing Hunter range, Husky has been conspicuous by its absence from the ranks of those who have brought out new computers in recent years. No longer: the Husky Hawk has arrived.

The machine is an ultra-light CP/M-type lap portable. It weighs in at just 750g., and costs a rather heavier £895. The Hawk's dimensions are 8.25in. by 5.75in. by 1.4in. Inevitably there are penalties for such extreme miniaturisation. The display is a reasonable eight lines by 40 columns but the keyboard is tiny and cramped.

HUSKY HAWK

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	☐	■	☐
Ease of use	☐	☐	■	☐
Documentation	☐	☐	■	☐
Value for money	☐	■	☐	☐

Expensive unless you really need a tiny micro.

Husky has gone some way to avoiding the problems of small keyboards by no longer using the square grid pattern of keys found on the Hunter. It adopts a more conventional QWERTY layout, though on a scale suitable for a five-year-old. As a result, touch-typing is out of the question, and even two-finger typing requires concentration. The keys are square with small dimples, and in use they got stuck sometimes.

One reason the keyboard is so small is that there is a separate numeric keypad. This doubles as a cursor pad as on the IBM PC. Husky has made some effort to follow the overall layout of the IBM keyboard as far as the auxiliary keys are concerned. Nonetheless, some of the positions are not obvious. Most serious is the placing of the Return key where you expect the Shift key; on several occasions I pressed the wrong one.

There are three ports: one for general add-ons, another for a modem and comms, and the third which is principally for an external floppy-disc drive but can also be used for comms. Internal storage is provided by 352K of battery-backed RAM. Husky advises recharging the internal battery at least once every month when the machine is not in use.

The LCD has backlighting as an option, but to conserve batteries the default is to use

(continued on next page)

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ambient lighting. Also to save power, the screen switches itself off after a preset interval if no input has occurred. With the battery-backed RAM to store the last state of the machine, the Hawk is designed to be switched on and off as and when it is needed. Switching it on returns you to your previous working position.

Most of the inside of the machine is taken up by RAM and ROM. The ROM holds the Disc Emulation Operating System (DEMOS), which is based on CP/M 2.2, together with Locomotive Basic and a few other system files. There are a few jumper leads on the board, suggesting the design is not quite finalised.

When you switch the machine on you are presented with a Husky welcome screen followed by the usual CP/M-type A> prompt. There are two internal RAM discs, A and B, and the external floppy which is addressed as drive C. The battery-operated external drive, which costs £295, is made by Brother and uses 3.5in. discs. Unusually the capacity is only 100K: this is the price paid for extra ruggedness.

Unfortunately when we were copying a file across from the RAM disc to this drive, the Hawk hung up completely and resisted all attempts to reboot. There is a Reset button, accessed by poking a paperclip or substitute through a small hole in the base of the unit, but this failed to work. In the end it was necessary to use a system command invoked by pressing X and P simultaneously, and then switching the machine on and off to clear the problem.

Running the standard Basic benchmarks produced an impressive average time of 7.2 seconds — twice as fast as the IBM PC which is a 16-bit machine against the Hawk's eight bits. Partly this is due to the excellent Locomotive Basic, which is based on that supplied with the Amstrad PCW-8256.

The Hawk comes equipped with function keys, invoked using the Control key with the appropriate number. The functions on offer are displayed on the bottom line of the screen. In Basic you get the usual assignments; in DEMOS, they handle the comms settings, the clock and so on.

Husky is offering a number of add-ons to go with the Hawk, including a modem and battery-powered thermal printer. A Homebase is also planned which will allow you to download information without having to plug in a modem. Instead, optical connections are made from the Homebase unit to the underside of the Hawk.

The Hawk emerges as a well though-out product. It is easy to use apart from the problem with the disc, and packs a lot of processing power into its compact form. But like all lap portables, the Hawk remains a specialist machine. Indeed, vertical markets promise to be one of its main areas of application. The truly personal computer which can be taken home, to the office or to the shops, remains a dream. These ultra-light machines — the so-called picocomputers — are still waiting for the development of several new technologies, notably in screens and input.

SPECIFICATION

CPU: Z-80 work-alike
RAM: 352K
ROM: 128K
Display: eight lines by 40 columns
Keyboard: miniature QWERTY with numeric keypad
Ports: two comms ports and external disc-drive port; optical link
Software in price: DEMOS, Locomotive Basic, text editor
Hardware add-ons: modem, external disc drive, Homebase unit
Size: 210mm. (8.25in.) x 146mm. (5.75in.) x 36mm. (1.4in.)
Weight: 750g. (1.65lb.)
Price: £895
Manufacturer: Husky Computers
Supplier: Husky Computers Ltd, PO Box 135, 345 Foleshill Road, Coventry, West Midlands CV6 5RW. Telephone: (0203) 680612
Available: now

CONCLUSIONS

- The Husky Hawk is probably the smallest CP/M-type portable around.
- Although its screen has good legibility, the keyboard is very cramped and not suitable for touch-typing.
- If you require a very lightweight compact machine, the Hawk will meet most needs, although there are cheaper solutions. PC

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WRITE NOW
DOCUMENT PROCESSOR

By Carol Hammond

As easy to use as Macwrite, but with plenty of formatting features, this package could do the job of a DTP program for simple documents.

The publisher of Write Now, T/Maker, claims that it is "the next step in word processing". It is certainly one of a new breed of packages that lie somewhere between a conventional word processor and a desk-top publishing (DTP) package in the tasks they set out to perform. Write Now is a sophisticated word processor which allows you to copy text or pictures from other applications, insert footnotes and divide the page into multiple columns. It is facilities like these that make it suitable for producing simple presentation documents, and allow it to encroach into the realms of DTP.

T/Maker calls Write Now a "document processor", but the label you attach to a package of this kind is probably irrelevant. As word processors become more sophisticated the concept of DTP may become a thing of the past. What is interesting about Write Now is that it is a powerful word processor with many of the features you might wish were in Macwrite. It has a number of other capabilities which make it suitable for producing reports and suchlike without recourse to a full-blown DTP package, which you may not have the expertise or time to use to its best effect.

Write Now comes on two discs. One contains the Write Now application, dictionary, a Mac System Folder and three example files. The other contains a System Folder, a restricted version of Write Now, an example file and the Translator utility which you use to transfer files into Write Now from other applications.

When you open Write Now it looks similar to Macwrite. There is a menu bar, a ruler and a title bar at the top of your text window and a scroll bar down the side. Unlike Macwrite it has a horizontal scroll bar, allowing you to type in a document that is wider than the window. Write Now has seven pull-down menus, compared to Macwrite's six.

Write Now's text window can be positioned so that the ruler peeps out above the document window just enough for you to see the tab and margin settings. To activate the ruler you click on it to reveal four text-alignment boxes and a box to set the spacing between lines; you adjust line spacing to a specified number of points, which gives you finer control than Macwrite. Each paragraph has its own ruler settings, which means that ruler changes only apply to selected paragraphs, not necessarily to an entire document. I found using the ruler rather fiddly, as I did adding headers and footers.

To set up headers and footers you go to the View menu, which allows you to view the page, headers and footers, and footnotes. When you are working on a page you are usually in the View Page option. You put page numbers into headers and footers by choosing Insert Page # from the Format menu. You can choose different arrangements for even- and odd-numbered pages by clicking on the two buttons marked Even and Odd.

WRITE NOW

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	☐	■	☐
Ease of use	☐	☐	■	☐
Documentation	☐	■	☐	☐
Value for money	☐	☐	■	☐

☐ Something more than a plain word processor but without the features of a full DTP program.

You can choose exactly where to position headers and footers by selecting Show Space from the View menu. Non-printing characters in a document, plus other items which would normally be invisible, such as hard Returns, tabs, the bottom and top of the header and footer regions, are shown by a combination of dots and arrows. This is particularly useful when setting up forms, for example, as it allows you to see exactly how much space is where.

Show Markers will show where headers, footers, time, dates and so on are, representing them with symbols. You may want to use Show Markers to see where things are on the page to make your document easier to read.

Footnotes can consist of pictures or text, and can be numbered automatically if you wish, according to where they appear in text. If you move, copy or delete a footnote the remaining footnotes will automatically be renumbered. Footnotes appear at the bottom of the page separated from the body of text by a line.

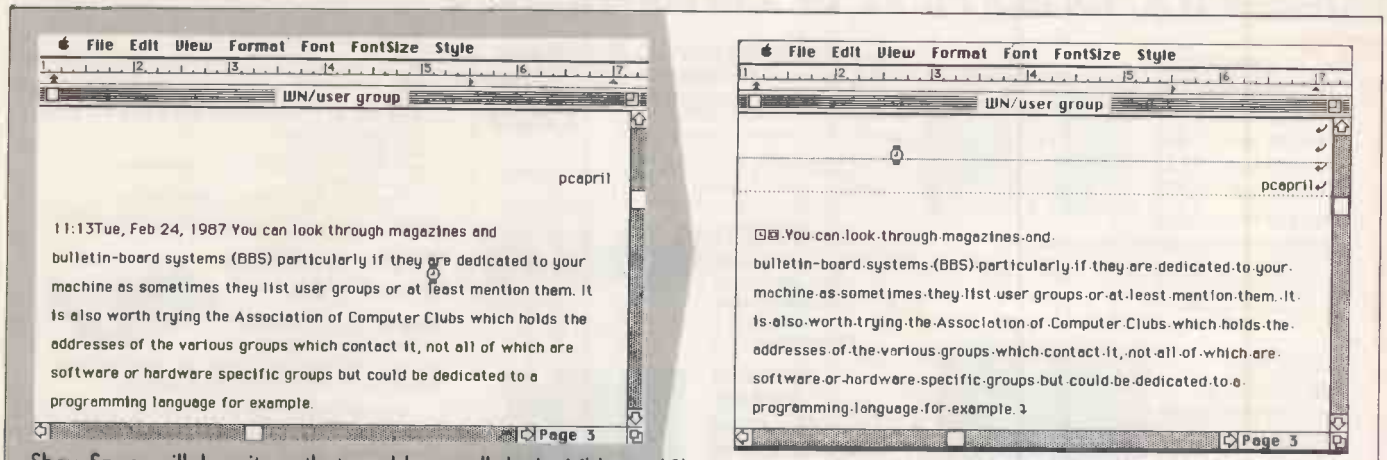
SPECIFICATION

Description: word-processing program suitable for producing simple documents; incorporates 50,000-word spelling checker
Hardware required: 128K Macintosh upwards
Copy protection: none
Price: £165
Publisher: T/Maker of Mountain View, California
U.K. supplier: Mac Serious Software, 17 Park Circus Place, Glasgow G3 6AH. Telephone: 041-332 5622
Available: now

As supplied, the Write Now disc contains only the Calculator desk accessory and the Chicago, Monaco and Geneva founts in a very limited selection of sizes; there is simply not room on the disc for anything more. This can prove a problem if you are using only a single-disc system. However, we did find that we could delete the system folder from the Write Now disc and run it in conjunction with a separate startup disc.

The Font Size menu lists eight sizes from nine point to 48 point; using the Smaller and Larger options you can increase and decrease sizes one point at a time to achieve fount sizes from four to 127 point.

The Style menu offers eight text styles plus Subscript and Superscript to move text up or down. Using the corresponding keyboard commands allows you to make fine adjustments to text or pictures by moving them up or down one point at a time. One welcome feature of Write Now is that it offers a large number of command-key combinations which duplicate options from the pull-down menus.



Show Space will show items that would normally be invisible, and Show Markers will represent dates and times by symbols.

It is refinements such as these that make Write Now a pleasure to use. Obviously a lot of thought has gone into providing extra features. For example, you can have as many documents open as the amount of memory available will allow, and Cut, Copy and Paste between them. To flip between documents you just select Send Behind from the View menu.

To change the fount of an entire document you just choose Select All from the Edit menu. You can insert soft hyphens using the Hyphenate command from the Format menu. Write Now follows sensible rules when it comes to hyphenation, and will break words where there are hyphens, soft hyphens and dashes, but not at minus signs. The Format menu also offers you the option of normal or hanging indents at the beginning of a paragraph, and allows you to insert the time and date within a document.

When you save a document you can choose to Save or Save/Compact to conserve disc space. The Compact option is certainly worth choosing: we found that saving a disc compactly reduced the size of a 23K document down to 15K. The only drawbacks are that saving takes slightly longer and you lose the backup copy that Write Now otherwise makes automatically.

To access the backup copy you choose Revert to Backup from the File menu. This is a handy option if you have saved a document by mistake or under the wrong name. You can also choose Revert to Saved, which takes you back to what your document was like before it was last saved.

FIND AND REPLACE

Write Now's Find and Replace command is also fairly sophisticated. You can search the whole document or restrict the search to the areas before or after the insertion point. You can choose to search only for entire words that match the specified text, or for words that only match the exact appearance of a word that includes accents, upper-case characters, quotation marks and so on. The ? symbol is available as a wild-card character, but you have to insert a ? for every missing character — a fairly cumbersome procedure that is hardly worth the effort required to use it.

The inclusion of a 50,000-word spelling checker within Write Now would also seem to make it an attractive option. The version we had was an American one, though the British distributor, Mac Serious, said that an English dictionary would be available in March. Meanwhile it is possible to customise the dictionary as you require. The spelling checker offers the facility to Find, Ignore, Guess, Learn and Forget words. It is disapointing in its handling of plurals and possessives. For example, it rejected "group's" and "clones" giving "groups" and "clone" as its guesses.

You can import files from other applications using the Translator, which converts Macwrite and Microsoft Word documents to Write Now format. It will also convert Write Now documents to text-only files, and vice versa. We found importing Macwrite documents no problem, though the position of some features such as decimal tabs are not exactly the same.

GRAPHICS

You can transfer graphics into Write Now via the Clipboard. We imported a chart from Cricket Graph, and by printing out on an Imagewriter 2.3 with a colour ribbon we were able to incorporate a coloured chart into the Write Now document. Pictures can be cut, copied or pasted and positioned just like text. Inserting extra line spacing or Returns before or after a picture will adjust its position vertically. To resize a picture you double-click on it and then use the mouse to expand or contract it. You can also make a picture fatter or thinner than the original, using the Option key.

Before printing you will probably want to go to the Page Setup command on the File menu. It is here that you specify the number of columns you want to print in; up to four columns per page are allowed. You can also specify the width of the binder margins and whether they should alternate, which is useful when printing double-sided documents. You can specify the starting page number; by setting it to zero you can have an unnumbered title page.

It is also from the Page Setup dialogue box that you can set the mysterious Page Wrap factor. The manual describes the Page Wrap factor as "The height of the tallest line that may continue from one page to the next . . . If, in any paragraph that may cross a page boundary, you increase the line spacing beyond 24 points, or insert text or a picture taller than 24 points, you should probably increase the Page Wrap factor accordingly." This means if you have some text in 48 point then it may well be cut in half if it comes at the bottom of a page unless you adjust the Page Wrap factor appropriately.

I found the reasoning behind the Page Wrap factor rather hard to grasp, and felt the program should do the job automatically. Write Now offers the facility to keep all the lines of a paragraph on the same page, or allow them to cross a page — which you may need when setting up a form, for example. Perhaps that has something to do with it. In any case, I did not find that the manual cast much light on why the Page Wrap factor is needed.

The Write Now documentation takes the form of a single 178-page spiral-bound manual. A lot of the material was scattered about rather unsystematically; it could have been better organised. It includes notes and tips to use as you go along, which is useful, but it is a pity they could not also be summarised in one place. Most of the information I required was there, but often the explanations read like an Act of Parliament and required several readings before I could get the gist of what was going on. However, on the whole this is not a problem since you can use most of the package's features without referring to the manual, which sometimes makes things sound more difficult than they really are.

CONCLUSIONS

- Write Now is certainly an advance on a conventional word processor. It provides a lot of useful features and is very suitable for producing presentation documents.
- The package could do with some honing and refining to make it even easier to use, and the spelling checker and wild-card facilities need improvement.
- Write Now could well prove adequate for simple DTP applications. It may not have the detailed features of a full-blown DTP package, but it is much easier to use, and by giving the inexperienced less rope to hang themselves it could well produce a more attractive document. PC

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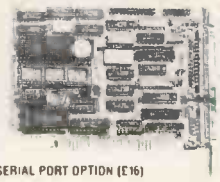

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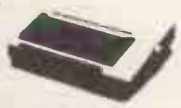

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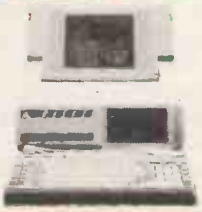

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dBASE III ADD-ONS
BEES ROUND THE HONEYPOT

By Mike Lewis

With Ashton-Tate's established database-management package thriving, the market for products to make life easier for its users continues to expand.

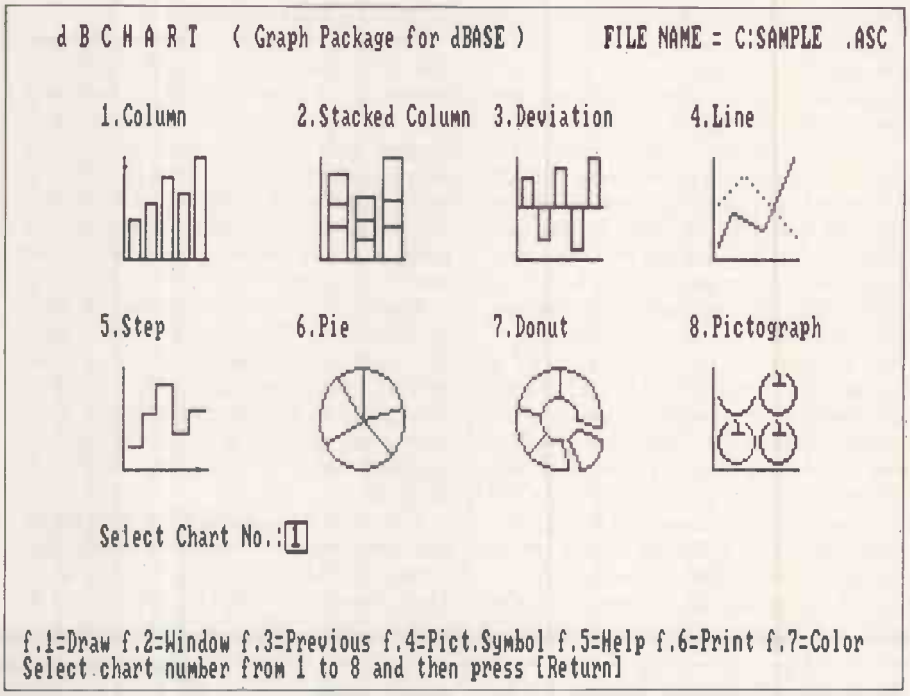
With Ashton-Tate now claiming over 1,000,000 users of dBase II and III, it is not surprising that the market for dBase add-ons continues to boom. Since we last surveyed this scene in April 1985, scores of new third-party products have appeared, all aimed at making life easier and more productive for users of dBase in general, and dBase III in particular.

For many of the makers of these packages the most fruitful area has been in trying to reduce the drudgery of typing dBase III programs. One of the more successful offerings in this category is Salamanca Software's Expressbase III, a sort of shorthand version of dBase III and III Plus. You write a program in the Expressbase language, type it in with your usual editor, run it through a translator, and end up with normal dBase code.

At its simplest, Expressbase lets you abbreviate common verbs and keywords: for example, AB for Append Blank. But you can also use it to pull in chunks of program text from a library, generate Say/Get commands from a screen image and transfer code from other programs. It has a built-in cross-reference lister, and it can expand and contract dBase keywords and produce automatic indentation. Used to the full it could well cut the number of keystrokes needed to type the program by 70 percent or more. Apart from the need to learn the abbreviations, its main drawback is the extra translation stage.

Of course, a top-quality editor or WP package can provide at least some of the features of Expressbase, especially if it supports keyboard macros. One of the better programmers' editors is Brief. This has a macro facility that is so powerful that it is like a programming language in its own right. With some effort you can use the macros to turn Brief into what is, in effect, your own personally designed editor.

Brief's authors at Solution Systems have written a set of macros that convert Brief into a highly intelligent editor geared specifically for dBase III and III Plus. The product is called dBrief and, like Expressbase, it can generate whole chunks of program code from abbreviated commands. It also lets you type repetitive statements through a sort of template, so that you only have to enter the elements that are different in each line.



Wordtech's dBChart supports eight standard charts, which you select from a pictorial menu.

If you already have Brief and you do a lot of dBase work, dBrief will be an excellent investment. It is not as liberating as Expressbase, but it does not need the intermediate translation stage. In fact you can run your edited program — and most other software too — from within Brief without quitting your current document.

Some of the features of dBrief and Expressbase can also be found in dAnalyst, a dBase II file tidier and pretty printer. Among other things, it will indent a program, expand or contract dBase keywords, change their case, remove excess spaces, and output a cross-reference list. One of dAnalyst's useful tricks is its ability to print lines down the left edge of a listing, so emphasising the program's block structure. This can also highlight any structural errors, such as a Do-While without an End-Do. Another of its outputs shows the tree structure of all the program files and procedures within an application.

Running dAnalyst is straightforward, all its options being driven from pull-down menus. These are self-explanatory, which is just as well because the manual is very skimpy. My biggest problem was that the options that were supposed to run external programs and display file directories did not work.

If using even an Expressbase style of shorthand is too much for you, perhaps you should consider an application generator. Several have been published for dBase II/III, but Bytel's Genifer is probably the most powerful. It is centred around its own set of databases, which hold details of all your files, fields, menus, help screens, forms, and report layouts. Thus you can specify a field's default value and its validation details, and Genifer will use this information wherever necessary in the generated system.

Unlike most packages of this type, Genifer is not restricted to flat-file applications. You can use it to set up relational systems, including those whose databases have parent-child relationships. You also have control over such issues as whether duplicate keys are allowed, or whether searches on partial keys will succeed.

However, Genifer can ultimately only produce standard filing applications, consisting of file updating, enquiries and reports. It cannot generate, say, an accounting system which involves posting transactions to a master file. But given that almost every dBase application involves some form of database maintenance, it does provide a good starting point.

(continued on next page)

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Another popular area for dBase add-ons is graphics. Wordtech's dBchart is a program that creates eight different types of chart from dBase II and III databases. It outputs to the screen, so you need a colour/graphics adaptor. It can also print the charts on an Epson-compatible printer.

Running the program is a two-stage affair. First, you go into dBase and use a .Prg file supplied to extract the relevant figures from the database. Then you invoke dBchart itself to generate the charts. You can customise the output by selecting colours, hatching styles, etc. dBchart can also be used independently of dBase, since the intermediate data file is straight ASCII and can therefore be typed with a text editor.

One of dBchart's more interesting outputs is a histogram in which the bars are made up of little pictures. You can choose from a library of 26 of these. Six are predefined and include symbols for a car, house and phone. For the rest, you use a built-in picture editor to create your own designs, each of which is built on a 16-by-32 grid.

An alternative approach to graphics is taken by dGE, from Bits per Second. This is a set of machine-language routines that can be called directly by a dBase III program. There are 28 functions in all, ranging from low-level primitives like drawing lines and arcs, to complete pie charts and histograms.

Although dGE is not as easy to use as dBchart, it does allow a developer to integrate graphics into an application. It also gives you more control over the finished product. dBchart is fine for the occasional chart, but its two-stage approach could be a nuisance.

Another product that is based on callable machine-language routines is Taos Tools from The Art of Software. This is a mixed bag of functions, including routines to turn the cursor on and off, generate Soundex codes, set up scrollable windows, test passwords, and find such details as the size of the machine and the amount of free RAM. Its biggest module allows you to add pull-down menus to a dBase program.

The package does have some rough edges. The pull-down menu routine does not restore the screen after the menus are closed, and the cursor function does not work properly with a monochrome adaptor. There is no proper manual, just a text file of hastily written instructions. But the product still represents excellent value. Given its low price, it would probably be worth buying even if you only needed one of its functions.

Finally, there is a new compiler for dBase III Plus, from Wordtech Systems. Quicksilver has all the features of Wordtech's existing dBIII Compiler, plus an optimiser that produces Microsoft-style object modules; they can be linked with either a standard linker or an overlay linker like Plink-86.

The result is an .Exe file that runs noticeably faster than one compiled by the dBIII Compiler alone, and an order of magnitude faster than under dBase III Plus. In one informal test I obtained a speed-up factor of six to one. This probably puts Quicksilver ahead of Clipper in terms of execution speed, although both products suffer from lengthy compile-link times.

Quicksilver is highly compatible with the dBase III Plus language, but it also sports many new features. The best of these is its extensive windowing commands. It also has DOS interrupts and user-defined functions. A compiler switch lets you hide the Quicksilver-specific commands in comments so that the program will run under dBase. PC

SUPPLIERS

Expressbase III £125, Salamanca Software Ltd, 64 More Close, St. Paul's Court, London W14 9BN. Telephone: 01-741 8632
Brief/dBrief £275, **dAnalyst** £79.95, In Touch, Fairfield House, Brynhyfryd, Caerphilly, Mid-Glamorgan CF8 2QQ. Telephone: (0222) 882334
Genifer £295, Bytel Corporation, 32 Broad Street, Wokingham, Berkshire RG11 1AB. Telephone: (0734) 791737
dBchart £99, **Quicksilver** £599, Micro Minder Consultants, 68 Upper Richmond Road, London SW15 2RP. Telephone: 01-870 7431
dGE £120, Bits Per Second, 17 Guildford Road, Brighton, Sussex BN1 3LU. Telephone: (0273) 727119
Taos Tools £49, The Art of Software, 262 Hayling Road, South Oxhey, Watford, Hertfordshire WS1 6QA. Telephone: 01-421 4206

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Hayes compatible	✓	
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Auto-dial	✓	
Baud rate scanning	✓	
Internal number store (with battery back-up)	✓	
Call progress monitoring	✓	
Internal audio monitor	✓	
Auto repeat dial	✓	
Auto-answer	✓	
Tri-level configuration	✓	
Help menus	✓	
Front panel LED indicators	✓	
25-way RS232 socket	✓	
Rear panel telephone socket	✓	
Anti-tinkle suppression	✓	
All included in one low price	✓	✗

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Linnet features battery back-up and has a 32 number store facility. It comes with 'AT' commands and 'S' registers pre set but these can be reconfigured to suit the needs of the user, and retained in memory.

Three built-in help menus make Linnet simple to use and its range of features make it one of the most advanced modems available.

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SMALLTALK AT
THE DADDY OF 'EM ALL

By Steve Malone

Smalltalk gave rise to the mouse and icon interfaces of the Mac, Windows and Gem. Now it is commercially available to run on an AT as a programming language in its own right.

Most people have heard of Smalltalk. Since the launch of the Apple Lisa and Macintosh machines in 1983 and 1984, Smalltalk has been a byword among the microcomputer cognoscenti. Despite this, few people actually know what Smalltalk is, and even fewer have seen it working.

The origins of the language, like many other developments in computing, lie in the Xerox Palo Alto Research Center (Parc). Research into human learning processes led to Smalltalk as the ultimate in easy-to-learn languages. It introduced the concept of the object-orientated program and included the first mouse and icon user interface. As such, it is the ancestor of the Macintosh, Windows, Gem and the rest.

Although originally confined to a handful of single-user minicomputers, Smalltalk is now available for the masses in the form of Smalltalk AT. This is a Xerox-licensed version of the language for the IBM PC/AT and compatibles. The possibility of porting Smalltalk to the AT has been around for some time, but it is only in the last year or so that it has become commercially feasible.

AT INSUFFICIENT

A simple AT is not enough to support Smalltalk AT. To run the system you need at least 1Mbyte, or preferably 2Mbyte of RAM. When we received the package, we made the mistake of trying to install the program on an AT clone with a mere 640K. It informed us there was not enough room on the disc, which was rather confusing as there was 12Mbyte free on the hard disc. It was only a call to Smalltalk Express that put us right. We eventually installed Smalltalk on Elonex's PC-286 Turbo — reviewed on page 46 of this issue — fitted with 2.64Mbyte of RAM.

You run Smalltalk from the DOS prompt but the program takes over from DOS and runs the 80286 CPU in Protected mode. As a result it is able to whizz about a lot faster than it would if kept to 8086 Real mode.

As well as the megabyte of RAM you need several other bits of hardware. First, you need an EGA card or equivalent to be able to cope with the bit-mapped graphics supported by Smalltalk. You also need a Logitech three-button Genius Mouse or equivalent; a simple two-button Microsoft mouse will not do.

Finally, your AT needs to be equipped with a printer port. Smalltalk discs are not copy protected but you will be unable to run the program without a special device, known as a software sentinel, which plugs into the printer port. It has a female end to it so that you can still plug in your printer cable in the normal way.

When running, Smalltalk presents the windows, icons and pull-down menus made familiar by its progeny. If you are used to Gem or the Mac you should have no problem using the scroll bars, windows and selections. Each of the three mouse buttons — called, from left to right, Red, Yellow and Blue in Smalltalk nomenclature — has a different function. In general, the Red button performs the usual window and item select, while the Yellow and Blue buttons produce pop-up windows with additional global features, like Close Window, Cut and Paste. In addition, the three keys perform different tasks while manipulating the scroll bar which appears whenever the mouse pointer moves into a window.

The opening screen is dominated by the System Browser window. It is through this window that the user can access any of the files resident in Smalltalk, and at this point you begin to realise why you need 1.5Mbyte of disc space and 1Mbyte of RAM. There are literally dozens of files making up the Smalltalk environment.

SPECIFICATION

Description: object-orientated programming environment with mouse and icon user interface
Hardware required: IBM PC/AT compatible with at least 1Mbyte of RAM, EGA display card or equivalent, Logitech three-button mouse or equivalent and printer port.
Copy protection: discs can be copied but security sentinel must be in place in the printer port before the software will run
Price: £995 for commercial customers, £395 for academic customers
Publisher: Softsmarts Inc. of Woodside, California
U.K. distributor: Artificial Intelligence Ltd, Intelligence House, Merton Road, Watford, Hertfordshire WD1 7BY. Telephone: (0923) 47707
Available: now

One of the best things about the system is that the kernel, windowing and graphics commands are all available as source code, allowing you to tinker with the system. Letting a naive user loose on the source code sounds alarming, but Smalltalk provides backup files in a separate window, so most errors are recoverable. While we were playing about with the kernel it seemed remarkably robust.

SIMILAR TO LOGO

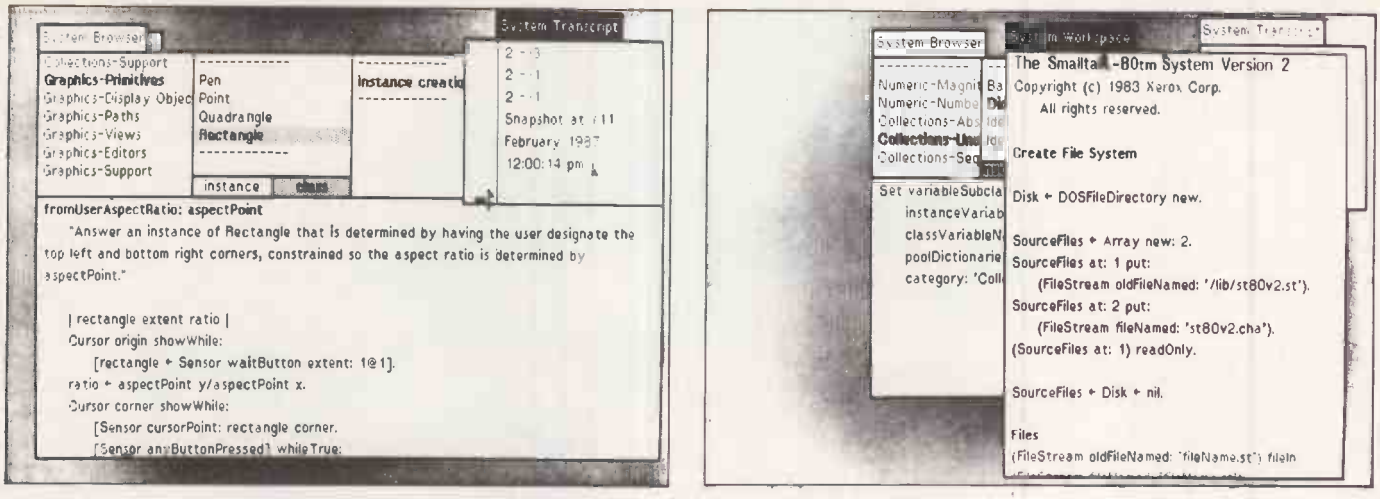
The only features of the language you cannot play about with are a set of primitives which provide the machine-level interface, and are the foundation on which all other parts of the system are built. Most of these files are constructed in terms of other files, which provides a clue to the philosophy behind Smalltalk. In many ways, the use of recursion and primitives to build up procedures which can be used to create other procedures is very similar to Logo, the language from which Smalltalk was derived.

Smalltalk files are organised via a set of sub-windows within the System Browser. The main window is divided into six smaller windows. There are four windows across the top, with a smaller window in the second box and a large window covering the bottom half of the System Browser. You select a file from the System Browser by moving the mouse pointer to the top left-hand window containing the Class Categories, and selecting one of the categories. This will cause a list of Class Names to appear in the second window. Once again you select an item, causing another set of items to appear in the third window, Message Categories, and so on.

When you have selected an item in the fourth window, the Message Selectors, the source code for that file appears on the lower half of the screen. This is the Edit window, where you can examine and, if necessary, alter the contents of the file.

Execution of a file is performed by selecting the Do It option on the Yellow button's pop-up menu. Sometimes it may be necessary to type in other parameters, or to view the output of a program. All this is done within the System Transcript window, which lies behind the System Browser on entry to Smalltalk.

One of the nice things about Smalltalk, which we have seen adopted by other



Left: You enter commands in the System Transcript window. Right: The System Workspace window catalogues what you have done.

language developers like Metacomco, is that once you have typed in a command there is no need to do so again. To re-execute the command all you have to do is highlight the command recorded in the System Transcript and select Do It. The technique can be extended to the source code itself. You can embed the execution commands as comments in the source code; simply by highlighting the comment and selecting Do It the program will run.

Object-orientated programming, the basis of Smalltalk, is conceptually very different from the likes of C and Pascal. Each of the files within Smalltalk can be considered as a procedure — known as a method in Smalltalk — and performs a specified function. In order to get output from the method you do not have to define the data structures. Rather, you pass a message to it, telling the method — an "object" if you are talking in theoretical terms — what it needs to do. In many cases it is unnecessary even to give Smalltalk a set of default parameters, as it will try and work out a sensible set of defaults while it is processing.

HIERARCHICAL FILING

The object is much more powerful than its source code suggests because of the hierarchical nature of the filing system. An object has at its disposal all the information about the nature of its class. For example, an object on a branch from the root class Graphics has all the necessary information concerned with drawing pixels on a screen without it needing to be defined by the programmer. All the user has to do is, for example, tell the object to draw a window and the object will use the knowledge of its class to create the desired effect on the screen.

A message consists of a number of expressions: the receiver, the selector and the arguments. The receiver is the object to which the message is targeted, while the selector is the command directed at the receiver. The arguments are parameters used by the selector.

There are three basic types of message which can be passed to an object. A unary message is one without an argument; it consists of a receiver and a selector and can be considered as a simple command to an object. The second type of message is the binary message. Here the message has a single argument and a selector. In this type of message, a particular type of selector, known as a binary selector, is used. Typically it will be an arithmetic operator and is used to associate the receiver with its argument.

The final type of message is the keyword message. As you might guess, it consists of a number of keywords. The keyword message is made up of a selector and one or more arguments. Using these basic message types any Smalltalk program can be constructed.

Although all of this might sound a bit complicated, Smalltalk AT is very easy to use once you get the hang of it. The concept of the object-orientated language came about by research into the ways humans think, not on the whim of the Parc development team. While programmers used to conventional languages might find it hard to grasp at first, the beginner will probably find its syntax easier to pick up than most other languages.

The environment is remarkably flexible, and supports powerful debugging tools such as step-through operations and the ability to execute sections of code independently of the rest. The Smalltalk compiler works on the basis of interpreting lines of semi-compiled pseudo-code, rather like Pascal p-code.

The fact that it is basically an interpreted language gives Smalltalk AT both its greatest strengths and its biggest weakness. On the one hand, Smalltalk code is very easy and very quick to write, run, debug and rerun; you do not have the long and involved compilation process characteristic of Pascal or C. On the other hand, the whole system seemed to us a bit on the slow side, even though it was running in Protected mode. This is due in part to the hardware. Despite the improvements made over the past couple of years, the EGA card is still too sluggish to support fast bit-mapped graphics.

The other reason for the lack of speed lies within Smalltalk itself. Because the entire basis of the language is to pass messages from one object to another, it is possible to write some very roundabout code to achieve a goal. A Smalltalk programmer we spoke to admitted that this was true, but pointed out that the idea is to get a working program running quickly. When the program is running properly you can then turn your attention to optimising the code by looking at the possibility of short cuts.

So who is Smalltalk aimed at? Obviously it has a place in academic institutions as a teaching aid. The U.K. distributor, Artifical Intelligence, recognises this and provides very generous discounts for academic customers. Out in the business community Smalltalk is probably of less use. The language is not good for developing low-level code as it lacks C's pointer structures or even an equivalent of Basic's Peek and Poke. What Smalltalk is very good at is developing fast, usable source code from the methods already provided, and it is an excellent systems-development or modelling tool.

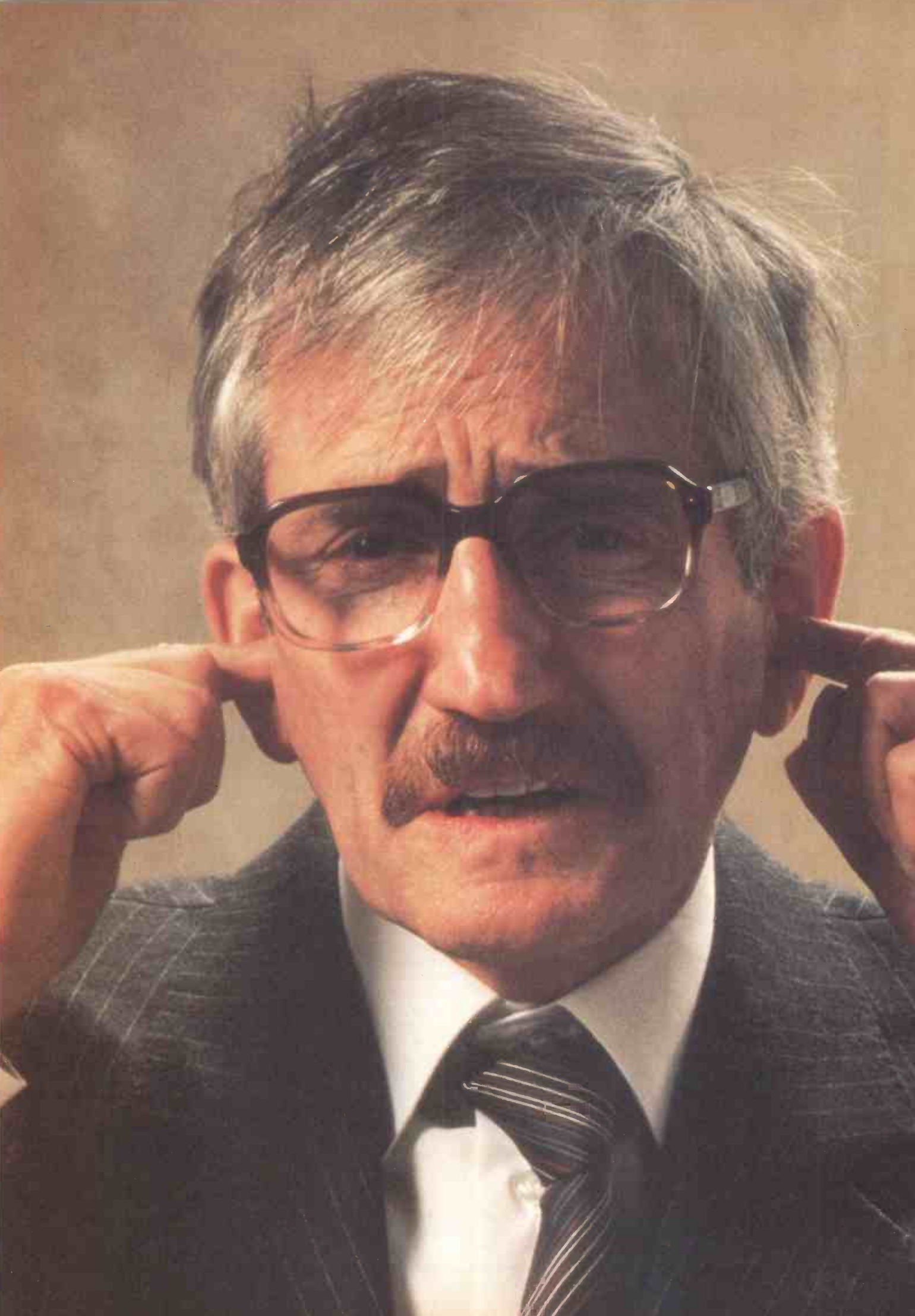
SMALLTALK AT PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	☐	■	☐
Ease of use	☐	☐	■	☐
Documentation	☐	☐	☐	☐
Value for money	☐	☐	■	☐

☐ The language of the gods comes to the masses.

CONCLUSIONS

- Smalltalk AT is a fully licensed version of the Xerox programming language.
- The sheer size and performance requirements of the environment makes heavy demands on the hardware: an AT with 1Mbyte of RAM, a hard disc and an EGA card is really the minimum you can get away with.
- The size of the system also affects the user. Although Smalltalk is intended as an easy-to-use language you need to absorb a lot of information before you can start programming effectively.
- Smalltalk is conceptually different from most other languages in its approach to problem solving. Yet once understood, it provides a fast method of developing large systems programs. PC



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CHEAP IBM WP
HOW LOW CAN YOU GET?

By Susan Curran

There are some gems to be found in this batch of low-priced software, but you have to watch out for the rubbish.

There has to be something crazy about a software field in which superficially similar programs are sold for prices that vary 20 times or more. But it's true: while the top IBM WP packages are still selling for over £450 some of their newest rivals come in at under £25. Here we look at five of the cheaper competitors in an overcrowded field: Tasword PC, Trustwriter, PC Write, Microsoft Word Junior and Business Writer.

Once upon a time, Tasword was a rather nice, cheap program for the Spectrum. Now it is also a nice, cheap program for the IBM PC and compatibles — just £24.95 including VAT. This price includes a mail-merge feature; a spelling checker is promised but is not available yet. You can buy a demo disc for £2, half of which is refundable if you decide to buy the full program.

Tasword is supplied on a single floppy disc with a neat and comprehensive 63-page A5 manual in a plastic folder. The manual includes a short tutorial on the mail-merging; there is a long general tutorial document on disc. An index would have been a help, but there are help facilities on-screen which you can switch on and off.

With the help off, Tasword uses just two lines at the bottom of the screen for system information, including a ruler. It scrolls smoothly both vertically and horizontally, and will accommodate documents up to 256 characters wide. Margins can be changed at any time, and the program will remember up to 10 rulers, which can be recalled instantly. Margin settings are not, however, saved within the text, nor is text automatically reformatted to new settings.

Reformatting to narrower margins must be done with care. There are several formatting commands, and choosing the wrong one may corrupt text. Formats also have a tendency to destroy indents at the start of paragraphs. Like earlier Taswords, this one allows you to type notes, numbers, etc. within the margins. There are a variety of insert commands, including a push-forward insert mode, but this is recommended only for occasional use, and not as the default mode.

Printer control codes, including underline, are reproduced in the text and are not executed on-screen. Otherwise, the program has a clean-screen display. Justification is echoed on-screen. Line spacing is handled only through the print menu, so it would be tricky to alter it within a document.

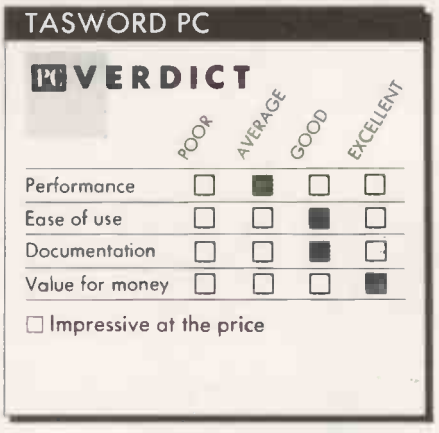
Only one document can be edited at once, though it is possible to view a second document without exiting from the one being edited. Text is held in RAM only; the program will use all available RAM and will handle quite long documents. Documents can be merged together, and there are four six-line notepads which can be used for additional text; the contents of the notepads are saved with the program. There is also a good macro facility.

All the usual commands are there, though sometimes in rather limited forms. There are variable tabs but not decimal ones; block move, copy and delete, but only on complete lines of text; and single-line headers and footers. Search and replace will search for a single word only, though the replacement can be longer; it has a case-sensitive option. There is also a rather selective undelete. Most commands are accessed from function keys, sometimes in conjunction with Shift, Control and Alt. I found them reasonably easy to use.

Tasword is a very customisable program, and it is possible to alter and save many of the default settings. Though the program comes up with an editing screen, a single command gives access to a main menu with its Load, Save and other file-handling options. This automatically displays a directory; it is also possible to log on to a different drive or directory. Tasword also makes WordStar-type .Bak backups.

The program will automatically paginate, but it advises you not to combine auto-pagination with manually forced page breaks. Printer support is largely of the do-it-yourself type, with the program preset with Epson codes. It is very versatile, and you can set it up to send a wide variety of control codes and alternative characters to a printer.

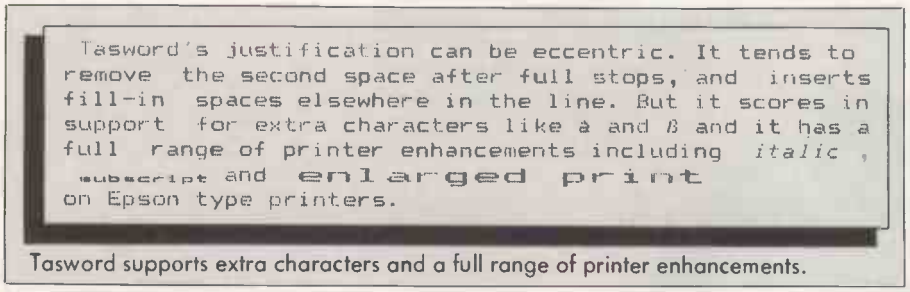
The mail-merge routine is sophisticated. It uses named record fields, can handle keyboard input, and also provides conditional printing on greater than or less than, and And/Or criteria. Alas, it does not reformat text, so inclusion of variable fields in continuous text is at the user's risk.



Error trapping is not all it might be, and very occasionally the program dumped me back in DOS, losing all my text. But all in all, this is an impressive little program which can be recommended to the hard-up or to very occasional users of WP. Tasword is particularly suitable for those prepared to dabble with printer controls and the like in order to extract maximum performance.

Trustwriter costs £49.95 including VAT and is very obviously designed for existing WordStar users looking for a cheap program for their home-based Amstrad. But what is one to make of a WordStar-type word processor that comes with just 45 A5 pages of manual, most of them barely half full of text? It sounds depressing even before you load it.

Though there is a learning file on disc, the Trustwriter manual is lamentably inadequate for teaching anyone WordStar-type word processing from scratch. The learning file, though quite well designed, far from fills the gap. Trust Software offers



Tasword supports extra characters and a full range of printer enhancements.

SPECIFICATIONS

TASWORD PC

Description: word processor with mail-merge
Hardware required: IBM PC or compatible with at least 128K RAM
Copy protection: none
Price: £21.70
Publisher: Tasman Software, Springfield House, Hyde Terrace, Leeds LS2 9LN. Telephone: (0532) 438301
Available: now

TRUSTWRITER

Description: word processor with mail-merge
Hardware required: IBM PC or compatible with at least 128K RAM
Copy protection: none
Price: £43.40
Publisher: Trust Software, Unit B11, Armstrong Mall, Southwood Summit Centre, Southwood, Farnborough, Hampshire GU13 0NP. Telephone: (0252) 522200
Available: now

MICROSOFT WORD JUNIOR

Description: word processor with mail-merge
Hardware required: IBM PC or compatible with at least 192K RAM; two disc drives
Copy protection: yes; one backup disc is provided; program can be installed once only on to a hard disc
Price: £60.80
Publisher: Microsoft, Excel House, 49 De Montfort Road, Reading, Berkshire RG1 8LP. Telephone: (0734) 500741
Available: now

PC WRITE

Description: word processor with mail-merge and spelling checker
Hardware required: IBM PC or compatible with at least 256K RAM
Copy protection: none
Price: £99
Publisher: Quicksoft of Seattle
U.K. distributor: Sagesoft, NEI House, Regent Centre, Gosforth, Newcastle upon Tyne NE3 3DS. Telephone: 091-284 7077
Available: now

BUSINESS WRITER

Description: text editor/word processor
Hardware required: IBM PC or compatible; 256K RAM recommended
Copy protection: none
Price: £20
Publisher: S&S Enterprises, 31 Hollow Way Lane, Amersham, Buckinghamshire HP6 6DJ. Telephone: (02403) 4201
Available: now

limited 90-day support; for more hand-holding you have to pay £25 a year.

There are few good reasons for picking Trustwriter unless you know WordStar already, so I'll concentrate on the differences. Trustwriter looks much like an old WordStar in which the underlining is not echoed on-screen. The usual top-of-screen menus are absent, but rudimentary help facilities are provided in a superimposed window. There is no on-screen ruler, just a note of the margin positions. These are adaptable, but the tabs are fixed at eight-column intervals. In the old WordStar fashion, margin positions are not saved with files, so you must check your margin every time you reformat text.

Cursor movement uses the good old WordStar diamond, with the IBM cursor keys installed as an alternative. The general editing commands are fairly WordStar standard. Trustwriter has a proper Insert mode, but does not automatically reformat text. It effectively combines WordStar's document and non-document modes.

The program works fast in normal editing, but like its original it becomes very slow when moving around large files. It can handle files too large to fit into RAM.

There are no numeric text markers. There is no way at all to get a disc directory on-screen, even on the initial non-document screen. There is no way to log on to an alternate directory or disc. There is no way to hide control symbols in the text. There is no indication of page breaks on screen.

A very few of the standard WordStar failings have been circumvented. The awful ^OG indent command has been replaced by a bizarre but reasonably effective indenting arrangement. Its main limitation is that you cannot automatically indent numbered paragraphs. There is an Undelete buffer. Another oddity is an Adjust command that shifts lines or blocks of text to the left or

(continued on next page)

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right; it can only be used on whole lines, not to make up for the tab limitations.

Trustwriter includes a fairly ambitious merge facility with named fields, and the opportunity for user input during a run. Printer support is abysmal. For the FX-80 and the IBM Graphics Printer it is poor; for anything else it is non-existent. There is some scope for defining your own driver, but as Trustwriter is totally non-customisable this is a poor option. In all, this program is as far below WordStar as New Word was above it.

PC Write originated in America from Quicksoft as a shareware program: try it first, buy for $75 if you like it. When you know that, Sage Software's price of £99 looks less than generous. The price includes 90-day support; for longer support you must pay out another £30.

PC Write comes on two floppies and consists of separate editing and print-formatting programs, both divided between the two discs. It is always necessary to save a file to disc before printing it, but otherwise they are quite well linked.

PC Write is a heavy kind of program: full of commands, with a hefty manual that is all small print and serious technical information. I found it rather daunting. There is so much to remember, and the on-screen guidance tends to be confusing rather than helpful. Though the manual has an index it is poorly arranged and it is difficult to find the information you need quickly.

The initial menu/system line can list any of nine different keyboard statuses and 17 edit statuses. It is full of little symbols which drastically affect the way the program behaves on-screen. It is entirely unclear how to get to menus with, for example, the spelling checker on them, and all too easy to land up in menus which deal with Highbits and other technical stuff. I found it hard to remember even the basic sequences which save files or exit without saving. With long-term regular use these problems would partly disappear, but PC Write certainly is not a program for the occasional user.

To start the editor, you must specify an old or new file to be edited. It is not easy to access a directory at this stage, though the program does offer two different directory features.

PC Write's text formatting is defined by commands in three different files: the text file, the edit format file and the print format file. Some types of format commands, similar to WordStar dot commands, can appear in any one of them, as you choose. This gives great flexibility to experienced and confident users, but is very confusing to the newcomer. Rulers seem to appear and disappear when you try to change them; formatting instructions in one file may be overridden by those in another, so what you see is not necessarily what you get.

All this should not detract from PC Write's merits. It has a proper push-forward Insert mode, for example, with Overwrite available as an alternative. Justification is echoed on-screen and there is an option to reformat automatically. Care is needed here since PC Write does not distinguish forced from natural line breaks, so reformatting can cause havoc with tables unless precautions are taken. Reformatting is not instantaneous, though it is reasonably fast.

The screen can be split vertically into two windows, and either two parts of the same document shown, or two different documents edited. Only one document is held in memory at any one time, so switching between windows is rather slow.

All the usual editing commands are there, plus macros, detailed sequences for accessing alternate characters and print enhancements, including colours on colour printers and different fount sizes. The program measures margins in inches, not in characters. There are indexing and footnoting, and excellent headers and footers which can be multi-line, and left/centre/right justified on the same line.

The rather complicated arrangement for mail-merging involves input and output template files as well as data files. It will accept keyboard output, and will reformat text on request. There is also a spelling checker, which will do an automatic check during text input, or check whole documents or single words. Its procedure for working through a document doing a check entirely defeated me. I still have no idea how you are supposed to make corrections other than the suggested one, and there seemed to be no way to tell it to ignore a word for the rest of the check.

What isn't there? Not much, though there is no background printing, no maths features, no columnar features. Page breaks are not echoed on-screen, and though the status line indicates how far through the file you are, as a percentage of the total, page, line or column positions are only shown if you specifically request them. New pages, when forced, generate only a confusing little symbol, and not a clear page line. Lines with tabs are not justified, so you have to start paragraphs with spaces instead.

PC Write is enormously customisable and has excellent support for a huge range of printers, including a wide range of cartridge and downloadable founts on Laserjets. All in all, this is the perfect hacker's program. Its power and flexibility are unquestionable, but secretaries and occasional users may find that too many of the powerful features are beyond their reach.

After the flakiness of the real cheapies, Microsoft Word Junior has a comforting solidity about it. This is the kind of program you just know will not crash or corrupt your text. It comes on two protected discs and it is recommended for use only on dual-disc machines. Considering the price of the big Word, £69.95 is a snip for this version, which is very recognisably the same. Corners have been cut with the packaging but the

TRUSTWRITER

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	■	☐	☐	☐
Ease of use	☐	■	☐	☐
Documentation	■	☐	☐	☐
Value for money	☐	■	☐	☐

☐ Even WordStar aficianadas should not have to put up with this.

PC WRITE

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	☐	■	☐
Ease of use	■	☐	☐	☐
Documentation	☐	■	☐	☐
Value for money	☐	☐	■	☐

☐ A great program for hackers, but impenetrable for casual users.

PC Write calculates its margins in widths, not
character positions, so changing the font width
means that
tab indents align perfectly.
A very wide range of fonts are available
and ready defined for supported printers,
including variable width fonts
but formatting sometimes seems
rather hit and miss.

PC Write offers a wide range of founts in variable widths, though its formatting proved to be unreliable.

Microsoft Word Junior will format cleanly even when your document contains a mixture of founts.

Word Junior offers a good range of print enhancements, including *italic type*, SMALL CAPS and ~~strikethrough~~. It's not possible to send other codes to the printer, however. A specially impressive feature is the program's ability to justify text consisting of different sizes of font. A special printer-oriented display shows line endings as they will be printed.

program itself has most of Word's normal features.

Word's hallmark has always been its high-tech orientation, and this version too works much better with a mouse than without one. It will display 43 lines of text with a suitable graphics board. Printer support has been slashed, though it is still adequate for cheap printers. There is a rough approximation to background printing but no queueing facilities.

The program will support up to eight windows, edit documents simultaneously, and handle footnotes, multiple columns of text and decimal tabs. The screen is profligate on system space, with a border all round every window and a full menu at the bottom which Word Junior does not let you hide, leaving only 19 lines for text.

Word is the very opposite of a do-it-yourself program. It does your formatting for you, in response to instructions you give. Ask for a line between paragraphs and it will do it; ask for a particular margin size and it will calculate it. The only annoyance is when the command structure proves to have gaps, and there is no DIY way to circumvent them. The program persistently double spaced on my printer, for instance, which always adds its own linefeed to a Carriage Return unless sent an initialising code. There proved to be no way within Word to send such a code.

The formatting is outstanding. Measurements can be given with great precision, in inches, centimetres, character positions or points. Text in different sized founts is perfectly aligned, and all varieties of indentation are fully supported. There is micro-space justification on a few supported printers, and there is even automatic hyphen help. Finished document layout with this program can be extremely professional. Adapting layout is much easier than with most other programs, whatever their price.

There is also a glossary feature for standard paragraphs. The big Word extends this approach into style sheets which summarise detailed formatting instructions for different types of document. They are horrendously complicated, and it is no great loss that they are missing from Junior.

Junior will not compile an index or a table of contents, and it is lacking Word's fancy outliner. A more serious omission is the spelling checker. It has, however, retained the mail-merge feature, which includes If and Else commands. All in all, Word Junior is outstanding value. LAN and laser-printer users should stick with the biggie, but for most of the rest, a mouse, Word Junior and a speller package will beat the opposition hollow.

WORD JUNIOR

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	☐	☐	■
Ease of use	☐	☐	■	☐
Documentation	☐	☐	■	☐
Value for money	☐	☐	☐	■

☐ No speller, but otherwise a great program for editing and formatting.

BUSINESS WRITER

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	■	☐	☐	☐
Ease of use	☐	■	☐	☐
Documentation	■	☐	☐	☐
Value for money	☐	■	☐	☐

☐ Too little, too cheap.

Business Writer is the kind of word processor that powers up with wordwrap toggled off. The kind that never automatically reformats text; that beeps in mid-indent when the line of text is full; that never, ever lets you access a disc directory; that has no printer driver at all, not even a default FX-80 one. It would have looked unimpressive even in the days of Dragon 32 word processors; for the IBM/Amstrad and compatibles it is beneath consideration.

The program comes on a single unprotected floppy disc. The text of the manual is also held on the disc in a document field and you print it out yourself. When loaded the program comes up with a totally blank screen: no ruler, no system information, no note of the help key, no nothing. Just a cursor, and text if you are loading an old file. It is possible to see a ruler or rudimentary system information, but only when you are not actively editing. The few help screens available are not context sensitive.

The program is not directly customisable, but you can determine initial settings for different types of document via a template file. There are no menus, only direct commands, using a mixture of function keys and alphanumeric keys. Some functions are duplicated to provide a rudimentary echo of the WordStar command structure.

Commands which require user input are handled by blanking the line containing the cursor, and producing a little double-arrow prompt. There is no verbal prompt, no confirmation of which command you have designated, and when a command cannot be carried out there is no explanatory message, just a rude little beep.

The precautions against accidental deletions are rudimentary, and there is no Undelete facility. It is possible to find and replace text in a very basic way with no case sensitivity or wild cards. Documents can be paginated, but once only. If you edit the document afterwards you must remove all the page-end symbols by hand before re-paginating.

On the plus side, Business Writer does have variable tabs, decimal tabs and some arithmetic facilities. It will justify and centre text and range it right, and will cope with documents up to 255 columns wide. Screen responses are speedy, and vertical scrolling is smooth. Horizontally it doesn't scroll: it jumps.

Printer support is virtually non-existent. It is possible to print either designated blocks of text, or paginated documents. There is no way within the program to specify the printer port. Text is sent, as it is saved on disc, in a basic ASCII string. There are no print-control codes built into Business Writer at all — not even underline codes. To send codes to a printer you have to insert the full Escape codes every time they are used, which destroys the formatting.

CONCLUSIONS

■ Prices really have dropped drastically, and it is now possible to get a good word processor for under £100. But none of these is as good all round as Word 3.0 or Word Perfect 4.2. Serious users can still justify paying the extra for a top-class program.

■ Price is still only a very rough guide to performance. As far as performance goes, I'd rate these word processors in ascending order: Business Writer, Trustwriter, Tasword, PC Write, Word Junior.

■ When, oh when are the top-end prices going to drop to match the fall at the bottom end of the market? PC

AN INNOCENT ABROAD

Carol Hammond recounts her experiences when she approached a number of dealers for advice on how to computerise a typical professional office.

Dealers are stuck in the middle. On the one hand they have to provide the customers with what they want; on the other they have to sell what the manufacturers give them to stock. Along the way the dealer tries to make a profit and keep both parties happy. But what a customer needs is not always what a dealer has to sell. The most the customer can hope for is a fair deal.

We decided to test out how different dealers would handle the same customer with the same problem. The firms we chose were picked from advertisements in the computing press and cover a broad spectrum of dealerships, from High Street stores to the more opulent showrooms of the West End. We approached them incognito, and for that reason we have not named any of them since they were not told that their responses might later be reported in *Practical Computing*.

Each dealer was asked to recommend a system to computerise a solicitor's office in which 10 people would want to use the system: three secretaries would be using their micros most of the time for word processing; a receptionist and a cashier would be doing some word processing; and five lawyers would from time to time want to use spreadsheets and access clients' files, which would be transferred on to the computer. We did not want to transfer our accounts on to computer, but we wanted the ability to link up our accounts to the setup at a later date.

I posed as someone sent out by the boss to find out what hardware and software would be needed, and how much it would cost. As well as wanting to see what the dealers would try to sell us we were interested in finding out how they would react to such a far-reaching request from an individual with no apparent experience of computing and no immediate purchasing power.

My first stop was at a small High Street store which sold a variety of micros, including IBM, Compaq, Olivetti and Amstrad machines. The salesman I spoke to spent about 10 minutes explaining what we could do. His story was that the price of the setup would be dictated by the software. He suggested buying a special package for solicitors which could cost up to £10,000, depending on how many modules of the package we might need. He pointed out that it would be cheaper if we bought more general packages and then customised them ourselves or got the dealer to do it. Training would be available at an extra cost.

For the hardware he recommended that we buy a network. He said that this would discount what he called the Amstrad solution; he claimed that Amstrads could not be used in a network. Instead he recommended IBM-compatible equipment, which would mean we could have a network that would allow us to interchange data and keep prices down by sharing printers and so on. He was non-commital about which machines to plump for, saying there was about £50 difference between the machines on offer.

The next stop was at a slightly larger dealer where, once again, a salesman recommended a network and extolled the merits of IBM. He recommended the G/Net Gateway LAN, IBM PC/ATs with an IBM PC/ATX as a file server, a Hewlett-Packard Laserjet printer and on the software side Ashton-Tate's Multimate with a Qed 2 appointment manager. The bill could come to £25,000, depending on how easy it was to install the network and whether we opted for extras like training and tape streamers.

The salesman spent around half an hour explaining exactly what a network was. He recommended a network solution on the grounds that a series of stand-alone machines would prove more expensive and would not allow us to share printers and so on. He also suggested that there were ways of sharing software like Lotus 1-2-3, although you were not really meant to and that whether you actually did so was a matter of conscience.

These two dealers were typical of the more up-market outfits I visited insofar as they tried to sell me networks. It could be that the advent of low-cost clones has forced dealers to push IBM as the ideal network solution. Nobody explained to me that you could carry a disc across to another micro and have all your printout done at once, and only two of the more up-market dealers explained that you only really need a network if everyone has to access the same files at more or less the same time. The IBM was being sold very much on the strength of its proven reliability and success, though one dealer did admit that he thought Compaqs were better because you got more bells and whistles for the same price or less.

> **The more opulent the showrooms I visited, the slicker the salesmen became and the more elaborate and expensive their solutions to my problem.**

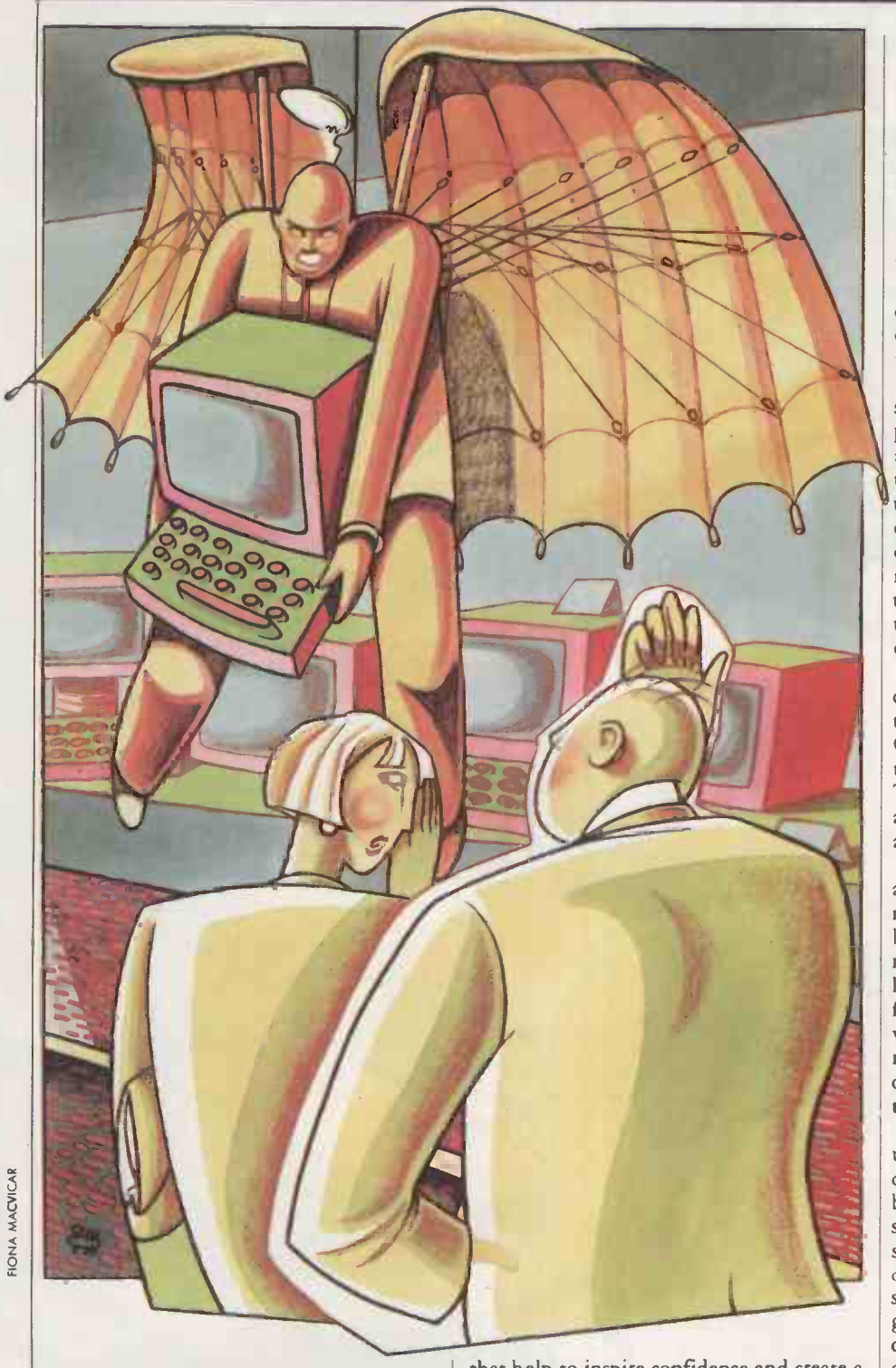
The more opulent the showrooms I visited the slicker the salesmen became and more expensive their solutions to my problem. I found that we could soon be expected to spend over £30,000, including training and maintenance. The idea of Big Blue as a professional outfit was projected well by the persuasive, besuited though slightly anonymous-looking salesmen trying to sell me its products.

The message from those selling less expensive clones was somewhat different. In the tackier surroundings of the busy stores I visited the story was much more along the line: "Why pay two to three times as much for an IBM when you could buy a cheaper and faster IBM compatible." These outlets did not sport the designer lighting and elegant fittings of the more up-market firms, nor would I be offered a seat and a cup of coffee. But neither were the price tags of the machines on offer quite so high. Of course, such dealers cannot offer the support of the large outfits.

One salesman did try to sell me an Atari 520ST complete with K-Spread spreadsheet, Trimbase database and First Word word processor. I was told the Atari's Gem operating environment would make it easier to use than an IBM PC and I would not need any training. Since the shop's business-computer section proffered only Ataris and the Commodore Amiga — which he said was good for simple word processing, graphics and sound, but not business — there was little else he could do.

In fact one salesman went so far as to suggest I try a couple of other dealers which, unlike his store, offered networking, so that I could at least consider it. He was also careful to point out that with some of the larger dealers we could end up paying out a lot of money without knowing quite what it was for. He recommended Word Perfect as a word processor but thought it also worth thinking about the Framework integrated package. As far as hardware was concerned he cited Epson and Olivetti as producing good-quality, reliable machines, and the Toshiba T-3100 as a fast and powerful portable.

One thing I was disappointed by was the salesmanship of the two Apple dealers I visited. The physical surroundings were trendy enough, but the Apple salesmen were casually dressed and even more casual in manner compared with the smart IBM types. In one shop I had to wait about five minutes for anyone to appear, which left me



FIONA MACVICAR

wondering whether they ever lost any Mac Pluses or software to the voluminous raincoats of passers-by. When I was eventually served I was told to be careful of the wire chair I was about to sit on in case it snapped on me.

In the other shop the salesman could not demonstrate the computer he was using because it had been configured to work with an Arabic keyboard and now he could not get it to recognise English, so we had to move to another machine. Neither of these points is vital, but I sensed that no IBM dealer would use dodgy chairs, and that an IBM salesperson would have a slick excuse with which to whisk me off to another machine. It is just such trivial considerations that help to inspire confidence and create a mood of professionalism. Could this explain why there are not more Macs on corporate desks?

When it came to explaining the technical merits of the Mac the salesmen also fell short of my expectations. I asked what the differences betwen IBM and Mac machines were, and why I should choose the Mac universe. I was told that the machines were based on different operating systems, that the Mac was easier to use and required no training, and that it was also a matter of preference. When I enquired why the screen was black-and-white not colour I was told that the high-resolution screen would be much more restful on the eyes for people doing a lot of word processing, and that they would not want colour because that would cause flicker. I wonder how they are going to sell the new colour Mac.

Something most of the dealers I spoke to had in common was an apparently poor regard for the Amstrad, which they dismissed as only good for word processing and best suited for home use. They all claimed to be wary of it, and all said they had heard tales of machines being returned to the distributors. One cited problems with the hard disc and others criticised the keyboard; one even held up a keyboard and bent it around to show how flimsy it was.

Most of them thought the lack of after-sales support provided by Amstrad was suspicious. One said his firm would never stock an Amstrad machine as it was destined to go the way of the Sinclair QL. It is hard to resist the thought that these objections are a case of sour grapes on the part of the dealers. The dealer's profit margin on an Amstrad will not be high, and the dealer is also going to be in the front line when it comes to handling customers' complaints and queries.

One thing that impressed me about most of the dealers was that they took the trouble to speak to me and give me some advice. Only in one of the flashiest dealers was I told that no one was available to speak to me. The assistant pressed a leaflet in my hand and said that I would have to make an appointment.

Another up-market dealer was rather abrupt when I refused to give the telephone number or address of the firm I was meant to be working for — my stock excuse was that my boss did not want salespeople ringing him. The treatment I got after this was much frostier. The salesman told me he could not work with such vague information and that my boss would have to come down himself or pay a consultancy fee of £50 an hour for the saleman to visit him.

One dealer I had chosen proved elusive until a phone call revealed that the supposed dealer was in fact a computer-equipment broker or price monger. The man I spoke to said he was unable to give advice or demonstrations but suggested I went round a few dealers, get them to demonstrate some systems, and then come back to him for a good price on the setup which I eventually chose. He also cited the Amstrad as being good value for money.

However questionable the morality of the broker's advice may be, it certainly does pay to shop around. What sort of dealer you choose will depend as much on the size of your bank balance as on what you need. Up-market dealers may offer more in the way of backup services that will give you peace of mind, but they may also be better equipped to convince you that you need it.

It is worth remembering that dealers are out to sell you what is in their showrooms — people do not go to a Volvo dealer and come out with a BL car. But comparing what different dealers have to say is a good way of helping to make up your mind. It will cost you nothing as long as you remember to leave your cheque book at home. PC

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While good ideas count, marketing clout is worth more. **Steve Malone** reports on how companies are joining forces to improve their position.

HANGING TOGETHER

Although it might be difficult to believe at times, manufacturers in the data-processing industry are willing to form alliances with other companies to each other's mutual benefit. The reasons why they do this are manifold, yet in the alliances which have been formed over the past few years some patterns have emerged.

The companies involved are hardly ever in direct competition with each other. For example, it would be hard to imagine IBM and DEC forming an alliance. Rather, these agreements usually involve two or three different companies with their own specialities joining together where their interests overlap. Deals are sometimes struck as companies close ranks in the face of fierce competition.

One of the earliest and most successful combinations was formed in 1983 between the U.S. communications giant AT&T and European office-equipment manufacturer Olivetti. Both companies were in pretty poor shape in terms of success in the micro market. The IBM PC was sweeping the board, and non-compatible micros such as the Olivetti M-20 and AT&T's 7300 were being trampled in the rush.

In Europe, Olivetti was among the first to bow to the inevitable and introduce a compatible micro, in the form of the M-24. Yet for the machine to be a success, Olivetti also needed a bridgehead into the U.S. market. AT&T, on the other hand, badly needed an IBM-compatible micro to offer along with its established minicomputers and data-communication services. As a result of the Olivetti linkup AT&T is selling the M-24 as the 6300 series.

Bob Garrett, Marketing Manager of Olivetti U.K., takes up the story. "The agreement was signed in December 1983 and came into effect in January 1984. The agreement covered not just products; there were also financial arrangements and collaboration in the development of micros, minis and systems. The M-28 came about by combined developments and so did Starlan."

The results of the collaboration have been impressive. Garrett went on: "The 1985 figures show that just under 200,000 Olivetti machines have been sold in the U.S. under the AT&T name, while the figures are just over 200,000 under the Olivetti name for the rest of the world.

"The development of PC products require greater and greater resources, so it is preferable if costs are shared. We also have access to Bell Laboratories, which is important for theoretical research — for chips and so on."

Although the tactical decisions to form such linkups may vary, the strategic purpose behind the deals can be summed up in three letters: I B M. Compared with IBM, almost every other company is a minnow. With the cost of new launches rising all the time, many businesses feel they have to get bigger to compete with IBM's multi-billion dollar research budget.

The most striking recent example of this thinking led to the formation of Unisys from the union of Burroughs and Sperry. The new company is now reckoned to be the second biggest computer company in the world — much to the chagrin of DEC.

Lotus Development is another company which has made a series of arrangements with other organisations. One of the best known has resulted in a memory-expansion technique to allow additional data storage within a Lotus spreadsheet. This became known as the Lotus/Intel/Microsoft Expanded Memory Specification (LIM EMS).

Lotus spokesman Phil Peters told us: "We were looking to introduce a new version of Lotus 1-2-3, which the world now knows as version 2. We wanted the new version to contain a bigger matrix, and rather than develop our own we decided to co-operate with the chip manufacturer and the operating-system vendor to make the specification. We seem to have made the right decision. The LIM specification is now the best known of all the expanded-memory formats."

It is in the U.S. where the majority of such alliances are made. Over the past year or so there has been a distinct move towards computer companies forming loose alliances with communications businesses. A pointer to the way things are going can be seen in the development of the U.S. market. People thinking about upgrading their computers do not just look at the software base; they also look at what is available in the way of public databases and communications.

We do on-going reviews and talk to lots of different companies about lots of different things. What becomes fruitful is only the tip of the iceberg.

Lotus in its guise of a service company, has recently concluded a deal with U.S. electronic-mail carrier MCI-Mail. The two companies signed an agreement to work together on a product called Lotus Express. The idea is that Lotus users can log into their MCI mailboxes, download information and log out again. All this goes on in the background so that the user can be carrying on with something else.

While manufacturers are conscious of what the market wants, there are even bigger stakes to play for. It has been recognised for some time that developments have led to the convergence of data and communications technologies. The ISDN systems appearing would seem to confirm this.

Apple made a statement of intent last September when it announced a joint venture with Northern Telecom, one of America's largest digital-communications corporations. The agreement provides for the support and development of products which will allow Apple's Macintoshes to run on Northern Telecom's private branch exchange (PBX) systems. The Northern Telecom PBXs work with the Mac to support local area networking and email.

This move provides Apple with an opening into the American corporate market. Perhaps more importantly, it allows the Mac to communicate with machines from a number of other manufacturers, in-including IBM and DEC. Mary Ainsworth of Apple told us: "This is the only deal of this kind, but we do on-going reviews and talk to lots of different companies about lots of different things. What gets underway and becomes fruitful is only the tip of the iceberg."

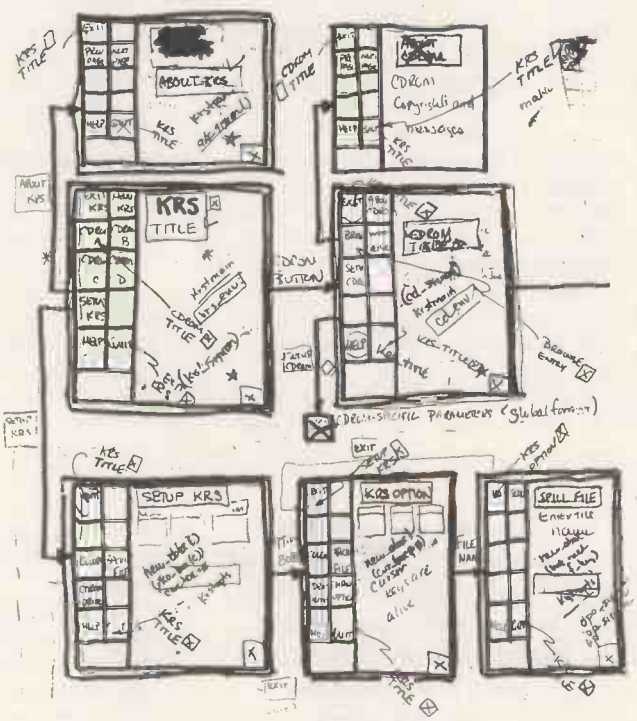
While IBM has, at least temporarily, lost its command of the corporate micro sector, there is a window of opportunity for other manufacturers. But in order to have any impact even the largest companies will need to join forces. Alliances will be a feature of the industry for many years to come. PC

PROGRAMMERS AT WORK

Microsoft has just brought out a book called Programmers at Work *in which Susan Lammers interviews 19 leading programmers — people responsible for such programs as Lotus 1-2-3, dBase and the Postscript PDL.*

We have arranged to publish some extracts from the book, which is nearly 400 pages long and a fascinating read. The interviewees talk about program design, the companies they have worked for or set up, and developments in the software industry generally.

Here we concentrate on the act of programming itself — how the guys actually write the code. We have edited some of the replies to fit the more compressed format of a magazine.



Gary Kildall's sketch of the menu tree design of the Knowledge Retrieval System.

GARY KILDALL

ONE OF the best-known personalities in the personal-computer industry, Kildall developed the CP/M operating system and founded Digital Research. He was the main programmer/designer of DR Logo, and recently he has been working on software connected with CD-ROM.

On working method: I follow very definite procedures which work for me, though they may not work for other people. I start with drawing the data structures, and I spend a lot of time thinking about them. I also think about what the program has to go through before I start writing code.

Once the data structures are developed, I start writing small chunks of code that I improve and monitor along the way. Checking them as I go assures me that the changes I make are localised; and if I have problems, I discover them immediately. This whole process of iterative improvement requires speed, so for me at least, it's very important to have fast edit, execute, and debug cycles. This method doesn't work as well on a mainframe or a card-batch system because you can't make small changes and check them out.

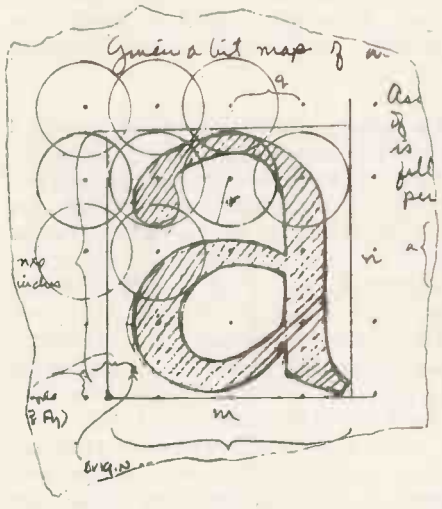
I rarely use comments, except at the beginning of procedures, and then I only comment on the data structure. I don't comment on the code itself because I feel that properly written code is very much self-documented. Once I get the algorithms down, I start writing code directly on the machine. I don't even write it on a piece of paper before it goes into the computer; it just doesn't seem necessary.

The actual coding process has always been a little scary for me because I don't know if I'm writing the right code, nor do I know what I'll write next. It just seems to come out. Sometimes I realise the code's not exactly right, but I also realise intuitively that it will relate to something else — it will factor out and become right even if I don't know exactly how at the time I'm writing it. The magical part is that, at some point, all at once the whole thing comes together.

On working routine: My pace varies during the development of the program. At some points, the code gets explosive and I have everything inside my brain at one time; all the variable names and how they relate to one another; where the pointers start and where they end, disc access, et cetera. All sorts of things go on in my brain that I can't put on paper simply because I'm always changing them. I'd spend more time writing than I would coding, and I'd never get the project done in a reasonable amount of time.

When the data structures are so new, they require intense concentration to keep them organised in your head. So at this point in the process, I'll usually start at 3a.m. and work until maybe 6p.m. Then I'll have dinner, go to bed early, get up again pretty early in the morning, and keep banging on until things are calmer.

During the calm times, when my pace is more relaxed, I come up with solutions for the next phase. When I'm trying to solve a problem that has a series of steps, I take them in order; one at a time — step A, step B, then step C. I've tried, but I just can't work on C until B has been completed.



Extract from John Warnock's notebook on Postscript characters.

JOHN WARNOCK

TOGETHER with Chuck Geshchke, John Warnock developed Postscript, the page-description language used in the Apple Laserwriter and other powerful output devices. Postscript is at the heart of the desktop publishing boom. Before that Warnock was at Xerox Parc, like many of the people Susan Lammers interviewed.

On working method: I think a lot before I do anything, and once I do something I'm not afraid to throw it away. It's very important that a programmer be able to look at a piece of code like a bad chapter of a book and scrap it without looking back. Never get too enamoured with one idea, never hang on to anything tenaciously without being able to throw it away when necessary; that should be the programmer's attitude.

I don't know if there's a single set of things. Don't bind early; don't ever make decisions earlier than you have to. Stay an order of magnitude more general than you think you need, because you will end up needing it in the long term. Get something working very quickly and then be able to throw it away.

Learn from small experiments rather than large ones. Don't go into a two-year development with nothing coming out in the middle. Have something come out every two months, so you can evaluate, regroup, and restart.

Also, never make an assumption that you know something somebody else doesn't know. There will always be some smart guy who will come along and figure out a better algorithm, or figure out an easier way of performing some task. One of the tricks of the trade is to recognise this early, adopt it quickly, and exploit it without having a "not-invented-here" hangup about doing it your way.

I once heard that any programs you write reflect the organisation in which you work. Adobe was started as a very small company with about a half dozen people. The code was written by a half dozen people and the structure shows it. Certain parts belong to person X and certain parts belong to person Y, and they all have their own character and their own interfaces.

On the other hand, IBM is a huge organisation and their code is convoluted, with self feedbacks and different strategies that reflect separate divisions of the company. A fairly standard rule is that if you want to keep something simple, then the organisation that develops it has to be simple.

CHARLES SIMONYI

CHARLES SIMONYI is the man responsible for Multiplan, and the main programmer/designer on Microsoft Word and Excel. Before joining Microsoft Simonyi worked at Xerox Parc, where he developed an innovative text editor called Bravo. Simonyi is by origin a Hungarian.

On working method: The first step in programming is imagining. Just making it crystal clear in my mind what is going to happen. In this initial stage I use paper and pencil. I just doodle, I don't write code. I might draw a few boxes or a few arrows, but it's just mostly doodles, because the real picture is in my mind. I like to imagine the structures that are being maintained, the structures that represent the reality I want to code.

Once I have the structure fairly firm and clear in my mind, then I write the code. I sit down at my terminal — or with a piece of paper in the old days — and write it. It's fairly easy. I just write the different transformations and I know what the results should be. The code for the most part writes itself, but it's the data structures I maintain that are the key. They come first and I keep them in my mind throughout the entire process.

The knowledge of the best algorithms is the science, and the imagining of the structure is the art.

On readability: All the code that I have written since about 1972 has been written with certain naming conventions that are popularly called "Hungarian". You can immediately recognise all the code that has been written under my influence, including Microsoft Word and Multiplan, Bravo, and many others written with those conventions.

It's called "Hungarian" as a joke. The joke is that the program looks so unreadable, it might as well be written in Hungarian. But it's a set of conventions that controls the naming of all quantities in the program.

If you were to break up a program, put it into a grinder, and then sort the pieces, you would find that the bulk of the program is in names. If you just write, "apples + oranges", the name "apples" is six characters, the operation " + " is one character, the name "oranges" is seven characters, for a total of 14 characters. Only one character, the plus sign, had to do with the operation. So to me it seemed logical that to make an impact or improve things, I would try to improve the greatest bulk — and that was the names. "Hungarian" is a way of almost automatically creating a name from the properties of the named quantity. So if you have a structure with certain properties, instead of giving it some arbitrary name and then having everybody learn the association between the name and the properties, you use the properties themselves as the name.

On clean listings: I think the listing gives the same sort of pleasure that you get from a clean home. You can just tell with a glance if things are messy — if garbage and unwashed dishes are lying about — or if things are really clean. It may not mean much. Just because a house is clean, it might still be a den of iniquity! But it is an important first impression and it does say something about the program. I'll bet you that from 10 feet away I can tell if a program is bad. I might not guarantee that it is good, but if it looks bad from 10 feet, I can guarantee you that it wasn't written with care. And if it wasn't written with care, it's probably not beautiful in the logical sense.

But suppose it looks good. You then pick deeper. To understand the structure of a

(continued on next page)

```
Oct  8 11:59 1985  example1 Page 1


        vfli.dypAfter = 0;
        if (vfli.cpMac == caPara.cpLim)
                {
                int dyp = vpapFetch.dyaAfter / dyaPoint;
                vfli.dypLine += dyp;
                vfli.dypBase += dyp;
                vfli.dypAfter = dyp;
                }
/* First, need to scan thru grpchr, till we find a chr whose ich is >= ichMac
(this can happen because we add a chr and then decide to do the line break
before the character indexed by chr.ich) or until we reach &(**vhgrpchr)[vbchrMac]
*/
        for (pchr = pchrBeg = &(**vhgrpchr)[0],
                (char *) pchrMac = (char *) pchr + vbchrMac;
                pchr < pchrMac;
                (char *) pchr += pchr->chrm)
                if (pchr->ich >= vfli.ichMac)
                        break;
/* Now, enter chrmEnd in grpchr. Note: no need to check for sufficient space*/
        vbchrMac = (char *) pchr - (char *) pchrBeg;
        pchr->chrm = chrmEnd;
        pchr->ich = vfli.ichMac;

        Scribble(5,' ');
        CkFli();
        return;
}
```

"Hungarian" code written by Charles Simonyi for Microsoft Word.

(continued from previous page)
program is much, much harder: some people have different opinions about what makes the structure beautiful. There are purists who think only structured programming with certain very simple constructions, used in a very strict mathematical fashion, is beautiful. That was a very reasonable reaction to the situation before the sixties, when programmers were unaware of the notion of structuring.

JOHN PAGE

PAGE is the only one of Susan Lammers' interviewees who is British, although he is now based in the U.S. Page wrote PFS File and was one of the founders of Software Publishing Corporation.

On working method: I sit down and work out what I want the program to do. Then I mentally map out the components. I tend to zoom in first on the pieces where I think I've got problems and try to understand them. This looks hard, that looks hard and these other pieces are just normal files and old hash tables. Once I've dealt with the hard parts in isolation — maybe by writing a little program just to prove out some theory — I have a level of confidence about the whole program. I have pieces that are either a piece of cake or very difficult, but I know how I'm going to handle them all. Then I can go about structuring the program before I start implementing it.

I have to believe that what I want to do is achievable, otherwise I can be very distracted. I've seen some immature programmers who are so frightened about reaching the end goal, they just zoom in on some piece of the program and just start writing. They back into the program from a relatively minor position.

Once I've sketched the structure, I work on each piece in turn and define the interfaces between them. I don't like to have a nagging feeling that I'm designing something but don't know if a crucial component can be built. It gives me the willies, stops me from having the confidence level to proceed vigorously on the project.

When I went back to programming [after a period in management at Hewlett-Packard] I was forced to rely purely on myself. That was a shocker. It was kind of frightening — I wondered if I could still write programs. But it's like riding a bike — you don't ever forget; you just pedal off into the sunset.

On working routine: You have to say to all your relatives, "Look, I'm going to be gone from six to nine months. I'll be here physically, but I might as well not be. I'm going to be working on this thing and I'll be absent-minded. I want you to understand and tolerate that and I promise to make it up to you when I get to the other end." If you have loved ones it's important to come through on that promise. Working so hard can be devastating to your marriage and to other relationships.

On concentration: You constantly try to hold the state of the entire system you're working on in your head. If you lose the mental image, it takes a long time to get back into that state. It's like being an air-traffic controller who has nine planes in his mind and knows exactly where they're all going. Distract him by asking him when his shift is over and he loses those planes. In programming, a big complicated model is very efficient once you're in the groove. If you get out of it, you've got to work on it quite a while to get back in.

C WAYNE RATLIFF

RATLIFF wrote dBase II, which was originally called Vulcan. At first Ratliff sold the program by mail order on his own, but he later came to a marketing agreement with George Tate and joined Ashton-Tate. Ratliff was the main programmer/designer on dBase III.

On working method: I do a lot of changing. I like to make an analogy between writing code and sculpting a clay figure. You start with a lump of clay and then you scrape away, add more clay, then scrape away again. And every now and then you decide that a leg doesn't look right, so you tear it off and put a new one on. There's a lot of interaction.

The ideal module should be a page long. If it grows beyond a page, I have to decide, now what is it I'm doing here? How many separate things am I working on? Should they be broken down into separate modules? Part of the elegance, and the balance, is that at a certain level, in this layer-cake hierarchy of a program, all the modules should be about the same weight, same size, same duty, and same functionality.

When you have a good balance the program becomes maintainable. It's as though you've discovered some basic physical underlying principle and implemented it. When things get really out of balance, you know something is wrong. There's probably some inherent fault that makes it out of balance. Generally, when I get this feeling that something's out of whack when one module is just too big, I think about what I'm doing, and I reorient or rejuggle the pieces.

On the appeal of programming: A program is a lot of fun at the very beginning, when you first have ideas about what it can do. Those ideas grow very rapidly. You have some little spark, and then you keep tacking other capabilities on to it. When that euphoria fades and you have to start coding, it gets tough.

The moment of programming I enjoy the very most is when I get something almost complete. I try it for the first time, it fails miserably, and it continues to fail until about the 100th time, when it does pretty good. There's a peak experience there, because then I know I've got it. I just have to apply a little more elbow grease to weed out the rest of the bugs.

JONATHAN SACHS

SACHS is the man who wrote Lotus 1-2-3. Together with Mitch Kapor, who was more on the marketing side, he set up Lotus, now the biggest micro software house — by a hair's breadth ahead of Microsoft. In 1984 he left Lotus to develop software independently. Manuscript, which we review next month, is his first major product under the new setup.

On working method: First, I start out with a basic framework, which I keep adding to. Also, I try not to use many fancy features in a language or a program. For example, the text editor I use is a derivative of one I wrote at MIT 15 years ago. It has only a few simple commands, but it has everything that I need. It's written in C now, so I take it with me on every new machine. I don't like using any tools or programs I didn't write myself or that I don't have some control over. That way if I don't like some part, I can change it.

Some people are very good at optimising every instruction. They can make one little piece of code extremely tight. At the other end, some people think only about the algorithm and the actual implementation. I'm somewhere in the middle. I'm not that good at writing extremely tight code. I've found over the years that if you write that way, every time you have to make a change, you have to unravel the whole program and write it over again. But if you back off just a bit, and code very tightly only in a few spots where it's important, it's a lot easier to maintain the program once you've finished it.

The methodology we used to develop 1-2-3 had a lot to do with the success of the product. For instance, 1-2-3 began with a working program, and it continued to be a working program throughout its development. I worked largely in isolation at the time. I had an office in Hopkinton, where I lived at the time, and I came to the office about once a week and brought in a new version. I fixed any bugs immediately in the next version.

This was the exact opposite of the standard method for developing a big program, where you spend a lot of time and work up a functional spec, do a modular decomposition, give each piece to a bunch of people, and integrate the pieces when they're all done. The problem with that method is you don't get a working program until the very end. If you know exactly what you want to do, that method is fine. But when you're doing something new, all kinds of problems crop up that you just don't anticipate. In any case, our method meant that once we had reached a certain point in the development, we could ship if we wanted to. The program may not have had all the features, but we knew it would work.

These extracts have been taken from Programmers at Work *by Susan Lammers, published by Microsoft Press, ISBN 0 914845 71 3. It is distributed in the U.K. by Penguin Books, price £12.95.* PC

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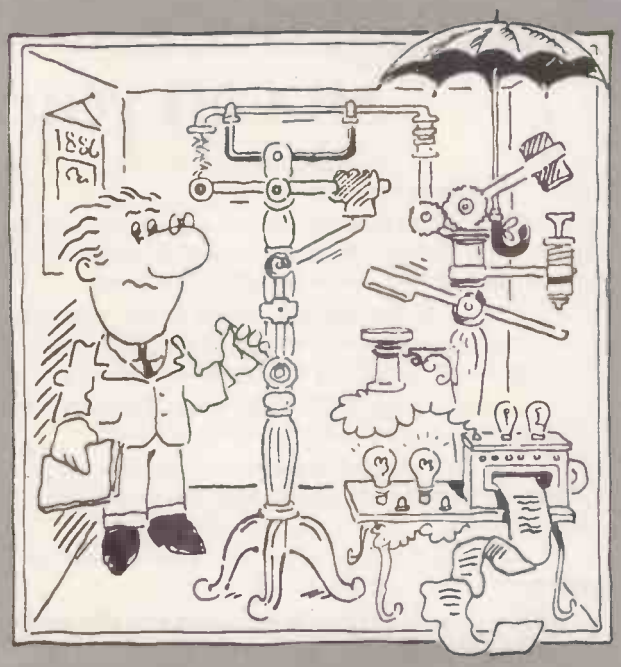

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TECHNOLOGY SO ADVANCED ...

MEMORY
* 512Kbytes RAM (520ST-M, FM)
* 1024Kbytes RAM (1040ST-F)
* 192Kbytes ROM
* 128Kbytes external plug-in ROM option

ARCHITECTURE
* Motorola 68000 Central Processing Unit (CPU) with a clock speed of 8MHz
* 16-bit external data bus
* 32-bit internal data bus
* 24-bit address bus
* 8×32-bit data & address registers
* 7 levels of interrupts
* 56 instructions
* 14 addressing modes
* 5 data types
* DMA (Direct Memory Access)
* real time clock as standard

GRAPHICS
* full bit-mapped display
* palette of 512 colours

Using Atari Monitors (on 520 & 1040):
* 640×400 high resolution - monochrome
* 640×200 medium resolution - 4 colours
* 320×200 low resolution - 16 colours
* 80 column text display (40 col low res)

Using Domestic TV (on 520):
* 640×200 medium resolution - 4 colours
* 320×200 low resolution - 16 colours
* 40 columns × 25 line text display

SOUND AND MUSIC
* 3 programmable sound channels
* frequency programmable 30Hz - 125KHz
* programmable volume
* wave & dynamic envelope shaping
* programmable attack, decay, sustain, release
* Musical Instrument Digital Interface (MIDI)
* MIDI allows connection of synthesisers etc.

MOUSE
* high precision
* 2 button control
* free with 520ST-FM/1040ST-F
* non slip ball motion sensor
* removable ball for easy cleaning

STANDARD SOFTWARE
* GEM desktop + TOS operating system
* ST BASIC interpreter/language system

INPUT/OUTPUT
* MIDI out ..... (5 pin DIN) 31.25K baud
* MIDI in ..... (5 pin DIN) 31.25K baud
* audio out .. 1.0V DC peak to peak, 10K ohm
* audio in ..... 1.0V DC peak to peak, 10K ohm
* RGB monitor ..... 1.0V DC, 75 ohm
* mono monitor ..... 1.0V DC, 75 ohm
* mono horizontal scan rate 35.7KHz
* mono vertical scan rate 71.2KHz
* sync ..... 5V DC (active low) 3.3K ohm
* modem/serial ..... RS232C, 50 to 19,200 baud
* floppy disk ..... 250 Kbits/s
* hard disk ..... 11.3 Mbits/s
* mouse ..... standard Atari connector
* joystick ..... standard Atari connector
* cartridge port ..... 128K capacity
* RF output (520ST-FM) ..... for TV use

OPERATING SYSTEM
* TOS with GEM environment in ROM
* hierarchical file structure with sub-directories and path names
* user interface via GEM, with self explanatory command functions
* multiple windows + icons
* window resizing, re-positioning and erasing
* drop down menus (selected by mouse)
* GEM virtual device interface

COMMUNICATIONS
* RS-232C serial modem port
* 8-bit parallel printer port
* MIDI port (also for networking use)
* VT52 terminal emulation

KEYBOARD
* standard QWERTY typewriter format
* 95 full stroke keys
* 10 function keys
* 18 key numeric keypad + cursor keys
* variable auto-repeat & key click response
* keyboard processor reduces CPU overhead

... IT'S AFFORDABLE

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At Silica Shop, we have a dedicated service department of five full time Atari trained technical staff. This team is totally dedicated to servicing Atari computer products. Their accumulated knowledge, skill and experience makes them second to none in their field. You can be sure that any work carried out by them is of the highest standard. A standard of servicing which we believe you will find **ONLY FROM SILICA**. In addition to providing full servicing facilities for Atari ST computers (both in and out of warranty), our team is also able to offer memory and modulator upgrades to ST computers.

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TV MODULATOR UPGRADE: Silica can upgrade the 1040ST-F to include a TV modulator so that you can then use it with your TV set. This is an internal upgrade and does not involve any untidy external boxes. A cable to connect your ST to any domestic TV is included in the price of the upgrade which is only £49 (inc VAT). The upgrade is also available for early 520ST computers at the same price.

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520ST-M

The affordability of Atari computers is reflected in the price of the 520ST-M keyboard, which is a mere £259 (inc VAT). This version of the ST comes with 512K RAM, as well as a modulator and lead for direct connection to any domestic TV. The price does not include a mouse. In addition, when you buy your 520ST-M from Silica, you will also receive the FREE Silica 'ST Starter Kit'. During 1987, many software houses will be producing games software on ROM cartridges, which will plug directly into the cartridge slot on the 520ST-M keyboard, giving instant loading without the expense of purchasing a disk drive. With the enormous power of the ST, you can expect some excellent titles to be produced, making this the ultimate games machine! If your requirement is for a terminal, then the 520ST-M can fulfill this role too. Leads are available to connect the ST to a variety of monitors, and with the imminent introduction of terminal software on ROM cartridge, the ST provides a low price terminal for business use. If you wish to take advantage of the massive range of disk software available for the ST range, you will need to purchase a disk drive. Atari have two floppy disk drives available, a ½ Mbyte model £149 and a 1Mbyte model £199. Full details of these drives, as well as the Atari 20Mbyte hard disk are available on request. If required at a later date, the mouse may be purchased separately.

£259

520ST-FM

The 520ST-FM with 512K RAM and free mouse, represents a further breakthrough by Atari Corporation in the world of high power, low cost personal computing. This model is the latest addition to the ST family, and is not only powerful, but compact. It is priced at only £399 (inc VAT) a level which brings it within the reach of a whole new generation of computer enthusiasts. When purchased from us, it comes with the FREE Silica 'ST Starter Kit' see paragraph on the left. To make the 520ST-FM ready for use straight away, Atari have built into the keyboard a ½ megabyte disk drive for information storage and retrieval, allowing you easy access to the massive range of disk based software which is available for the ST. This new computer comes with all the correct cables and connections you will need to plug it straight into any standard domestic television set. You do not therefore have to purchase an Atari monitor. If you do require a monitor however, these are available with the 520ST in the following money saving packages:

520ST-FM Keyboard Without Monitor - £399 (inc VAT)
520ST-FM Keyboard + High res mono monitor - £499 (inc VAT)
520ST-FM Keyboard + Low res colour monitor - £599 (inc VAT)
520ST-FM Keyboard + Med res colour monitor - £699 (inc VAT)

Because the 520ST-FM has its own power transformer built into the keyboard, there are no messy external adaptors to clutter up your desk space. You are left with only one mains lead, serving both the disk drive and the computer. You couldn't ask for a more stylish and compact unit.

£399

1040ST-F

For the businessman and the more serious home user, Atari have their most powerful model, the 1040ST-F with 1028K RAM. This low cost powerhouse can be introduced into a business environment as a stand-alone system, or can support a mainframe computer as a terminal. The 1040ST-F not only features twice as much memory as the 520ST-FM, but also includes a more powerful built-in disk drive. The drive featured on the 1040ST-F is a one megabyte double sided model. The extra memory facility of the 1040ST-F makes it ideal for applications such as large databases or spreadsheets. Like the 520ST-FM, the 1040ST-F has a mains transformer built into the console to give a compact and stylish unit with only one mains lead. The 1040ST-F is also supplied from Silica Shop with a free software package and 'ST STARTER KIT'. In the USA, the 1040ST-F has been sold with a TV modulator like the 520ST-FM. However, for the UK market, Atari are manufacturing the 1040ST-F solely with business use in mind and it does not currently include an RF modulator, this means that you cannot use it with a domestic TV (Silica Shop do offer a modulator upgrade for only £49). The 1040ST-F keyboard costs only £599 (inc VAT) and, unless a modulator upgrade is fitted, will require an Atari or third party monitor. There are three Atari monitors available and the prices for the 1040 with these monitors are as follows:

1040ST-F Keyboard Without Monitor - £599 (inc VAT)
1040ST-F Keyboard + High res mono monitor - £699 (inc VAT)
1040ST-F Keyboard + Low res col monitor - £799 (inc VAT)
1040ST-F Keyboard + Med res col monitor - £899 (inc VAT)

The 1040ST-F comes with a mouse controller and includes 1Mbyte of RAM. It has a 1Mbyte double sided disk drive and mains transformer, both built into the keyboard to give a compact and stylish unit, with only one mains lead.

£599

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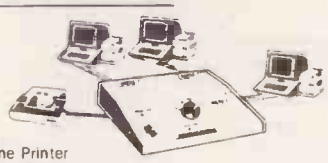

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THE NETWORK EFFECT

NETWORKING SYSTEMS HAVE HITHERTO BEEN A FREE-FOR-ALL OF INCOMPATIBLE COMPETING PRODUCTS, BUT STANDARDS ARE NOW BEGINNING TO EMERGE. **STEVE MALONE** EXPLAINS WHAT THEY ARE AND HOW THEY WORK.

Sales of networks are booming. Large corporations are connecting their PCs together at a great rate, making this one of the major growth areas in information-technology investment. Much of the current interest in networking is undoubtedly due to the City's Big Bang last year. Businesses needed to be able to connect with the Stock Exchange databases and were prepared to spend money on the terminals and cabling required.

Investment in this kind of technology has been a decisive step in the development of networking systems. Not so long ago, the prime reason given for office networking was resource sharing, but this is no longer the case. Now the prime consideration when buying a network is for fast and efficient communication between employees and information sources outside the company.

The explosion in the popularity of LANs is also a result of the gradual, albeit piecemeal, emergence of a credible standard. This has allowed software houses to develop programs to a single network configuration, rather than having to write drivers for a dozen different networks. Meanwhile, purchasers have developed sufficient confidence in the nascent standards to invest in the technology.

The principle behind current standardisation movements is the Open Systems Interconnection (OSI) model. It has been adopted by the majority of national standards governing bodies, and is backed by the International Standards Organisation (ISO). Countries throughout Western Europe, as well as the U.S. and Japan, have all adopted the OSI model as the basis for network communications. While a complete implementation of the OSI model is some way off, it is the eventual goal worldwide.

The second major advance towards a networking standard occurred in 1984 when IBM and Microsoft unveiled the first components of their joint strategy. The two legs on which IBM PC networks are constructed were MS-DOS 3.0 and the Net BIOS hardware interface.

DOS 3.0 was the first version of the operating system to contain networking primitives, and as it was released IBM announced the PC-Network Program — a proprietary version of MS-Net — which contained Net BIOS. IBM has declared Net BIOS to be the basis around which all future PC networking systems will be developed. It is fitting Net BIOS in ROM within the PC-Network, and has subsequently adopted Net BIOS emulation for its Token Ring network.

The emergence of these standards has not come a moment too soon. Corporations with an eye to the future are having their new office blocks built with network cabling and access points built-in. The systems are there and increasingly the user base is there. All that is required is for the software houses to come up with the applications.

THE SEVEN-LAYER MODEL

The OSI model does not attempt to define what the components of a network should be. It simply sets out the way the various parts of the network should fit together. It divides a network into seven layers. The top-most layer — the one the end-user sees — is layer 7, called the Application layer. It is connected in turn to the Presentation layer, the Session layer, the Transport layer, the Network layer, the Data Link layer, and finally, at the deepest level to layer 1, the Physical layer.

The OSI model defines a standard interface between each layer and the layers above and below it. The model does not much care what goes on within the layer as long as it presents the right face to its neighbours. This allows software and hardware manufacturers to develop competing products within a layer. Customers can choose which of the products on offer is most suitable for them and can mix and match them accordingly, with implementations of the different layers coming from different suppliers.

Level 7. The Application layer. This is the top-most layer of the model and is the one with which the user interacts. It contains the application software and operating-system shell. It also provides some common services such as file transer and terminal support.

Level 6. The Presentation layer. This is the interface between the application and the network. It provides any data conversion that may be necessary from a local application into a form which is suitable for transmission through the network.

Level 5. The Session layer. This level handles the reception and transmission from a local station on to the network itself, and controls the synchronisation of traffic on the network. It will monitor for collisions on the network and deals with recovery from any collisions that occur.

Level 4. The Transport layer. This layer is concerned with addressing the nodes on the network. It also checks data integrity and the protocols required to transmit information over the network.

Level 3. The Network layer. This layer provides the interface which enables different networks to communicate with each other. It manages switching and routeing between different networks to provide gateway functions.

Level 2. The Data Link layer. This is the hardware/software interface which also maintains the transfer and control of the data over the communication lines and provides error correction. Attributes such as whether the system will be of the token-passing or collision-detection format are defined here.

Level 1. The Physical layer. The deepest layer is the network hardware itself.

The concept of the OSI model has been accepted for almost a decade, but until recently it has been more honoured in the breach than the observance. Part of the trouble has been that OSI standards so far adopted have been market-led. The only hard-and-fast standardisation has been for layers 1 and 2. Here the standards committees have simply adopted existing products as the standards.

With no such standardisation at the higher layers, the OSI model is still in some disorder. Much of the trouble occurs in layers 3, 4 and 5 where different manufacturers have made their own interpretation of the model and have supplied non-compatible systems. This situation is changing, with the emergence of the IBM Net BIOS as a de facto standard for the middle layers.

Life is not made any easier by the fact that some functions are not restricted to a particular layer but can be achieved by several layers. An example here is in network-to-network communication. Although it is strictly the preserve of layer 3, the Network layer, this only really applies if the networks use dissimilar software as, for example, in communications between MS-Net and Ethernet. If the two communicating networks are identical the Data Link layer (layer 2) can be used, as no conversions or high-level data checking needs to be performed. Data can be transmitted across the network by the Data Link repeating the message until it is accepted by the server. On the other hand, if the two networks use different hardware some kind of protocol conversion is required, and this is performed by layer 4.

The Reference Model for OSI is published as ISO 7498. It is available in the U.K. as BS 6568 from The British Standards Institution, Sales Department, Lindford Wood, Milton Keynes. Telephone: (0908) 320066.

THE OSI MODEL

LAYER	FUNCTION
7: APPLICATION	COMMUNICATIONS SERVICES
6: PRESENTATION	APPLICATION-TO-NETWORK INTERFACE
5: SESSION	MESSAGE DELIVERY AND RECEPTION
4: TRANSPORT	NETWORK ADDRESSING
3: NETWORK	INTER-NETWORK CONNECTIONS
2: DATA LINK	HARDWARE INTERFACE
1: PHYSICAL	HARDWARE SPECIFICATIONS

FILE SERVERS

When introduced, networks were principally used as a method of sharing disc resources. The quick and dirty method of doing this was to convince the computer that any hard disc it had access to was local rather than a shared resource. The trouble with this method, known as the disc-server environment, becomes apparent when you have a number of users on the network. Each user can access the hard disc directly and at any time. Because the network ends up as a free-for-all, data integrity and multi-user file management are very difficult to maintain.

The file-server concept was introduced to sort out this problem, and has been an important factor in the development of networks. With a file-server system, a management program is placed between the work stations and the shared hard disc. The file-server software can regulate the traffic and manage the files to

provide an efficient service both to the users and the hard disc.

Networks are full of potential bottlenecks. To take one example: in order to send information from a PC work station to a file server, the local PC has to construct a packet of information in a form in which it can be transmitted and understood by the file server. The time this takes depends on the speed and type of the processor used by the work station itself. It is also dependent on the efficiency of the operating system in creating the information it sends to the network. Other factors are the width of the network interface bus and the speed of transfer to the NIC.

The NIC provides the physical link between the PC and the network cabling. A wide variety of types of card are available, each with its own characteristic cable support, cable-access type, etc. Features that can improve performance include the provision of an on-board processor to handle the I/O, a wider bus to increase the transfer bandwidth to the PC, and shared memory access. Under this last system the NIC and the PC set aside an area of memory accessible to both, which has the effect of avoiding the delays which occur when transferring data from NIC buffers to main memory and vice versa.

Another obvious improvement to an NIC is to provide a large on-board buffer. Commonly 512K is provided and there are also 1Mbyte and 2Mbyte systems available.

Another of the bottlenecks is in cable access. While maintaining MS-DOS and Net BIOS as standard, IBM is currently offering two solutions which represent very different philosophies in dealing with the problem. They are enshrined in the PC-LAN program and Token Ring.

PC-LAN is a contention cable-access scheme, often referred to as a carrier sense multiple access with collision detection (CSMA/CD) system. It works by monitoring the network for activity, and transmitting its message if the NIC detects no traffic. If another message happens to have been transmitted at exactly the same moment the two data streams will collide and destroy each other. The collision is detected by the work stations, which will instantly cease transmission. Each NIC will then listen to the network and wait for a cessation of traffic before trying again. Most networks build algorithms into each work station to delay transmissions by varying amounts so that two stations which have already collided will not attempt to re-transmit simultaneously.

Under PC-LAN, once the server NIC has received the information it sends an acknowledgement to the transmitting work station. If the station receives no acknowledgement it transmits the information again. Because they have no central organisation CSMA/CD sysems are unsuitable for big networks. The number of collisions and subsequent retransmissions on the net increases with the number of stations, so the system very soon becomes overloaded.

In the Token Ring system a packet is passed from station to station. If a station wishes to transmit information, it changes a bit on the token to give it control of the network. The station is then able to transmit the data along the cable. The amount of data that can be transmitted in a single token round is limited to prevent stations with large amounts of data to transmit from hogging the system. Token Ring is discussed further on page 88 of this issue.

When it comes to the practical installation of a network, much is dependent on the Physical layer. Cabling can make up half the cost of installing a network, so it is important to get it right. When deciding to install a network, the customer must consider how long the cables are going to need to be, how many users will be involved and how heavy the traffic will be. It is also important to consider the extent to which the network is expected to expand in the lifetime of the system. For example, twisted-pair cabling is cheap, but can only support a limited amount of traffic. If major expansion is envisaged for the network it is worth buying a more expensive layout with temporary slack in the system, rather than having to pull the whole lot out and start again in a couple of years.

There are three major classes of networking cable. The cheapest cable is the twisted-pair type, commonly used in telephone leads. Twisted-pair cabling is very flexible and therefore easy to install. On the minus side, it is unsuitable for transmission rates above 1Mbit/s. and is restricted to a cable length of 500 metres unless you fit boosters.

The second class of cable is the co-axial cable, which comes in two major types. Baseband systems use a simple transmission of data down the line, while the more advanced broadband system transmits data superimposed on a carrier frequency. The broadband system is more efficient and can support longer cable runs than the baseband type, although it is more expensive and requires more maintenance.

The final type of cable is fibre-optic. It is a very fast, highly efficient system, which will not decay like the metal-based cables. The major drawback with fibre-optic systems at present is that they are wildly expensive, and much of the technology is still in the development stage. You might also have difficulty in interfacing it with existing networks.

MS-DOS & NET BIOS

Order was brought to networking when IBM and Microsoft unveiled the PC-Network program and DOS 3.0. The foundation of the PC-Network program is the Net BIOS software held in ROM on the IBM Network Interface Card (NIC). Net BIOS covers layers 3, 4 and 5, and became the de facto standard for PC networks as other manufacturers stated that they would support it.

Like the PC ROM BIOS, Net BIOS is IBM copyright. Third-party manufacturers therefore have the task of emulating the operation of Net BIOS. Emulation is usually provided in software, with third-party NICs providing the necessary hardware hooks to the Net BIOS emulation program.

Further standardisation was provided by the realease of MS-DOS 3.0, which effectively implements layer 6 by supplying the interface between application programs running on a work station and the network itself in the form of the NIC board installed in the computer.

Versions 3.0 and higher of MS-DOS contain a number of functions designed to allow communications with a network. They are called via interrupt 21 hex. Once this interrupt has been invoked by the network it can issue calls to the operating system to lock and unlock records, open shared files and redirect devices to the network.

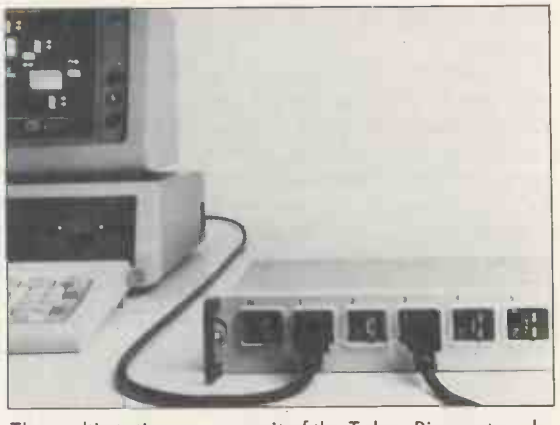
Interrupt 21 is the gateway between MS-DOS and Net BIOS, and provides standardisation at the Presentation layer. This layer is supported by MS-Net, with the use of the Microsoft Redirector to provide the interface between the two programs. When an application wishes to access a file on the server it issues interrupt 21; this is received by DOS, which recognises the information as being intended for the network and passes it to the Redirector

The Redirector then builds a Server Message Block (SMB), which is passed to Net BIOS and thence to the server. The SMB can only communicate with Net BIOS, so third-party manufacturers have had to emulate the Redirector. There are a number of programs on the market which emulate the procedures outlined here. One of them, Novell's Netware, is examined in detail on page 95 of this issue.

(continued on next page)

LOOKING TO THE FUTURE

IBM'S TOKEN RING IS BECOMING THE STANDARD LAN SOLUTION. **STEVE MALONE** REPORTS ON HOW IT WORKS.



The multi-station access unit of the Token Ring network provides a central control point for maintenance.

Token Ring is seen by IBM as its flagship LAN product to take it into the 1990s. As such, Token Ring is designed with sufficient flexibility, speed and power to prevent it becoming obsolete in the 10 to 15 years that the cables themselves are expected to last. The transmission speed of the system is 4Mbit/s, and up to 260 work stations, or nodes, can be connected to the network, although this is not an absolute limit.

The layout of Token Ring is a star ring as shown in the diagram below. The logical structure of the system is of a uni-directional ring with information passing from one work station to another down one wire and out again on another. The wires to connect one work station to the network go via a central box known as an access unit. In this way, the input and output leads can be bundled together in a single cable.

The hub of the Token ring is the 8228 multi-station access unit. This is a box with eight interfaces fitted, each supporting one work station. Two plug sockets are also fitted to each 8228 unit, enabling them to be daisy-chained together. The units are designed to be mounted together on a 19in. rack. Configuring the network is simply a matter of patching the cables to whatever layout is required.

The components inside the access unit are almost all relays and capacitors. IBM says this — dare we say — old technology has been fitted to the units because it is well understood, easy to maintain and extremely reliable. An IBM spokesman said that as far as he knew only two access units had failed in the world — both of them in the U.K.

The type of cable used with Token Ring does not matter a great deal. The network is a baseband system, and can use anything from a simple twisted-pair cable —as used in telephones — up to high-performance fibre-optic cable. It is even possible to use a combination of cables to optimise installation and performance.

Apart from the cables and the access unit, you also need adaptor cards which plug into your PC or other device. When Token Ring was launched, it was criticised in some quarters for being limited to the PC family. Since then IBM has produced adaptor cards for a range of its equipment, including the RT/PC, industrial computers, and minicomputers such as the System 36 and the newly announced 9370 range, as well as linking systems to giant IBM mainframes.

Details of the adaptor card have been published to allow other manufacturers to produce compatible systems. The chip set providing the Token Ring interface is available from Texas Instruments. This means that adaptors can be provided for other manufacturers' computers which will enable them to hook into a Token Ring network.

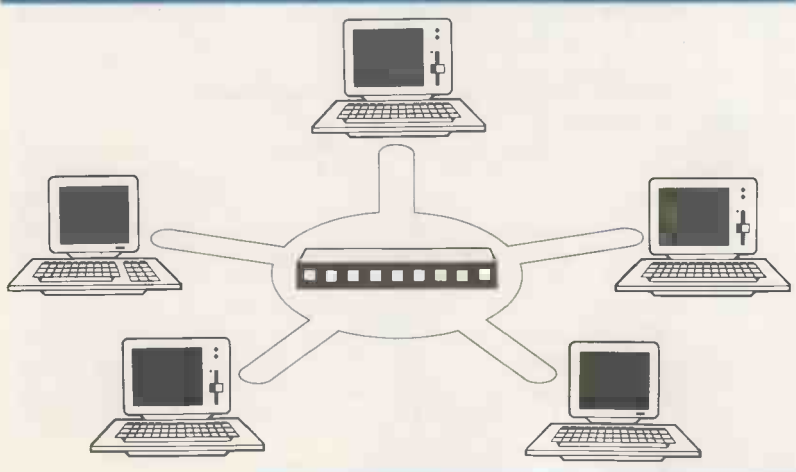
The operation of Token Ring differs considerably from Ethernet-type CSMA/CD networks which have dominated the office environment so far. Rather than the free-for-all permitted by CSMA/CD networks, order is brought to the Token Ring system by the transmission of a token, which is a 24-bit packet of information that is passed from work station to work station on the network. Data can only be sent through the network via the token.

The Token Ring network is managed by a work station known as the monitor. This machine will generate the token, ensure that it is circuiting the network correctly and retransmit a new token if necessary. Any machine can act as monitor as all the circuitry and software required is built into every Token Ring network interface card. Typically, the role of monitor will be assumed by the first machine switched on to the network. As there will be no token on the network, after a period of time the machine will begin to generate its own automatically.

The monitor technique is important in maintaining the integrity of the system. Token Ring is designed to suit large corporate users; they would be unhappy if the entire system crashed if the monitor NIC went off-line. If the monitor does go out of action, this will be recognised by the network and another machine can auto-

(continued on page 90)

TOKEN RING NETWORK LAYOUT



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(continued from page 88)

matically issue a new token and take over as the monitor.

The drawback with the retransmission solution is that it introduces a delay into the system. IBM says that this will be typically 2.5 bits. To compensate for this, IBM has added three bits on either end of the token so that the monitor can rectify the problem by shifting the bits as they arrive from the network. This makes the token 30 bits long, although only 24 of them are significant.

The delay is the factor which governs the size of the ring. With each work station introducing a delay to the system, more than 260 stations may produce a delay longer than three bits, which makes it impossible for the monitor to recover the data stream. IBM says it is possible to add more machines to the network but cannot guarantee its performance.

One of the prime requirements of Token Ring is that faults can be isolated and recognised swiftly and efficiently. Fault diagnostics start before a work station logs on to the network. The work station checks whether the line to the access unit is performing properly by sending 1,500 2K frames down the line.

Because the work station interfaces on the 8228 unit have closed relays, the frames will be sent back down to the work station. If the registered error rate is within a specified limit the station sends a 5V burst down the line, opening the relay and connecting the station to the ring. Otherwise a local error message will report that log on failed.

The work station NAC will then send a message to the next station along the ring. The frame contains the address of the NAC. This address will be logged by the receiving work station as being the address of the nearest active upsteam neighbour (NAUN).

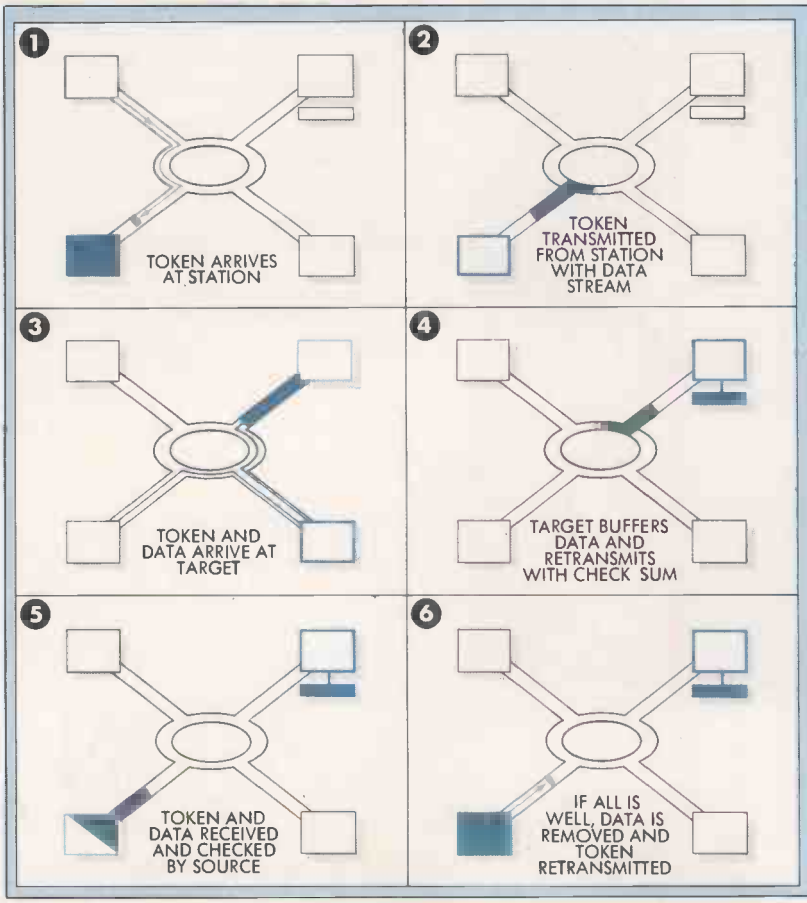
If a work station begins to malfunction, or a break occurs in the line, the first station to recognise this will be the next one downstream from the token. It will register a fault because a token either comes in garbled or not at all. When this occurs the station will issue a beacon frame which consists of the work station's own address and that of its NAUN. The information will travel around the network until it arrives at the NAUN, which will recognise the address at fault as its own and will remove itself from the network without interfering with the working of the system.

The suspected node will then perform self-testing routines similar to those performed prior to logging on. If it finds all is well, the work station will reinsert itself back into the system. Meanwhile, if the downstream station continues to receive faulty data, it will conclude that its own receiving equipment is at fault and will log off the system.

This method allows faults to be located precisely, so that you do not have to inspect the entire system to find out where a breakdown has occurred. You can take advantage of this when there are two rings going between the access units. The second ring is part of the built-in redundancy of the unit. If one of the cables becomes severed the other will come into play, allowing the network to continue functioning while the fault is repaired.

Although 260 nodes is an awful lot of work stations, this may not be enough for the 1990s where IBM foresees network nodes numbering in thousands. To cater for the demand, IBM has introduced the Network

HOW TOKEN RING WORKS



If one work station wishes to send information to another it waits until the token arrives from its neighbour on the LAN. The adaptor card changes a bit on the token, giving it command of the network so that no other work station can transmit during the operation.

Each network adaptor card has an address number built in which is licensed from IEEE. This means that each adaptor card can be addressed specifically by another. IBM claims to have licensed around 14 million of these addresses. When a node wishes to transmit information to another work station, it includes the target machine's network interface card (NIC) address and its own into the token.

The token is then retransmitted over the network followed by a stream of data from the source machine and a check sum, which is part of the token, at the end. The token travels to the next machine, which checks whether the target address corresponds to its own. If it does not, the token and data stream is retransmitted by the work station to the next machine downstream. The information does not simply pass through the work station but is retransmitted so that the token and its information is repeated at each work station. When the token and data stream arrive at the target work station, the receiving machine buffers the information following the token, adds a check sum and passes it on to the network along with the data stream.

The token will eventually arrive back at the source machine, where it will be reset to allow another workstation to control the network. The source device will also remove the data stream and verify the check sum. If it is incorrect, the data will be retransmitted.

Adaptor II, an NIC capable of acting as a bridge between two rings. To create an effective bridge between two rings you need a dedicated PC/XT or PC/AT. This might seem an expensive solution, but when you are talking about hundreds of PC work stations perhaps one more here or there does not matter much.

Addressing stations across a bridge is a variation of ordinary ring addressing. A station sends a token and data stream out around a ring. If the message is not picked up by one of the stations on the ring, the message is retransmitted, picked up by the bridge and passed over to the second ring. It is transmitted around the second ring as normal until it reaches the destination work station. This method of addressing obviates the need for large address tables to be held in each machine which constantly need to be updated.

If there is a lot of traffic on both rings it might be advisable to have two bridging stations connecting the rings. The reason for this is that one or other of the bridging stations might be busy with something else. When the source machine gets its token back it will log which bridge was used for the transfer. From then on it will send the information directly to the target station via the station which is the quickest route.

Token Ring can operate with up to seven such bridges. However, with careful planning this obstacle need not arise. One of the best implementations of multiple rings is to use a backbone. This is a ring consisting entirely of bridging machines. A typical implementation might be where you have a large office building. The backbone would transmit data between floors while there might be smaller rings to service each department or office. Using suitable gateways, it is possible to us a high-speed Token Ring backbone connected to low-cost or existing Ethernet-type departmental networks.

In designing Token Ring, IBM appears to have gone to some lengths to ensure the system will survive to the 21st century. The provision for extension, patching and failure all while the system is running shows a long-term commitment to the LAN market. For everybody's sake let's hope IBM has got it right.

SPECIFICATION

Network speed: 4Mbit/s
Maximum number of nodes; 260
Hardware prices: PC Adaptor I £568; PC Adaptor II £653; 8228 access unit £621
Software prices: Net BIOS £33; Network Manager £1,229; PC-Local Area Network £108; Token Ring Bridge Program £1,229
Manufacturer: IBM U.K. Ltd, 389 Chiswick High Road, London W4 4AL. Telephone: 01-995 1441
Available: now

WORKING WITHIN THE IBM STANDARD

JUST AS MICRO MANUFACTURERS CAME UP WITH CLONES TO TAKE ADVANTAGE OF THE IBM PC STANDARD, SO THEY ARE HAVING TO MIMIC IBM WHEN THEY PRODUCE NETWORKS. **GLYN MOODY** REVIEWS THE CURRENT STATE OF PLAY.

There are parallels between the development of the local area network and the personal computer itself. In the early days of micros, confusion reigned as each manufacturer offered its own usually incompatible solution. Purchasing decisions could lock you into what subsequently turned out to be a complete cul-de-sac, so although sales proliferated, there was a general feeling of unease throughout the industry and among users.

The appearance of IBM PC changed all that. Whatever the pros and cons of product itself, its pricing and the way it was sold, it did bring the microcomputer industry to its senses. Today's huge software base and aggressive pricing are largely due to the creation of the IBM PC standard.

It is still early days for local area networks. Different manufacturers trumpet the virtues of their own systems, and until recently it has been hard to gain an impression of where the market is heading.

The OSI model explained on page 86 offers hope of some interchangeability of products between competing systems. At the moment it remains little more than a hope: some of the layers of the model have yet to be defined, and not all of the industry has committed itself to adhering to standards when they emerge.

In the meantime some standards are beginning to come through. The dominance of MS-DOS means that any future networking standard will have to be able to work with it. In practice this means working with MS-Net and Net BIOS. Furthermore, as Steve Malone explains in the preceding article, the appearance IBM's Token Ring network looks like creating another de facto standard like the PC itself; it should in turn bring about a similar rationalisation of the marketplace.

This can only be good news for the user. But it poses a problem for manufacturers competing with IBM: how do they work within the new standards without submitting to them completely? A case in point is

(continued on page 94)

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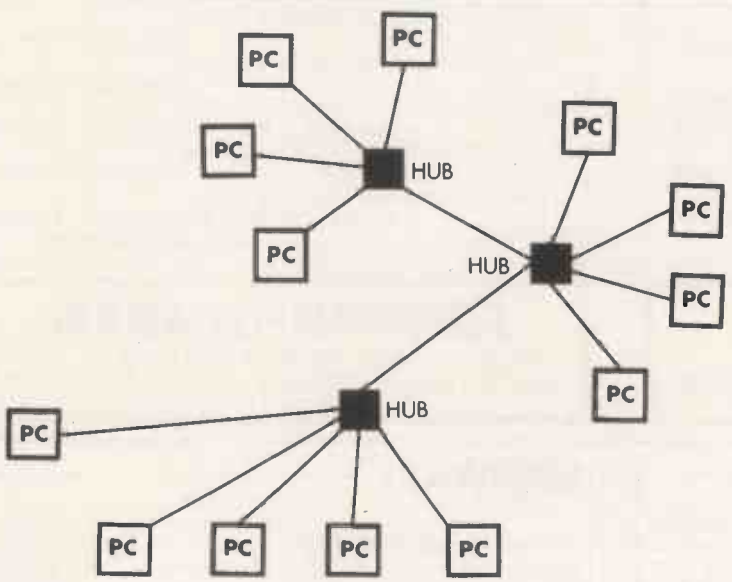
Olivetti, which has established itself as one of the most successful clone makers, and is evolving a comparable strategy to deal with what it sees as a key new area.

In one sense working with the MS-Net and Token Ring standard is simply an extension of ordinary IBM compatibility. True compatibility means being able to accept and use add-ons such as LAN cards, for instance. But since the whole area of networks is in such a state of flux, companies need to take a pragmatic approach. For example, network products could come through which throw up small incompatibilities in what had hitherto appeared to be an completely compatible clone.

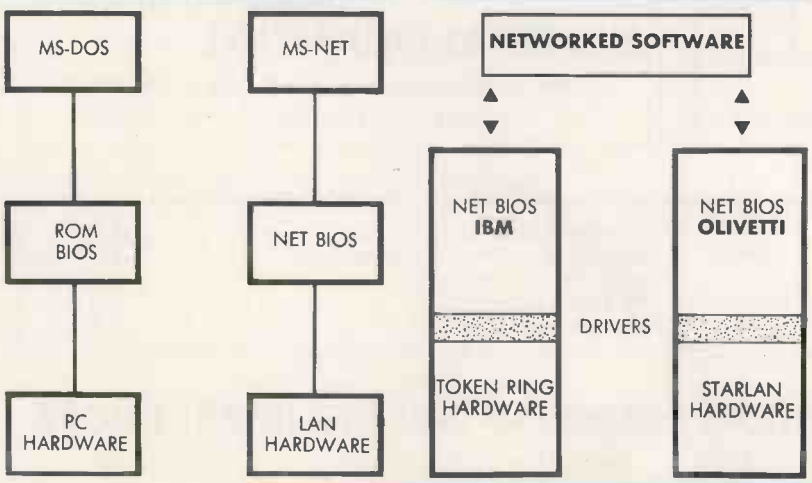
Such problems can usally be sorted out by making modifications to the ROM BIOS. However, depending on compatibility to cater for networking is clearly only half a solution because companies would still be relying on IBM for the LAN hardware. Fortunately the existence of the Net BIOS standard allows different network solutions to be adopted while still remaining within the mainstream LAN universe.

Starlan clusters work stations round local hubs. Up to 1,000 stations can be linked.



Net BIOS is to networks what ROM BIOS is to PCs.

System software has to emulate IBM's Net BIOS standard.



The similarity between cloning the IBM PC and cloning IBM's network is illustrated in the diagram below. Just as the ROM BIOS allows MS-DOS software to run on non-IBM machines by emulating the behaviour of IBM hardware, so a suitable Net BIOS will allow software to run on networks other than the standard Token Ring.

This is the approach Olivetti has adopted for its Starlan network. It is based on a proprietary system developed by AT&T, with which Olivetti has close links. As its name suggests, it uses a star topology. Individual work stations are connected to a central hub; the spokes of the hub can also connect to other hubs, allowing for a maximum of around 1,000 users. One advantage of the star topology is that if one system goes down, it does not take the whole network with it. The approach used for sending data over the network is the CSMA/CD technique.

Clearly, Starlan's approach to networking is different from that on the IBM Token Ring. However, by writing a version of the Net BIOS with drivers to cope with Starlan, the same software can be run on both networks without the user ever being aware of the difference. In addition to the greater resilience of Starlan Olivetti claims that it is cheaper than many rival solutions — typically £700 to £750 per node. However, it is slower, running at 1Mbit/s. against IBM's 4Mbit/s.

Olivetti also has an earlier network product, 10-Net, which was designed before Net BIOS was released, so it was completely incompatible in its initial form. However, compatibility with MS-Net has now been added, and there are plans to introduce Net BIOS compatibility at a later date.

The progression from simple MS-Net to full Net BIOS compatibility will probably closely map a similar shift in programming techniques. At the moment, programmers writing network software are content to work directly with MS-Net. This is equivalent to writing programs which work with MS-DOS but avoid making calls direct to the ROM BIOS. But for some purposes it is necessary to move below the MS-Net layer and make direct calls to the Net BIOS. This allows certain functions to be carried out more easily, just as programs which go directly to the PC's ROM are often faster. The penalty you pay is that such quick and dirty programming locks you into the specifics of the Net BIOS; any upgrades will require recoding. Sticking with the insulating layer of MS-Net ensures that your programs are protected from all such details.

The existence of such strategies of progressive compatibility indicates the growing maturity of the LAN market. The success of the clone approach in the personal-computer sector holds out hope that networks could evolve in a similar way, with corresponding reductions in cost and advances in technology. Once a fully fledged standard has evolved, people can then begin to consider whether that solution offers any real benefits.

NOVELL NETWARE

FOR STAND-ALONE MICROS THE CHOICE OF OPERATING SYSTEM IS ALL BUT AUTOMATIC, BUT FOR NETWORK SYSTEMS THE CHOICE IS LESS CLEAR. **STEVE MALONE** LOOKS AT ONE OF THE LEADING CONTENDERS.

Without doubt, one of the biggest-selling network operating-system programs is Novell's Netware. The range of machines it caters for spans the IBM PC and Apricot families, with systems for the Wang PC and Apple Macintosh promised soon. Netware has also been configured to run a wide range of third-party networks, including Arcnet and Omninet. While Novell's claims of setting a de facto industry standard are perhaps a little premature, Netware as a hardware-independent system is certainly the one the rest are chasing.

The program can be configured for both main kinds of office LAN configurations — that is, token-passing rings and CSMA/CD systems. The version of Netware we looked at was based on a CSMA/CA network; although there are differences between the two formats, for most practical purposes they can be considered identical.

The configuration consisted of a dedicated PC/AT file server connected to several IBM PCs and Amstrad PC-1512 work stations on a linear bus system. The cables used were the standard co-axial variety. The transmission rate on the review layout was 3Mbit/s.

One problem arising with Netware is the hardware integrity. If a spur cable is pulled from the back of a work station or the co-axial cable is cut in any way, the entire network will hang up. This should not be a problem in the normal course of events, providing the hardware installaton has been performed sensibly. However, it does leave the system vulnerable to the proverbial electrician's drill.

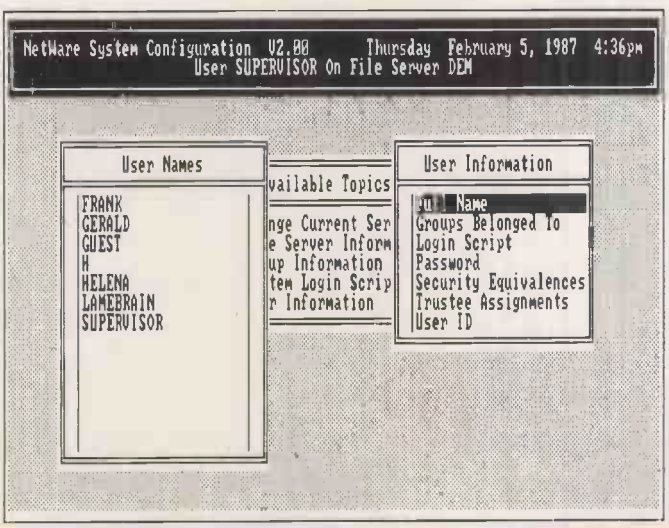
Care needs to be taken when installing a new work station on the network while it is running. The spur has to be fitted to the computer network interface card before being attached to the main bus. Doing things the other way round will hang up the network.

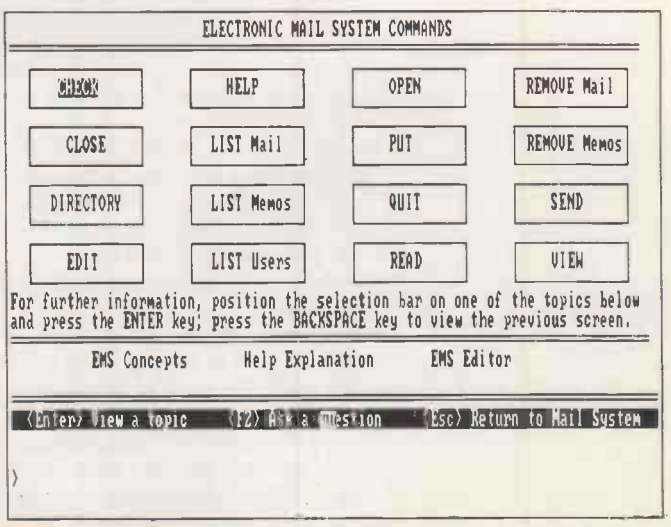
No more than 100 users can be attached to a single file server. This is partly the fault of Novell Data, which considers that if you are fitting more than 100 work stations together you ought to pay for a second Netware licence. But for most customers, it is more of a theoretical rather than practical limit as the amount of traffic would quickly overwhelm the current generation of PC-based file servers. Novell Data also says that up to five shared printers can be hooked into the network.

Part of the continuing success of Netware has been that while it pre-dated the introduction of MS-DOS 3.1 and Net BIOS, Novell was one of the first companies to introduce Net BIOS emulation into its network software, including the range of network calls available through interrupt 21h. In addition, Novell has maintained its earlier Extended Function Call Set, which includes peer-to-peer communications and printing. The result is that the current generation of Netware is compatible with earlier versions and with software written to run on Net BIOS.

Another example of how Netware extends the features available under MS-DOS 3.1 is the number of logical drives supported by the program. While maintaining drives A-E as local in accordance with MS-DOS practice, Netware can support a further 21 drives, up to drive Z. This is in contrast to MS-DOS, which supports a total of only 16.

Network security and data integrity are of paramount importance when developing network software. Netware has a host of features intended to prevent unauthorised access to sensitive files. The most important element is the security of the server. One of the major problems with MS-Net is that you can boot the server using an ordinary floppy-disc version of DOS. Once the system is booted, it is possible to investigate the sensitive files on the hard disc simply by examining the directories. Netware gets round this by formatting the





Left: The Supervisor can alter the privileges of each user. Right: The electronic-mail command menu.

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hard disc to its own configuration, so that the operating system will be unable to recognise the fixed disc even if you boot the server with a floppy-based version of DOS.

This technique provides an insight on how Netware arranges itself. On power-up, DOS is downloaded into the local work station, where it resides for the remainder of the session. DOS is interfaced to Netware's Net BIOS emulator, which in turn passes information to and from the Novell network manager on the file server. MS-DOS therefore remains local to the work station while the network is run entirely by Netware.

For the ordinary user, security begins when a work station is booted. Before any access to files is permitted you have to log on with the option of passwords. Normally this will log you on to the local file server. If your system has a number of file servers linked together it is possible to log on to one of those. This is achieved by adding the name of the file server into the log-on sequence, in a variation of the directory Path format. For example, to enter a remote file server the entry would be

LOGIN SALES/FRED

where Sales is the name of the file server and Fred is the user name you wish to log into.

The 26 possible drive names are used as forms of directories which provide pointers to files on the hard disc. Thus logging into one drive letter will allow you access to a number of files, together with associated privileges, while another drive letter will give you a different set.

One of the major features of Netware is its ability to send a file to two file servers simultaneously. This allows records held on different servers to be updated simultaneously. More importantly, if you have the cash to do so, you can have mirrored servers, each performing the same task. If one goes down, for whatever reason, the other will continue functioning.

Governing the entire system is the Supervisor. This is a default user name which has full access to all the files, passwords and other information on the system. One of the most powerful commands available to Supervisor is Syscon. This allows the Supervisor to alter the privileges of each user and the names and passwords.

One of the best features of Netware is the no-nonsense way in which this is done. The utility is entirely menu driven, with on-line help constantly available from the f1 key. This enables someone who is not particularly familiar with computers to operate the system.

Each user has access to a number of files. Access to files is supplied to users via Syscon in the form of so-called trustee rights. There are eight such rights available on each file, including such things as the ability to read or write to a file, open new files and search directories. There are other rights allowing the user to permit others access to directories, or to modify attributes such as setting files to be sharable or non-sharable.

The Supervisor can allocate privileges to a group of users. For example, each member of the sales department could have the same access to all relevant files, and when a new member enters the department all the required files and trustee rights will then be assigned automatically.

Within your own area it is possible to organise your own files. As well as logging on to two servers at once, you can map files locally from one logical drive to another or set up paths to and from directories.

Though Netware had been configured to run on a variety of network interface cards Novell Data Sysems has also introduced its own network interface card (NIC). Introduced at the beginning of March, the Elite card is a clean NIC in that none of the software protocols have been built-in. Novell will supply you with the ROMs which allow the card to run at a variety of baud rates for either a token-passing or CSMA/CA format.

Novell says the advantage becomes apparent when a business wishes to upgrade its network system. Instead of having to throw the network cards out and start all over again, the customer can simply fit the new ROMs to the cards at a fraction of the price. The Elite card also has support for Gateway operations, either synchronous, asynchronous or X-25. This will allow you to hook on to a network and communicate with a mainframe through a single card. The basic Elite card costs £395; the ROMs are extra.

SPECIFICATION

Description: non hardware specific local area network program
Copy protection: key card required for system to operate
Number of users: 100
Price: £2,100 for Netware operating system, including print utility and comms software
Publisher: Novell Inc. of Orem, Utah
U.K. distributor: Novell Data Systems, 78-82 St. John's Road, Tunbridge Wells, Kent TN4 9PH. Telephone: (0892) 37833
Available: now

TORUS TAPESTRY

WITH THE NETWORKING SYSTEM TAKEN CARE OF THERE IS STILL THE PROBLEM OF THE TOP-LEVEL OPERATING SOFTWARE THAT THE ORDINARY USER SEES. IAN STOBIE LOOKS AT AN EASY-TO-USE SOLUTION.

Despite regular reports of booming network sales, it is still difficult to believe that everyone is furiously cabling up their offices. LANs are really quite hard to understand, let alone to set up and use. In the IBM world, Torus is the company which has most obviously set out to tackle this issue. Torus now has over 10 percent of network sales through U.K. dealers, according to market research company Romtec. It is regularly in Romtec's top four LAN suppliers, and in December 1986 — the last month for which figures are available — it got to second place behind Novell. Torus is one of the few successful British network companies. It was set up in 1983 with the aim of producing office-orientated network products for the IBM PC. It now employs 60 people at its U.K. headquarters in Cambridge.

There are three main Torus products. Torus Tapestry is network software that runs on top of Token Ring, PC LAN or other hardware compatible with Net BIOS. IBM (U.K.) is among the distributors for Tapestry. Torus Icon is a hardware/software combination which puts Tapestry software together with Torus's own Ethernet-based interface cards and cabling. Finally, Torus Netware is software licensed from Novell put together with Icon hardware.

With the IBM Token Ring bandwagon starting to roll, Tapestry looks like becoming the most important product. It is a network operating system, the key system component responsible for controlling users' access to resources on a network. Compared to other IBM network software, Tapestry is very user friendly, with a graphics-based interface and plenty of context-sensitive help. It comes with several office-productivity functions built-in, including electronic mail.

Torus Icon is aimed at people who prefer one-stop shopping, with less opportunity for finger-pointing between different suppliers if things go wrong. From the outside it looks identical to Tapestry, but underneath is Torus's own hardware. Torus Netware is aimed at more experienced system builders. The combination of the Icon Ethernet hardware — which at 10Mbit/s. is faster than Token Ring — and Novell's software gives a very high-performance network. However, you have to do without the friendly interface provided by Torus Tapestry or Icon software.

According to Torus marketing director Bernie Allenstein network users divide up into two broad groups. Those in the first group know from the outset that they need to run multi-user software. They want to use a shared database or multi-user accounting software, for instance. For these users it is a straight choice between a network of PCs or a dedicated multi-user system. The networked PC option is attractive because it lets you run up-to-the-minute MS-DOS software. By comparison, much of the software available for dedicated multi-user systems is old-fashioned and expensive, and the choice is much more restricted.

The second group of users are looking for less easily defined productivity gains. These people may already have many PCs in their organisation. By linking them together they are hoping to get better value from them, sharing physical resources such as printers and discs, and perhaps also gradually integrating tasks that are currently worked on separately.

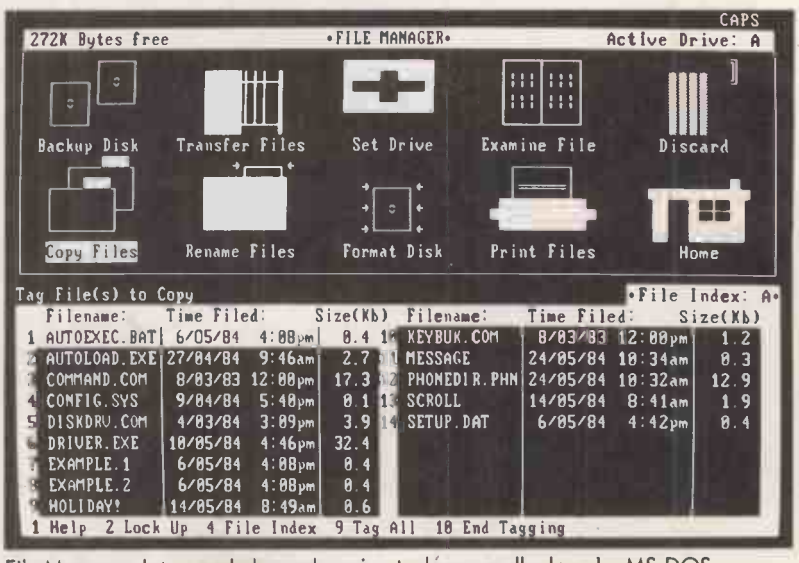
Allenstein sees the second group as eventually having the most potential. "The best growth prospects are in office productivity. Multi-user is really a specialist application appropriate to perhaps five or 10 percent of administrative workers." But for the office-productivity market to take off, LANs must be made easier to use. And the benefits must be made much clearer to users. Allenstein sees the market as too technology driven. "Manufacturers have still not properly turned the technology into products. It still requires a clever user to see the opportunities of using the things."

This is where Tapestry and Icon come in. They aim to tackle the ease-of-use issue with a straightforward menu-driven approach concealed behind a Mac- or Gem-like system of icons. So that the user can at least see one obvious benefit of a network straight away they bundle in good electronic-mail facilities.

Both systems, in fact, look identical to the user. When you turn on a machine connected to the network you are asked to enter your name and password. That done, up comes the main menu of the system, which in Torus terms is called the home screen.

The home screen contains eight icons. You select by cursoring over the icon and hitting Return, or by typing in the initial letter. At the top left are In Tray and Out Tray, used by the local electronic-mail system. Next to them is the Communications icon used for linking to the outside world through services like Telecom Gold or Prestel, or through a gateway to a remote mainframe or mini. The Telephone icon activates a telephone book, which you can use for looking up phone numbers, or for direct dialling if you have an autodial modem attached to your machine.

File Manager gives you access to the sort of



File Manager lets you do housekeeping tasks normally done by MS-DOS.

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housekeeping tasks normally done with MS-DOS: backing up a file, copying discs and so on. The shared Cabinets icon gives you access to whichever disc drives on the network your password entitles you to; Cabinet is the Torus word for file server. One of the strengths of Tapestry and Icon is that you can have any number of file servers on the network.

Network Printers obviously lets you print. If your application software does not let you choose printers easily it is necessary to make a copy for each printer type you wish to support: for example, laser printer with 70-line A4 page length, or matrix printer with 66-line page length.

Application contains all your other MS-DOS software, which can be single- or multi-user. It generally runs in the normal way. Multi-user software such as Smart, Open Access II or Rbase System V provides whatever level of file or record locking the application package itself supports. Net BIOS is the part of the network which handles file and record locking, so Tapestry just passes on the applications requests to the network layer beneath.

When several people are running single-user software at the same time there is obviously the danger of more than one user trying to get at the same file. When this happens Tapestry detects the clash, locks the second user out, and displays a message on your screen telling you who is already working on the file. But there are some problems. Most memory-resident pop-up programs like Sidekick do not work with Icon or Tapestry; you lose some functionality.

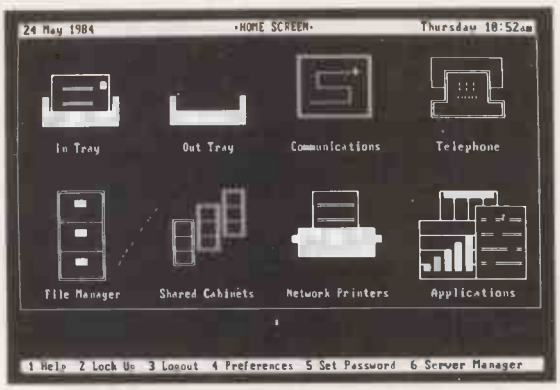
Mail is the most obvious gain. To send a message you select the Out Tray and hit Return. The standard Torus text editor comes up, and you type in your text. The editor supports the basic word-processing functions, including block moves. You can enclose an ASCII text file directly into your message as you type. Other sorts of file — for example, spreadsheets or program files — you can send attached to the message.

Your recipient knows they have an incoming message because their machine will bleep and a one-line alert message will appear briefly on their screen, whatever application they are in. If they are away then they will be alerted next time they sign on to their machine: the In Tray icon on their home screen will now contain an envelope.

The mail function will also show you whether your message out has been read yet. Recipients get the choice of discarding messages they have read, leaving them in their In Tray or copying them to a file. Pretty much the same system, with the on-screen editor, is used for Telex. One machine functions as the telex server for every user on the network. However, Telex is an option; it is not included in the basic price of the system.

To make a network easy to use involves simplifying the task of the network manager as well as of the ordinary users. The network manager has the job of running the network, and with some systems this can be a tedious task. Tapestry/Icon management utilities generally use the same screen-based approach as the more public side of the system. The network manager allocates users to machines, sets up libraries of common software and generally tunes the system. If messages pile up on the mail server, for example, the network manager can sort and view the messages and set the system up to discard by date or other criteria.

Security is based on the same combination of user name and password. When the system is first set up you specify which machine is to run the network-management tasks which are the most critical. You can then physically secure the system.



Torus Tapestry's home screen. The Gem-like user interface makes Tapestry easy to use.

The Torus approach allows you to distribute the burden of running the network across several machines. You can set up any machine with a hard disc as a file server, and connect printers or modems to any machine to make them printer or comms servers. Server tasks run in the background, so you can use the machines for running normal applications when you are not actually tinkering with the server settings. This is important for small networks of three or four machines, where you would not want to lose the use of a PC. On a bigger network it might make sense, for performance reasons, to take a heavily used disc server out of routine use.

Torus Tapestry, the software-only system, costs £495 for the network manager and £300 for each additional user. To this, of course, you have to add the cost of the cabling and the network hardware, which can be any system compatible with Net BIOS. Icon, the all-Torus solution, costs £1,490 for the network manager pack, and £895 per additional machine. Each pack contains an adaptor card, documentation and a copyable system disc; the manager pack comes with an additional system disc and utilities.

To this you also need to add the cost of cabling. Ethernet-based systems have a rather undeserved reputation for high cabling costs. For most small networks, with cable runs between machines of under 100 metres, you can use the cheaper 50Ω thin Ethernet cable. It costs 60 pence per metre for the cable itself or £18.50 for a 10 metre length with connectors. The cable is quite flexible, so it should not be expensive to install. For a typical office network of four or five users cabling costs are negligible — probably under £100. Longer cable runs up to 500 metres require more expensive thick Ethernet cable. With yet longer runs things really do get expensive, as you need to put repeaters on the cable at about £1,000 a throw.

Is this all cheap enough? The traditional multi-user market does not appear to be particularly price sensitive. But the supposed market of people interested in networks for productivity reasons surely is. If users are to be tempted down the network path for hard-to-quantify productivity gains, the price must be reasonable. With all costs considered, it cannot be much more than the cost per user of a good up-market software package, say £650 maximum. After all, to the user the supposed productivity benefits of networking are on a par with the supposed gains of using a spreadsheet. Looked at this way, networks are just another application, and still a rather expensive one. Torus may well have cracked the IBM usability barrier, but the price barrier remains. PC

TOP 10

Despite the many recent advances in more specialised types of application software there must be very few users around who do not use a spreadsheet at some time or another. This rather humble breed of software has been with us since the first days of microcomputing. Yet it continues to go from strength to strength, with no sign of its popularity waning.

The spreadsheet's best-known application is in the world of financial modelling. Its ability to try out a variety of solutions to impending financial problems safely off-line using the What-If? facility has undoubtedly contributed most to its success. But there have been other useful applications too. It has proved useful in scientific and engineering environments, where repetitive calculations can be solved simply be entering data into preset boxes, and then printed out straightaway in a professional format.

The advanced cell-formatting techniques offered by spreadsheets for text as well as numbers also make it an ideal choice for producing large text-based tables. Setting up the table and incorporating later changes can be done far more quickly on a spreadsheet than they can on even the most powerful word processor.

BUDGET CONSCIOUS

As far as advances in spreadsheet technology are concerned, the last year has been relatively quiet. As with other areas of applications software, the biggest waves were caused by the launch of the Amstrad PC-1512 and the consequent round of price cutting, to provide a budget-conscious market with suitably priced packages.

This has given Supercalc 3 and Multiplan, two rather dated spreadsheets, a new lease of life. Multiplan was upgraded a few months ago, but rather than ditch the old package altogether Microsoft had the brilliant idea of repackaging it, adding a "Junior" tag to the title to distinguish it from its up-market big brother, and promoting it as the answer to an Amstrad owner's prayers.

Much the same can be said about Supercalc 3.1. It is now no less than two issues out of date, having been superseded by both 3.2 and 4. All the best bits have been cut out, such as the large matrix and sideways printing, but unlike Multiplan Junior it is good value judged on its graphics capabilities alone.

The Amstrad has also brought about some more innovative spreadsheets. Kuma's Kspread 2 is the first spreadsheet to use the Gem Desktop environment to good effect. It has a very similar feel to Macintosh packages like Excel and Mindsight, but suffers from documentation of a quality more suitable for home computers. Cracker III, an upwardly mobile package that actually originates from the home-computer market, is one of the first spreadsheets to make use of the Amstrad's 16-colour high-resolution mode. It is distributed by Newstar Software. Ironically, Newstar also looks after the U.K. distribution of VP-Planner, an immensely powerful Lotus 1-2-3 work-alike which, from a business user's point of view, puts Cracker well into the shade though it retails at a mere £30 more.

It was spreadsheets that gave micros their initial boost into the business world. **David Barlow** looks at the survivors from the old days, and at the newer products that have brought with them some new ideas.

There is something of a question mark hanging over the future of 1-2-3 work-alikes, as Lotus is currently dragging software houses Paperback Software and Mosaic — originators of VP-Planner and Twin respectively — through the U.S. courts for being just that little bit too similar to 1-2-3. Some informed opinion suggests that Lotus may be wasting its time, as there is no question of piracy of program code. The similarities are confined to data-file compatibility and the command structure, not the user interface.

POWERFUL REPORTING

One rather unusual spreadsheet also stands to get a new lease of life from the Amstrad. FT Moneywise, having now lost its backing from the *Financial Times*, has been renamed Moneypower. It uses a system of pages to enable users to find their way round the overall model, and also includes one of the most powerful reporting facilities around. At its new price of £99 including VAT it should provide real competition to some of the big names in the Amstrad spreadsheet camp.

At the top end of the market both Lotus and Supercalc continue to ask silly prices for their flagship products. In the States, Lotus has just announced a $40 version for the educational market, and this act is sure to have worldwide implications. When the price of Lotus moves so will that of Supercalc 4, as these packages are in a head-to-head battle for the corporate customers.

Although hardware specifications continue to improve, there are still only a few spreadsheets that can make use of memory over the limit of 640K imposed by MS-DOS. Such a facility is still regarded as somewhat exotic, even though it is impossible for most spreadsheets to get anywhere near their theoretical maximum size within 640K of memory.

The Macintosh now has two of the best spreadsheets within its stable. Excel and Mindsight both make full use of the still unsurpassed Macintosh interface. The one standard PC operating system that until recently did not have a truly modern spreadsheet to its name was Digital Research's Concurrent DOS. However, Grafox has recently announced Quintet, an integrated software suite featuring pull-down menus and full-colour graphics.

SUPPLIERS

Excel, Multiplan Microsoft, Excel House, 49 De Montfort Road, Reading, Berkshire RG1 8LP. Telephone: (0734) 500741
Farsight SK Micro Systems, St. Michaels House, Norton Way South, Letchworth, Hertfordshire SG6 1PB. Telephone: (0462) 679331
Javelin Ashton-Tate (U.K.), 1 Bath Road, Maidenhead, Berkshire SL6 1UH. Telephone: (0628) 33123
Logistix Grafox, South Bank Techno Park Building, 90 London Road, London SE1 6LN. Telephone: 01-922 8807
Lotus 1-2-3 Lotus Development (U.K.), Consort House, Victoria Street, Windsor, Berkshire SL4 1EX. Telephone: (0753) 840281
Mindsight Package Programs, 91 Blackfriars Road, London SE1 8HW. Telephone: 01-633 0121
Smart Spreadsheet Innovative Software, Southampton House, 192 York Road, London SW11 3SA. Telephone: 01-223 5008
Supercalc 4 Computer Associates, Edinburgh House, 43-51 Windsor Road, Slough, Berkshire SL1 2EQ. Telephone: (0753) 77733
VP-Planner Newstar Software, 200 North Service Road, Brentwood, Essex CM14 4SG. Telephone: (0277) 220573

TOP 10

EXCEL

SOMETIMES referred to, somewhat unkindly, as the 1-2-3 of the Macintosh world, Excel is at least similar in offering a powerful spreadsheet, a business-graphics module and a database. Of course, Excel gets a head start over 1-2-3 by being able to reap the full benefit from the Macintosh user interface and mouse. But even judged on its own technical merits it is an impressive package. Maximum matrix size is 16,384 rows by 256 columns with over 80 pre-programmed functions covering arithmetic, statistical and financial applications. The macro facility is particularly impressive, with its own procedural language. There are 42 different types of pre-designed business charts available and final presentations can be enhanced by the multi-fount lettering capability of the Macintosh. Excel also includes support for laser printers.

PRICE: £395

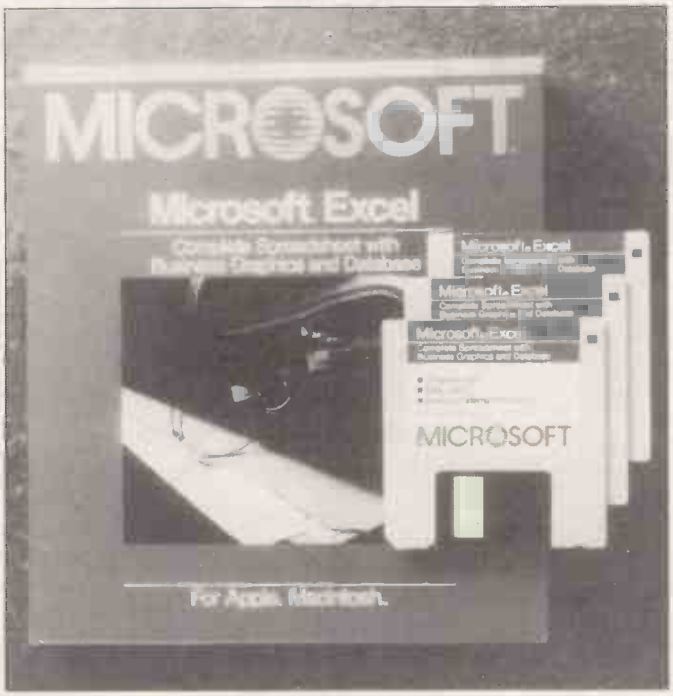
FOR: Macintosh interface. Ease of use. Graphics.
AGAINST: No IBM version yet. Expensive.

FARSIGHT

TO ALL intents and purposes Farsight is a 1-2-3 work-alike, but in common with most examples of this software breed it has a personality of its own. In this case the spreadsheet is augmented by a simple but effective word processor, which supports headers, footers and various type styles, and has a rudimentary mail-merge facility. The user interface is substantially more advanced than 1-2-3, using pull-down menus and windowing facilities to the full. Cut-and-paste operations within the windows allow a file to be moved or copied from one sub-directory to another. Files created under 1-2-3 load and run normally under Farsight. Maximum spreadsheet size is a useful 256 rows by 2,048 columns. The only area where Farsight falls down is its lack of any graphics facilities.

PRICE: £99

FOR: Pull-down menus. Handy built-in word processor. Windows.
AGAINST: No graphics. Documentation.



JAVELIN

THIS IS a spreadsheet with a difference, being something of a compromise between the powerful procedural modellers popular in the minicomputer world and the simple, easy-to-use PC spreadsheet. Javelin does not restrict you to rows and columns as it relies on the user naming all the variables and then defining the relationships between them. Javelin applies time periods such as days, weeks or months to each variable and works intelligently: for example it knows that February comes after January. Completed models can be analysed through 10 different views, including the diagram, formula, table, chart, quick graph, notes, errors, macro and graph view; there is also a worksheet view, which is the closest you get to the conventional rows and columns spreadsheet. Javelin is an advanced package that rewards users prepared to spend a little time getting used to its unusal approach.

PRICE: £595

FOR: Powerful multi-view analysis tool. Error-checking capabilities.
AGAINST: Expensive. Takes a while to learn.

LOGISTIX

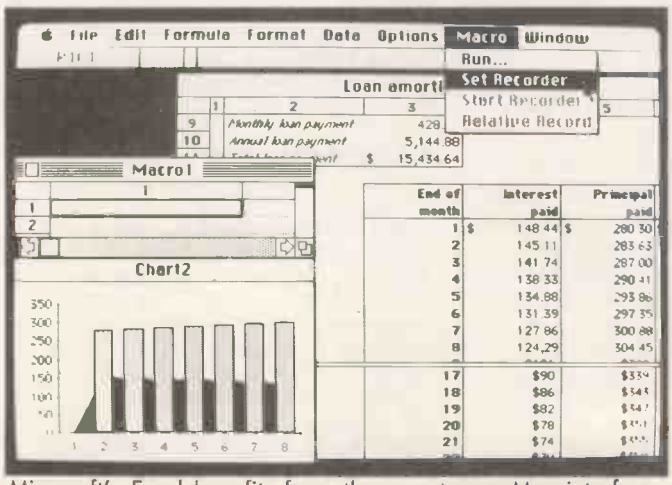
ANOTHER package that offers similar facilities to 1-2-3, though it uses a different command structure. But it is easier to use, has better graphics and includes a handy sideways-printing utility similar to the one provided in later versions of Supercalc. Maximum spreadsheet size is 1,024 columns by 2,048 rows coupled to a database that can handle 1,023 records with a maximum of 64 fields. Logistix also includes a time-management facility covering resource allocation, task scheduling, critical-path project planning and Gantt charts. Graphics facilities are up to presentation standard and the package makes excellent use of colour-display systems.

PRICE: £100

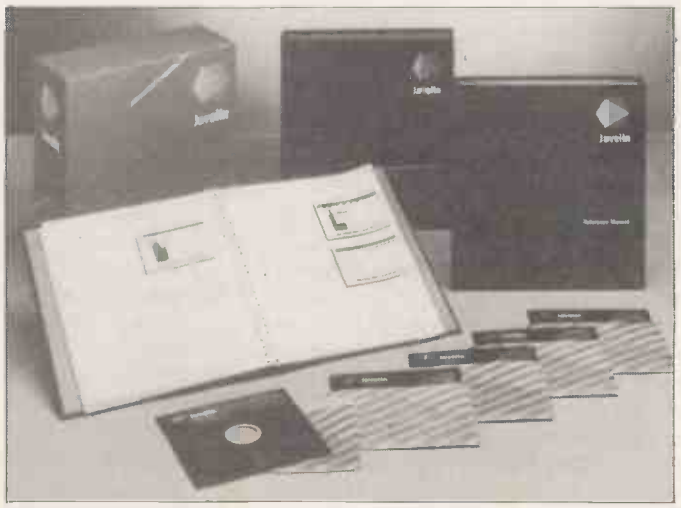
FOR: Powerful spreadsheet. Time-management facilities. Graphics.
AGAINST: Needs powerful hardware. Less well-established than some of the competition.

LOTUS 1-2-3

NOW a microcomputer legend of WordStar proportions, 1-2-3 continues to sell in huge numbers mainly — like WordStar — on the strength of its reputation rather than on its



Microsoft's Excel benefits from the easy-to-use Mac interface.



absolute technical merits. It has now been bettered in almost every area by cheaper packages, but none can match its massive user base or the cottage industry that has grown up to supply useful add-ons. Version 2 of 1-2-3 supports the LIM extended-memory standard, enabling much larger spreadsheets to be built, and has a vastly improved range of functions. It has, however, found it difficult to maintain data-file compatibility with the earlier version 1a.

PRICE: £395

FOR: An accepted industry standard. Availability of useful third-party add-ons.
AGAINST: Poor value when compared with 1-2-3 work-alikes.

MINDSIGHT

LIKE Excel, this package is only available to run on a Macintosh fitted with a minimum of 512K and a second disc drive. In many ways similar to Javelin, Mindsight is no ordinary spreadsheet. First, variables are named and then the relationships between them are specified in a simple English formula representation. The spreadsheet does not appear until all the relationships are solved, and even then data cannot be changed directly in the cells but only in the formulae. As you would expect of a Macintosh program, graphics are well integrated; it is possible to split the screen to display the formula, the spreadsheet and a graph simultaneously. The number of different types of chart that can be displayed is not up to Excel's standard.

PRICE: £150

FOR: Novel approach to modelling. Use of Macintosh display.
AGAINST: Copy protected. Limited graphics.

MULTIPLAN

MULTIPLAN version 2 is the full-power version featuring a maximum spreadsheet size of 4,095 rows by 255 columns. It is also considerably faster than the earlier version, now designated Multiplan Junior. Macros have also been added to bring it into line with the likes of 1-2-3 but it still lacks any form of graphics. Unchanged is the reliable and consistent Microsoft command line and the extensive and

powerful use of windows. Despite all these improvements Multiplan only requires 128K of memory to run. Multiplan Junior has a smaller spreadsheet of just 255 rows by 63 columns but still supports colour and allows you to have up to eight windows open at a time.

PRICE: £150; **Multiplan junior** £70

FOR: Use of windows. Consistent user interface.
AGAINST: No graphics. Junior now looks dated.

SMART SPREADSHEET

BOTH the spreadsheet and database modules of the Smart integrated suite are good enough in their own right to take on many dedicated packages. The spreadsheet can accommodate up to 9,999 rows by 999 columns and uses the sparse-matrix technique to make the most economical possible use of memory. Cells can contain up to 15 digits or 99 characters; a special screen can be called up to enter formulae, which can be up to 1,000 characters long. Up to 32 different spreadsheets can be active at a time. Transferring data from the spreadsheet to the integrated graphics module is easy, and data can be displayed in any one of six graphical formats. Completed graphs can be annotated with suitable titles, axis names and notes.

PRICE: £395

FOR: Powerful spreadsheet. Well-integrated graphics. Can be expanded by buying further modules.
AGAINST: Expensive.

SUPERCALC 4

SUPERCALC 4 and Lotus 1-2-3 are now battling it out for supremacy in the corporate spreadsheet market. On technical merit Supercalc must be judged comfortably ahead, but as yet it has not built up such an impressive record of sales. Maximum spreadsheet size is 9,999 rows by 255 columns and, as in Smart, data-compaction techniques optimise its use of memory. The user interface is compatible with earlier versions but has recently been modified to look more like 1-2-3. In further attempts to woo 1-2-3 users comprehensive data-file transfer utilities are provided to convert Lotus format to Supercalc 4 format and vice versa. Its graphics facilities are easier to use than Lotus's as it is not necessary to exit the main program. A handy sideways-print utility is included.

PRICE: £396

FOR: Easy to use. Good graphics. Excellent documentation and support.
AGAINST: Expensive. Not as many third-party add-ons as 1-2-3.

VP-PLANNER

A MOST impressive 1-2-3 work-alike that offers full file and command-line compatibility with Lotus. The user interface does not look the same, however, as the command line has been moved to a more suitable place at the foot of the screen. What sets VP-Planner apart are its powerful database facilities, which include a traditional flat-file system as well as an immensely powerful three-dimensional database capability. Both systems offer a high degree of compatibility with dBase III. VP-Planner also boasts a powerful macro facility and a Lotus-compatible graphics module.

PRICE: £86

FOR: 1-2-3 work-alike spreadsheet. Powerful dBase file-compatible database. Superb value.
AGAINST: No direct U.K. support.

ADVERTISEMENT

IMPORTANT NOTICE

TO ALL PROSPECTIVE USERS OF LOCAL AREA NETWORKS

Following increasing use of the CLEARWAY range of Local Area Networking equipment the manufacturers, RTD Ltd. of Farnborough, Hampshire, have issued the following warning to anyone contemplating installing a LAN.

SOME LANs CAN SERIOUSLY DAMAGE YOUR HEALTH!

Reports have shown that some people have paid many thousands of pounds to instal a network system only to find out they could have done it at a fraction of the cost!

Some have even bought relatively untried products from new companies with only a few installations and then found the unreliability sickening?

Other companies have suffered the trauma of fighting their way through the jungle of networking without any assistance or planning service offered by the manufacturer!

The remedy for all these problems is CLEARWAY. Launched in 1981 as the very first vendor-independent LAN, CLEARWAY now has well over 15,000 installations throughout the UK and Europe. In fact CLEARWAY is already being used by a large number of well known organisations such as the Stock Exchange, British Telecom, National Westminster Bank, Courage Brewery and many more.

The flexibility afforded by Clearway's innovative approach to networking is clearly demonstrated by interlinking a host of widely regarded diverse and incompatible computers and data communications devices in one Clearway ring. Information can be automatically passed between users and all peripherals such as printers, plotters, modems etc. can be shared by everyone on the ring. All this is made possible as Clearway only relies upon the commonly used RS232 interface, straightforward co-axial cable and an extremely efficient ring transmission medium.

"Clearway has been designed to provide a universal approach to low-cost, local area networking with the emphasis always being on simple installation and ease of operation," explains Neil Irwin, RTD's Products Director. "We offer a total networking service from network planning and a three node starter pack — at £630 the most competitive on the market — through to multiple node solutions for large corporates requiring communications between numerous pieces of equipment including minis and mainframes.

The Clearway range has a selection of different node systems with facilities unique to Clearway. These include a new Liquid Crystal Display model providing status and diagnostics in plain English and a pushbutton keypad for instant selection of destination on the ring. There is also a 19" rack mounted version capable of housing ten nodes and power supply to fit neatly into a standard computer cabinet.

Requiring no special expertise, the installation of Clearway is simple, enabling for example a three node starter pack to be set up in around 15 minutes. Up to 99 Clearway nodes with different peripherals can be linked to the ring network with up to 800 metres between nodes.

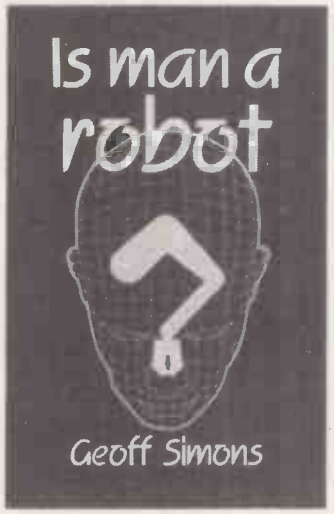
All the electronics to drive the LAN are contained in each node and there is no need to install special cards or boards in the equipment connected to it. Neither is there any need for a central controller as used in star networks. Information is passed from one Clearway node to the next until it reaches its destination.

For further information on the Clearway networking range of products ring 0252 546213 or circle the enquiry number below.

→ circle 141 on enquiry card ←

STILL A LOT TO LEARN

Glyn Moody samples some of the current offerings on AI.



MOST books on artificial intelligence are based on the premise that a computer could, at least in theory, be intelligent. As the title of *Is Man a Robot?* suggests, the author Geoff Simons is tackling the problem from the other end. He wishes to show that looking at humans as cybernetic systems with a central, programmed control unit provides us not only with interesting explanations for many human traits but even insights into some deeper questions.

This is not a book for theists. At one point the author opines: "the religious view is a superstitious irrelevance." The basic threads which run throughout are humanism, materialism and determinism. For example, the first chapter presents an exhaustive — and rather exhausting — list of robots down through the ages. This is followed by a chapter on the Models of Man which eventually suggests that humans are machines — and more specifically, that they are robots.

The next chapter marshals some supporting evidence by looking at the physical aspects of the body. Most of the points have been made before. For example, that the body is programmed by its genes, just like a computer, and that the cells and the body itself exist in a stable state of balance or homeostasis, just like cybernetic systems.

A chapter on programming examines in more detail how aspects of human life could be understood as a result of programming. In addition to the working out of the genetic material, mentioned both at the cellular level and in terms of the ultimate physical characteristics of the body, there is some consideration to how we are programmed by our environment. Many basic psychological theories can be framed in a program-like form. The author suggests that sleep, still largely a mystery to researchers, is a form of program clearance. Just as mainframes need maintenance and updating, so might the brain.

Few people would object to such an approach if it was happy to remain at this level, offering a few lateral thoughts on how the body works. Unfortunately Simons has bigger fish to fry. He suggests that humans are not only like robots in the way they function but that they are robots. From this, he takes it as axiomatic that any notion of soul goes straight out of the window. However, that does leave a number of thorny questions which form the bulk of the remainder of the book.

For example, if we are deterministic machines, what happens to free will? That went with the soul, according to Simons. However, he attempts to console any robots out there who might feel a little bereft by pointing out that the concept of choice is pretty woolly anyway. By free choice we mean something like: "I would have chosen differently if I had wanted to." But this begs the question whether you can choose what you want.

Simons also points out that according to his robotic theory, humans are still making choices. But instead of appealing to some high-falutin' will, decisions are made by virtue of the deep-coded programs within us which are partly genetic and partly environmental. These are so deep that we are unaware of any cogs grinding at all; it just feels as if we made a decision. As Simons puts it: "Choice occurs when a system discriminates between competing informational pressures."

What about creativity — how can machines write symphonies? This argument against a machine's creativity is normally applied to computers which fail to write Beethoven string quartets. As Simons points out, since most humans never write them either, they too fail the creativity test. Emotions, too, can be found in machines — provided you see them as feedback loops and homeostatic states. For Simons, emotions are simply decisions about broad objectives which are then attained using logistics developed by the tactical decision-making of reason. Similarly, personality can be thought of as a behavioural matrix.

The most interesting part of Simons' argument is in relation to ethics. If we are just machines subject to deterministic laws, how can we be held responsible for our actions and, more importantly, why should we be punished? It is at this point that Simons' argument seems weak. Accepting that there is no point in punishing a machine which was only obeying orders, he then goes on to espouse an extremely liberal prison policy. He would do away with prison altogether and rejoices in this unexpected bonus from his theory, though he concedes that such a policy makes society difficult.

What he fails to accept is that his earlier stated position on the dual influence of genes and environment, along with his general cybernetic theory, do in fact provide a justification for some form of restraint, if only to provide a little deterring input to those robots with anti-social tendencies. It is a pity that at this point Simons seems uninterested in examining the consequences of his theory in greater and more practical depth.

Whether or not you subscribe to his central thesis this is a fascinating book. Its maverick viewpoint makes it thoroughly thought provoking as well as amusing.

A far more conventional romp through the highways and byways of artificial intelligence is provided by James Brulé's book *Artificial Intelligence: Theory, Logic and Application*. Its introduction states that it is for the "open-minded, but as yet uninformed

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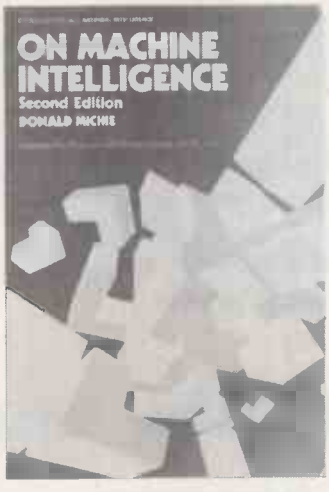

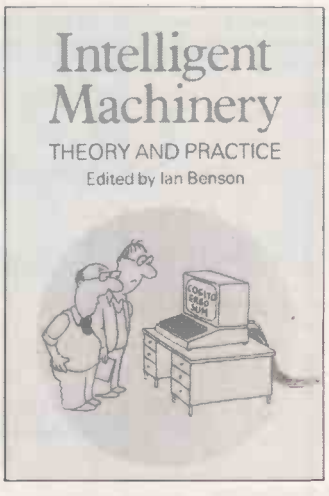

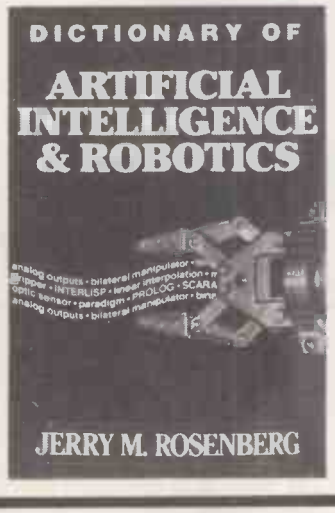

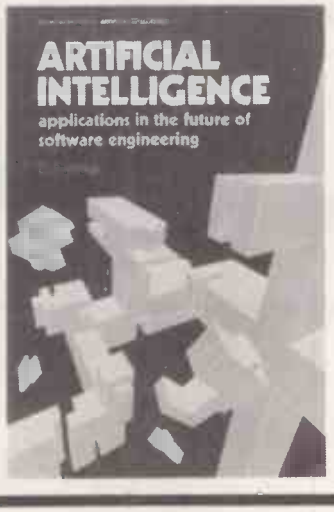

BOOK REVIEWS

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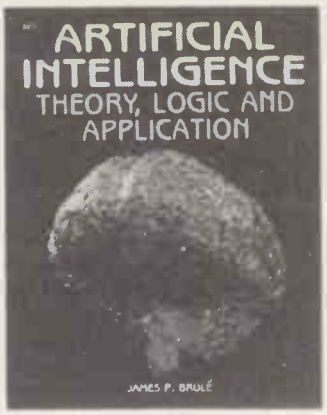
business person." It offers a very down-to-earth and practical approach to what is going on in the AI world.

First there is the obligatory tour of landmarks like the Turing Test, Eliza the psychiatrising computer, Parry the psychotic computer, and expert systems like Prospector and Mycin. The next chapter is called Theoretical Foundations, and tells you everything you wanted to know about undivided middles and syllogisms. Thereafter, the book looks at specific areas of AI such as knowledge representation, graph searching and pattern recognition. It offers simple examples, complete with Basic programs implementing the principles. There is a good chapter on the three most popular AI languages, Lisp, Prolog and Pop-11. Overall, the book is sometimes a little too specific, and lacks the more general details. But what it does, it does well.



A different approach again is offered in Donald Michie's *On Machine Intelligence*. Written by one of the founding fathers of AI in this country it is at once authoritative and accessible. Its approach is quite some way from the populist journalism of the previous two books, and follows closely the concerns of the academic world. Thus there are three main sections, one on computer game-playing, another on intelligent robots, and one on the mechanics of cognition. At the end there is a brief section on AI and society. The book is well written, and although slighly heavy-going at times it is well worth the effort for the insights it gives into how the professionals in AI are tackling the problems.

Another book in the same series from Ellis Horwood, *Artificial Intelligence: Applications in the future of software engineering*, is aimed at fellow practitioners and is of less general interest. It also begins to dip its toe in the murky waters of AI jargon and in-crowd talk.

Such opaque academese reaches new depths in *Intelligent Machinery: Theory and Practice* which is a reworking of a series of papers presented at a conference held at Cambridge. Apart from some general articles by Richard Ennals it has little to recommend it.

After all the jargon, the *Dictionary of Artificial Intelligence and Robotics* might seem just the job. But I find it hard to see who this book is aimed at. Experts will find its content obvious, and hardly anyone else is going to be looking up phrases like "incremental integrator". Sadly, there are not even many amusing words for the casual browser. Among its 4,000 entries only "bang-bang robot" caught my attention. It is also expensive at £14.75 for a 200-page paperback. Unfortunately this kind of pricing and this kind of book seems to be generally indicative of the AI world, which has a lot to learn. PC

STILL A LOT TO LEARN

Is Man a Robot? by Geoff Simons. Published by John Wiley, £14.95. ISBN 0 471 91106 2

Artificial Intelligence: Theory, Logic and Application by James F Brulé. Published by Tab Books Inc., £11.50. ISBN 0 8306 0471 5

On Machine Intelligence by Donald Michie. Published by Ellis Horwood, £29.95. ISBN 0 7458 0084 X

Artificial Intelligence: Applications in the future of software engineering by D Partridge. Published by Ellis Horwood, £25. ISBN 0 85312 753 0

Intelligent Machinery: Theory and Practice edited by Ian Benson. Published by Cambridge University Press, £17.50. ISBN 0 521 30836 4

Dictionary of Artificial Intelligence and Robotics by Jerry M Rosenberg. Published by John Wiley, £14.75 paperback, £31.85 hardback. ISBN 0 471 84981 2

▪ O P E N F I L E ▪

Open File offers programming tips and software to key in. We welcome submissions from readers. We are interested in business programs for any of the main machines such as IBM, Apple, Amiga, Atari 520ST, BBC and Amstrad PCW-8256. We are also interested in applications written in dBase, or for standard spreadsheets like 1-2-3. Utilities are also welcomed.

Submissions should include a brief description which explains what your program does and how it does it. This should be typed with lines double-spaced. The program should be printed with a new ribbon or at double-intensity; the width should be between 75mm. and 90mm., or between 105mm. and 135mm. Also include a disc of your program.

Please send your contributions to

Open File, Practical Computing, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

PASCAL

DOS MENU

A routine that sets up an option menu within MS-DOS, presented by **Harvey Thomas.**

THE batch commands of PC-DOS and MS-DOS provide a number of useful and powerful features, but there are some annoying omissions. Among them is the ability to perform conditional branching dependent on the response made by a user to a question asked in the middle of a batch file. With such a facility you could, for example, write simple menu-selection routines entirely as a series of batch commands within MS-DOS itself.

The Choose program presented here aims to provide just such a facility. It is invoked by a command line of the form

choose prompt to user resp1 resp2 resp3 . . .

where "prompt to user" is a delimited string; any printable delimiter may be used. The elements resp1, etc., are the allowable responses that the user may make; upper- and lower-case alphabetic characters are considered by the program to be equivalent.

(continued on next page)

LISTING 1

```
echo off
cls
type choose.opt
CHOOSE '          Choose an
  option ' a b c d
if errorlevel 4 goto label4
if errorlevel 3 goto label3
if errorlevel 2 goto label2
if errorlevel 1 goto label1
echo SOMETHING NASTY HAPPENED
ENDBATCH
:label1
ECHO OPTION A SELECTED
ENDBATCH
:label2
ECHO OPTION B SELECTED
ENDBATCH
:label3
ECHO OPTION C SELECTED
ENDBATCH
:label4
ECHO OPTION D SELECTED
ENDBATCH
```

LISTING 2. CHOOSE.OPT

```
D E M O N S T R A T I O N   O F   M S - D O S   M E N U
-------------------------------------------------------


                A - Choose option A
                B - Select option B
                C - Require option C
                D - Desire option D

Your selection letter must be followed by the Enter key
```

LISTING 3. CHOOSE

```
{$c-}       {disable ctrl/break}
Program Choose;
{-------------------------------------------------------------------------
    A program to assist decision making in PC/MS-DOS Batch files
    Syntax is :-

    CHOOSE 'PROMPT TO USER' Resp1 Resp2 Resp3 ...

    where the delimited string (' is used as an example) is used to
    prompt the user, and Resp1, Resp2 etc are the allowable responses
    the user can make (no distinction is made between upper and lower
    case letters).  The program sets the MS-DOS ERRORLEVEL on program
    termination to either 0 (which means an ERROR in specifying the
    parameters to CHOOSE), or the number of the response selected
    (Resp1=1, Resp2=2 etc).

    Current restrictions: 25 responses, maximum length of each response
    is 6 characters.  At least two responses specified on command line.

    Harvey Thomas.  July 1986

-------------------------------------------------------------------------}
const
  MAXRESPLENGTH=6;
  MAXRESPONSES=25;
type
  respstr=string[MAXRESPLENGTH];
var
  i,j,x,y:integer;
  cmdline:string[127] absolute cseg:$80;
  prompt,word:string[127];
  resp:array [1..MAXRESPONSES] of respstr;
  ans:respstr;
  delim:char;



procedure uprespstr(var s:respstr);
   {convert string s to upper case}
var
  i:integer;
begin
  for i:=1 to length(s) do s[i]:=upcase(s[i]);
end;


begin
  if paramcount<3 then halt(0);                {must be 3+ DOS parameters}
  i:=1;
  prompt:=cmdline;                             {copy DOS command line}
  while prompt[i]=' ' do delete(prompt,1,1); {remove leading blanks}
  delim:=prompt[1];
  prompt:=copy(prompt,2,length(prompt)-1);     {remove 1st delimiter}
  i:=pos(delim,prompt);                        {seek 2nd delimiter}
  if i=0 then halt(0);                         {error exit if not found}
  prompt:=copy(prompt,1,i-1);                  {remove 2nd delimiter}
    {now look for the DOS parameter that ends with the delimiter}
  word:=paramstr(1);
  delete(word,1,1);
  i:=1;
  while (word[length(word)]<>delim) and (i<=paramcount) do
  begin
    i:=i+1;
    word:=paramstr(i);
  end;
```

(listing continued on next page)

(continued from previous page)

When the user selects a valid option the Choose program terminates, setting the DOS Errorlevel to the number of the response. The first option after the prompt string is 1, the second 2, etc. The program will not terminate until a correct response is entered unless the command line was entered incorrectly, in which case the program terminates with Errorlevel set to zero.

For effective use, it is of course necessary to know how to test the DOS Errorlevel. The DOS command

IF ERRORLEVEL 8 GOTO ALABEL

will cause control to transfer to the line following the label Alabel, if the immediately preceding program terminated with an exit code or Errorlevel of 8 or greater. It is therefore sensible to test the exit code from the highest possible value down to the lowest, rather than from the lowest to the highest.

Listing 1 shows Select.Bat, a batch file used to control simple menu selection. The routine uses Type to display the body of the menu as this is much faster than repeated Echo commands. The file Choose.Opt is shown in listing 2. The dummy batch procedure Endbatch is used to terminate processing of a particular option; it is much faster than jumping to a label at the end of the batch file. Endbatch.Bat is simply a single blank line.

The response to Choose could be input redirected from a file generated by an earlier program. Some very complex batch jobs could be set up in this way.

Choose is written in Turbo Pascal and is shown in listing 3. It should be easy to follow as it takes advantage of some of the built-in functions and procedures provided by Turbo Pascal.

For those who do not possess Turbo Pascal or who do not wish to have to key in the program, copies of Choose for 5.25in. MS-DOS discs can be obtained by sending £5 to Harvey Thomas, 1 Westlecot Road, Swindon, Wiltshire SN1 4EZ. PCW

LISTING 3. CHOOSE

(listing continued from previous page)

```
    {remaining DOS parameters are the allowed user responses}
  if i>(paramcount-2) then halt(0);          {user must have 2+ choices}
  j:=0;
  repeat
    i:=i+1;
    j:=j+1;
    resp[j]:=paramstr(i);
    uprespstr(resp[j]);                      {convert to u/case}
  until (i=paramcount) or (j=MAXRESPONSES);

   {put the prompt up}
  write(prompt);
  x:=wherex;
  y:=wherey;                          {save screen position for response}

   {loop until we get a valid response}
  while TRUE do
  begin
    gotoxy(x,y);
    clreol;                                  {clear any previous response}
    buflen:=MAXRESPLENGTH;
    read(ans);
    uprespstr(ans);                          {set response to u/case}
      {see if response is valid}
    for i:=1 to j do if ans=resp[i] then
    begin
      writeln;
      halt(i);                              {sets DOS ERRORLEVEL}
    end;
    write(^G);                               {beep on invalid response}
  end;
end.
```

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BASIC UTILITY

PARTIAL SCREEN CLEAR

Neil Booth explains how to clear an area of your screen from within a Basic program.

ONE of the problems facing anyone who programs in Basic on an IBM and who wants their programs to interact with the user by means of friendly and uncluttered screen displays is screen clearance. Not whole screen clearance, which is achieved by use of the CLS command, but partial screen clearance. This is clearance to the end of a row, or to the end of the screen, or of a designated window within the screen.

Basic provides no commands which will achieve these ends directly. To clear to the end of a particular row, for example, you must use a command such as

```
PRINT SPACE$ (X)
```

where X is 80 minus the value of the current cursor column. To clear to the end of the screen from a particular screen location, you use this command followed by a command such as

```
FOR I=1 TO J:PRINT
  SPACE$(80):NEXT I
```

where J is the number of whole rows to be cleared. Likewise, to clear a window in the screen from, say, column 14 of row 6 to column 34 of row 15 you must use a routine such as

```
FOR I=0 TO 9:LOCATE 6+I,
  14:PRINT SPACE$(21) :NEXT I
```

This is all unnecessary, for there are at least two fast and effective ways of carrying out the desired operations from within a Basic program. One solution lies in the use of the alternative screen and keyboard driver, ANSI.Sys, which is provided as a file on the standard DOS disc. When DOS is first called on booting up the system, standard drivers governing screen, keyboard, disc drives, etc., are automatically loaded. But if a Config.Sys file containing the command

```
DEVICE=ANSI.SYS
```

is placed on the disc from which bootup takes place, data sent from the keyboard to the screen is passed through the ANSI.Sys driver instead of the standard console driver.

Data is handled in much the same way as it would be handled by the standard driver, except that additional commands in the form of Escape sequences may be given, including the set of screen-handling commands listed in table 1. These commands may be combined to produce within a Basic Program, a whole series of screen-clearing routines which may be invoked from within the program as required.

The necessary steps are as follows. First, the VDU screen is opened as an output device from within the program. For this purpose it must be given the name Con as illustrated in line 40 of the Basic program listed in listing 1.

Next a number of string variables must be defined in terms of the commands listed in table 1. CR$ may, for instance, be chosen as the variable signifying the command to clear to the end of the current row and return the cursor to the clearing start position; it might be defined as illustrated in line 60 of listing 1. Then whenever the operation signified by CR$ is required within the program, all that is necessary is to insert a line such as line 180. That line, when executed, will instantly clear row 8 of the screen from column 10 to the end before returning the cursor to the start-clearing position.

Another variable might be set to clear the screen from a particular cursor position to the end of the screen, and return the cursor to the clearing start position. CS$ might be defined as illustrated in lines 80 to 100 of listing 1. To clear the screen from, say, column 35 of row 12, it then becomes necessary merely to insert a line such as the illustrated line 220.

Unfortunately, the additional commands available under ANSI.Sys do not lend themselves to the defining of variables to clear a window, except where the

(continued on next page)

LISTING 1. ANSI.SYS METHOD

```
 10 REM SWITCH OFF SOFT KEYS AND DEFINE INTEGERS
 20 KEY OFF:DEFINT A-Z
 30 REM OPEN CONSOLE AS OUTPUT FILE
 40 OPEN"O",£1,"CON"
 50 REM DEFINE CR$ FOR END-OF-ROW CLEARANCE ROUTINE
 60 CR$=CHR$(27)+"[s"+CHR$(27)+"[K"+CHR$(27)+"[u"
 70 REM DEFINE CS$ FOR END-OF-SCREEN CLEARANCE ROUTINE
 80 CS$=CHR$(27)+"[s"+CHR$(27)+"[K"+CHR$(27)+"[B"+
    CHR$(27)+"[79D"
 90 FOR I=1 TO 23:CS$=CS$+CHR$(27)+"[K"+CHR$(27)+"[B":
    NEXT I
100 CS$=CS$+CHR$(27)+"[u"
110 REM DEFINE CW$ FOR 8-DEEP-WINDOW CLEARANCE ROUTINE
120 CW$=CHR$(27)+"[s"
130 FOR I=1 TO 8:CW$=CW$+CHR$(27)+"[K"+CHR$(27)+"[B":
    NEXT I
140 CW$=CW$+CHR$(27)+"[u"
150 REM FILL SCREEN
160 GOSUB 300
170 REM CLEAR ROW 8 FROM COLUMN 10 TO END
180 LOCATE 8,10:PRINT £1,CR$
190 REM PAUSE AND FILL SCREEN
200 GOSUB 340:GOSUB 300
210 REM CLEAR FROM ROW 12 COLUMN 35 TO END OF SCREEN
220 LOCATE 12,35:PRINT £1,CS$
230 REM PAUSE AND FILL SCREEN
240 GOSUB 340:GOSUB 300
250 REM CLEAR WINDOW IN SCREEN FROM ROW 8 COLUMN 60 TO
    ROW 16 COLUMN 80
260 LOCATE 8,60:PRINT £1,CW$
270 REM END DEMONSTRATION
280 LOCATE 22,80:END
290 REM CLEAR SCREEN THEN FILL WITH CHARACTERS
    SUBROUTINE
300 LOCATE 1,1:PRINT £1,CS$
310 FOR I=1 TO 23:FOR J=1 TO 79:PRINT CHR$(I+64);:NEXT
    J:PRINT:NEXT I
320 RETURN
330 REM CREATE SHORT PAUSE SUBROUTINE
340 FOR I=1 TO 4000:NEXT I:RETURN
```

LISTING 2. BIOS METHOD

```
 10 REM SWITCH OFF SOFT KEYS AND DEFINE INTEGERS
 20 KEY OFF:DEFINT A-Z
 30 REM LOCATE MACHINE CODE SUBROUTINE OUTSIDE BASIC
    WORKAREA
 40 DEF SEG=&H1700
 50 REM READ CODE FROM DATA STATEMENTS AND POKE INTO
    SPECIFIED LOCATION
 60 FOR I=0 TO 41:READ J:POKE I,J:NEXT I
 70 DATA &H55,&H8B,&HEC,&HB4,&H06,&HB0,&H00,&HB7,&H00,
    &H8B,&H76,&H06,&H8A,&H14,&H8B,&H76,&H08,&H8A,&H34,
    &H8B,&H76,&H0A,&H8A,&H0C,&H8B,&H76,&H0C,&H8A,&H2C,
    &HFE,&HCD,&HFE,&HC9,&HFE,&HCE,&HFE,&HCA,&HCD,&H10,
    &H5D,&HCA,&H08
 80 REM NAME SUBROUTINE AND SET VALUE TO ENTRY ADDRESS
    OF SPECIFIED SEGMENT
 90 S=0
100 REM FILL SCREEN
110 GOSUB 250
120 REM CLEAR ROW 8 FROM COLUMN 10 TO END
130 W=8:X=10:GOSUB 290
140 REM PAUSE AND FILL SCREEN
150 GOSUB 270:GOSUB 250
160 REM CLEAR FROM ROW 12 COLUMN 35 TO END OF SCREEN
170 W=12:X=35:GOSUB 310
180 REM PAUSE THEN FILL SCREEN
190 GOSUB 270:GOSUB 250
200 REM CLEAR WINDOW IN SCREEN FROM ROW 8 COLUMN 30 TO
    ROW 15 COLUMN 50
210 W=8:X=30:Y=15:Z=50:GOSUB 350
220 REM END DEMONSTRATION
230 LOCATE 22,80:END
240 REM CLEAR SCREEN THEN FILL WITH CHARACTERS
    SUBROUTINE
250 GOSUB 330:FOR A=1 TO 23:FOR B=1 TO 79:PRINT CHR$(A+
    64);:NEXT B:PRINT:NEXT A:RETURN
260 REM CREATE SHORT PAUSE SUBROUTINE
270 FOR I=1 TO 4000:NEXT I
280 REM CLEAR TO END OF ROW SUBROUTINE
290 Y=W:Z=80:CALL S(W,X,Y,Z):LOCATE W,X:RETURN
300 REM CLEAR TO END OF SCREEN SUBROUTINE
310 GOSUB 290:W=W+1:X=1:Y=24:Z=80:CALL S(W,X,Y,Z):
    LOCATE W,X:RETURN
320 REM CLEAR WHOLE SCREEN SUBROUTINE
330 W=1:X=1:Y=24:Z=80:CALL S(W,X,Y,Z):LOCATE W,X:RETURN
340 REM CLEAR WINDOW IN SCREEN SUBROUTINE
350 CALL S(W,X,Y,Z):LOCATE W,X:RETURN
```

(continued from previous page)

desired windows have column 80 as their right-hand parameter. However, for such windows the variable CW$ might be defined as illustrated by lines 120 to 140 of listing 1. The variable shown is for a window eight rows high, but any number between 1 and 25 may be substituted so as to obtain windows of different heights. Line 260 illustrates how a blanked window beginning at row 8 of column 60, and ending on row 16 of column 80, may be obtained.

A faster method of performing screen clearance, including the clearance of a window anywhere in the screen, is by accessing the ROM BIOS and issuing direct screen commands by means of an assembly-language routine which can be called from a Basic program. Access to the BIOS video I/O routines is through the 8088 software interrupt 10 hex.

There are numerous methods of interfacing an assembly-language subroutine from Basic, but the method described here is to make the subroutine part of the Basic program by placing the relevant machine code in Data statements which are then Poked into memory locations lying outside Basic's 64K work area. The subroutine is given an integer variable name and may then then be Called whenever necessary. This method does not require the use of an assembler, and all code is contained in the one Basic program file.

The assembly-language screen-clearing routine illustrated here must be supplied with four parameters in the form of four integer variables if it is to perform the clearing operations discussed. They may be contained in the Basic program in the form of declared variables, or may be obtained from the user in response to input commands. In listing 2, these variables are named W, X, Y and Z; W and X represent, respectively, the row and column from which clearance is to begin, while Y and Z represent, respectively, the row and column at which clearance is to end.

The parameters supplied are passed to the assembly-language subroutine by separating them by commas and placing them in parentheses after the subroutine's variable name in the Call command. In listing 2 the assembly-language subroutine has been named S and, accordingly, the Call is to S(W,X,Y,Z), as illustrated by lines 290, 310, 330 and 350.

The code for the assembly-language subroutine itself is as set out in the first column of listing 3. It may be contained in a single Data statement as illustrated by line 70 of listing 2.

If the machine code comprising the Data statement is to be Poked into an area of memory outside the Basic work area, the system must have a memory capacity of at least 96K so as to leave such an area free after accommodating DOS, Basic and the Basic work area. It is sensible to set aside the highest 4K or so of memory for assembly-language subroutines, in which case the starting address for the Poke routine will be the hexadecimal equivalent of the memory capacity of the system, expressed in Kbyte, minus 4K.

For example, in a 96K system the starting address will be 92K, which equals 94208 decimal or 17000 hexadecimal. The final zero is removed to arrive at the figure required by the Def Seg statement. Thus, in line 40 of listing 2 the memory segment is defined as that beginning at &H1700. If the system has less than 96K of memory it will be necessary to locate the assembly-language routine within the highest area of the Basic work area by issuing a Clear command within the Basic program.

CLEAR,&HF000

will reserve the top 4K for assembly-language subroutines; starting Basic with the DOS command

BASIC/M:&HF000

will have the same effect.

Once the starting address has been defined, the data is Poked into successive memory locations, beginning with that address, by means of Read and Poke commands as illustrated in line 60. The Basic program in listing 2 will fill the screen with characters and then perform various screen-clear operations. PC

LISTING 3. ASSEMBLY-LANGUAGE SUBROUTINE

```
55       PUSH BP          ;SAVE BASE POINTER
8BEC     MOV BP,SP        ;SET BASE POINTER FOR ADDRESSING STACK
B406     MOV AH,6         ;SET SCROLL INSTRUCTION AS "UP"
B000     MOV AL,0         ;SET SCROLL LENGTH AS "ALL"
B700     MOV BH,0         ;SET ATTRIBUTE AS "BLACK"
8B7606   MOV SI,[BP]+6    ;GET ADDRESS OF "Z"
8A14     MOV DL,[SI]      ;GET VALUE OF "Z"
8B7608   MOV SI,[BP]+8    ;GET ADDRESS OF "Y"
8A34     MOV DH,[SI]      ;GET VALUE OF "Y"
8B7608   MOV SI,[BP]+10   ;GET ADDRESS OF "X"
8A0C     MOV CL,[SI]      ;GET VALUE OF "X"
8B7608   MOV SI,[BP]+12   ;GET ADDRESS OF "W"
8A2C     MOV CH,[SI]      ;GET VALUE OF "W"
FECD     DEC CH           ;DECREMENT VALUE OF "W" BY 1 (1-25 VDU =
                          ;0-24 SYSTEM)
FEC9     DEC CL           ;DECREMENT VALUE OF "X" BY 1 (1-80 VDU =
                          ;0-79 SYSTEM)
FECE     DEC DH           ;DECREMENT VALUE OF "Y" BY 1
FECA     DEC DL           ;DECREMENT VALUE OF "Z" BY 1
CD10     INT 10H          ;CALL BIOS VIDEO INTERRUPT
5D       POP BP           ;RESTORE BASE POINTER
CA08     RET 8            ;RETURN AND DISCARD 4 ARGUMENTS
```

TABLE 1. SCREEN CONTROL COMMANDS

CHR$(27)+"[?A" — Move cursor up ? rows without changing columns. Default is 1. Command cancelled if row 1 reached.

CHR$(27)+"[?B" — Move cursor down ? rows without changing columns. Default is 1. Command cancelled if row 24 reached.

CHR$(27)+"[?C" — Move cursor forward ? columns without changing rows. Default is 1. Command cancelled if column 80 reached.

CHR$(27)+"[?D" — Move cursor back ? columns without changing rows. Default is 1. Command cancelled if column 1 reached.

CHR$(27)+"[?;?H" — Move cursor to position specified by ?;? (row number; column number). Default is 1;1.

CHR$(27)+"[?2J" — Clear entire screen and place cursor at 1,1.

CHR$(27)+"[K" — Clear to end of row from and including cursor position.

CHR$(27)+"[s" — Save current cursor position.

CHR$(27)+"[u" — Return cursor to saved position.

All the letters used in these sequences are case sensitive; A to K must be in upper case, s and u must be in lower case.

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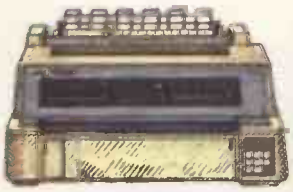

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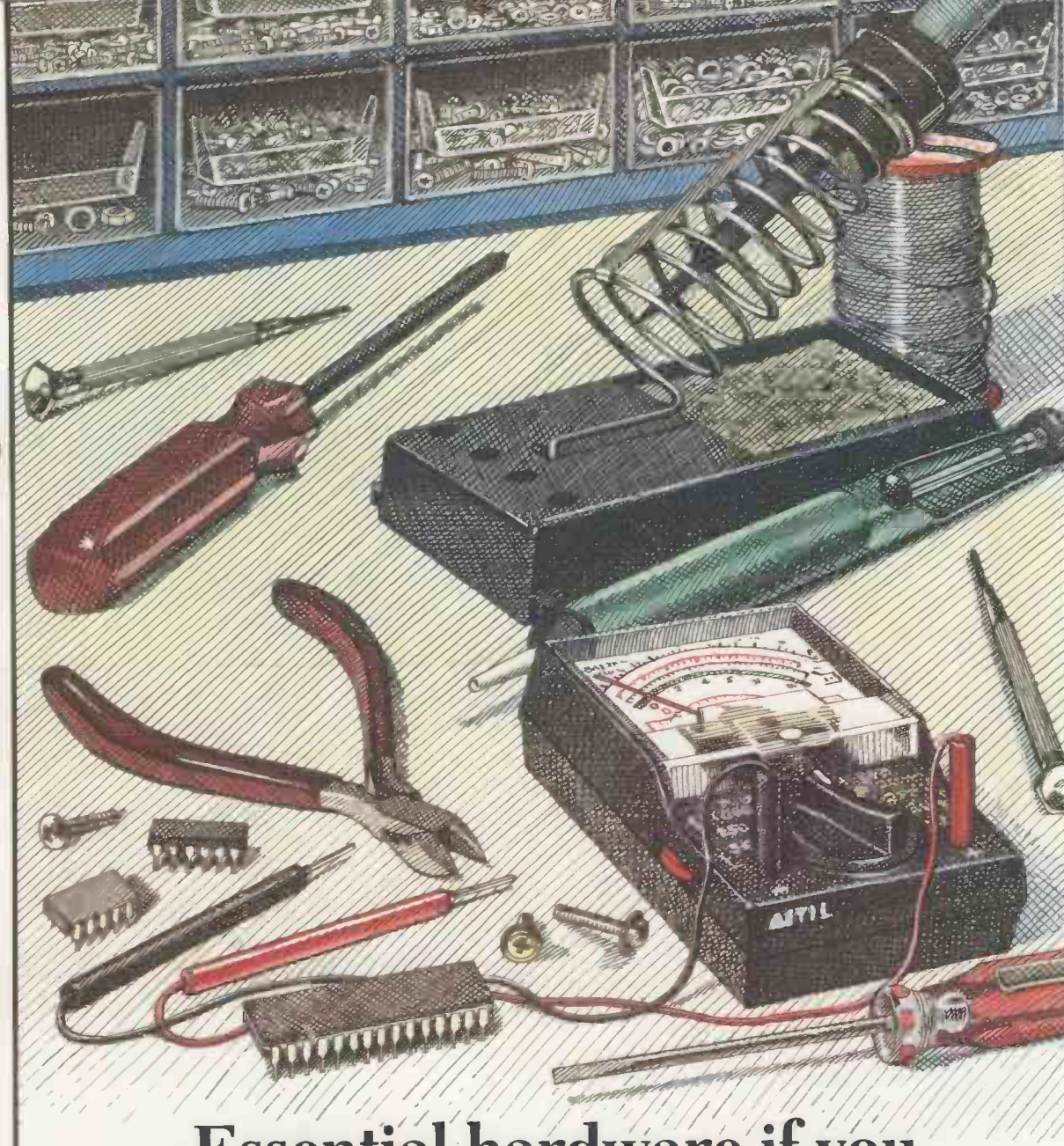

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