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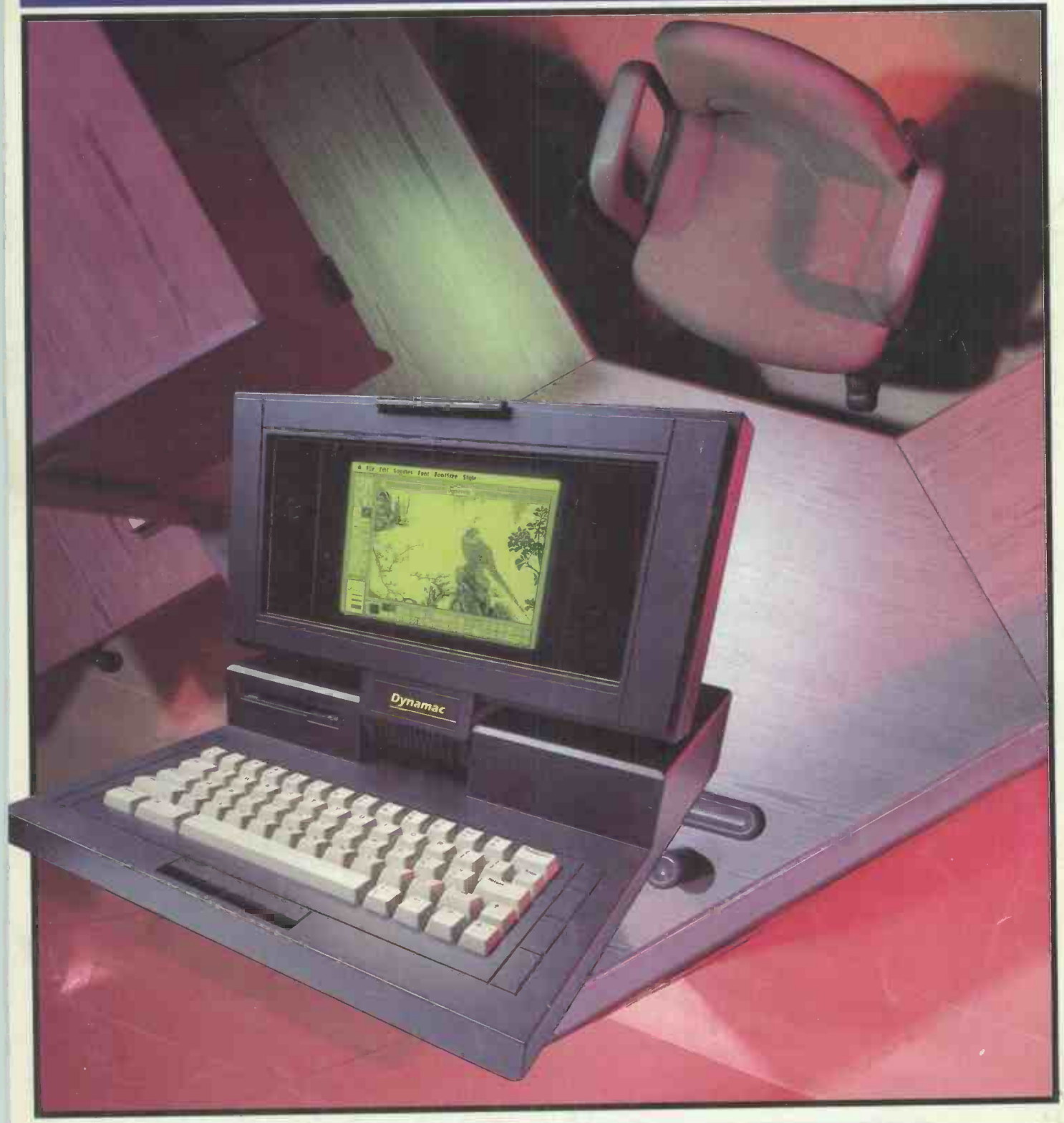

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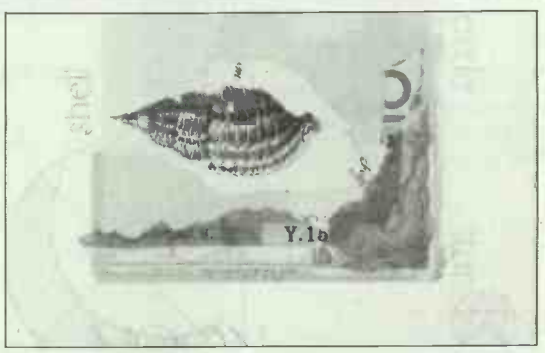

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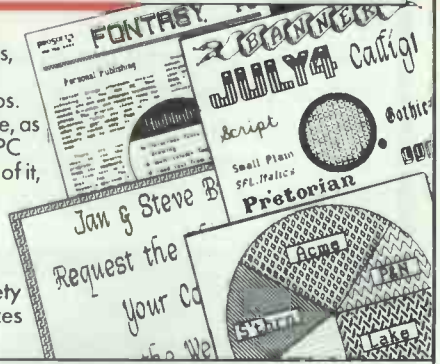

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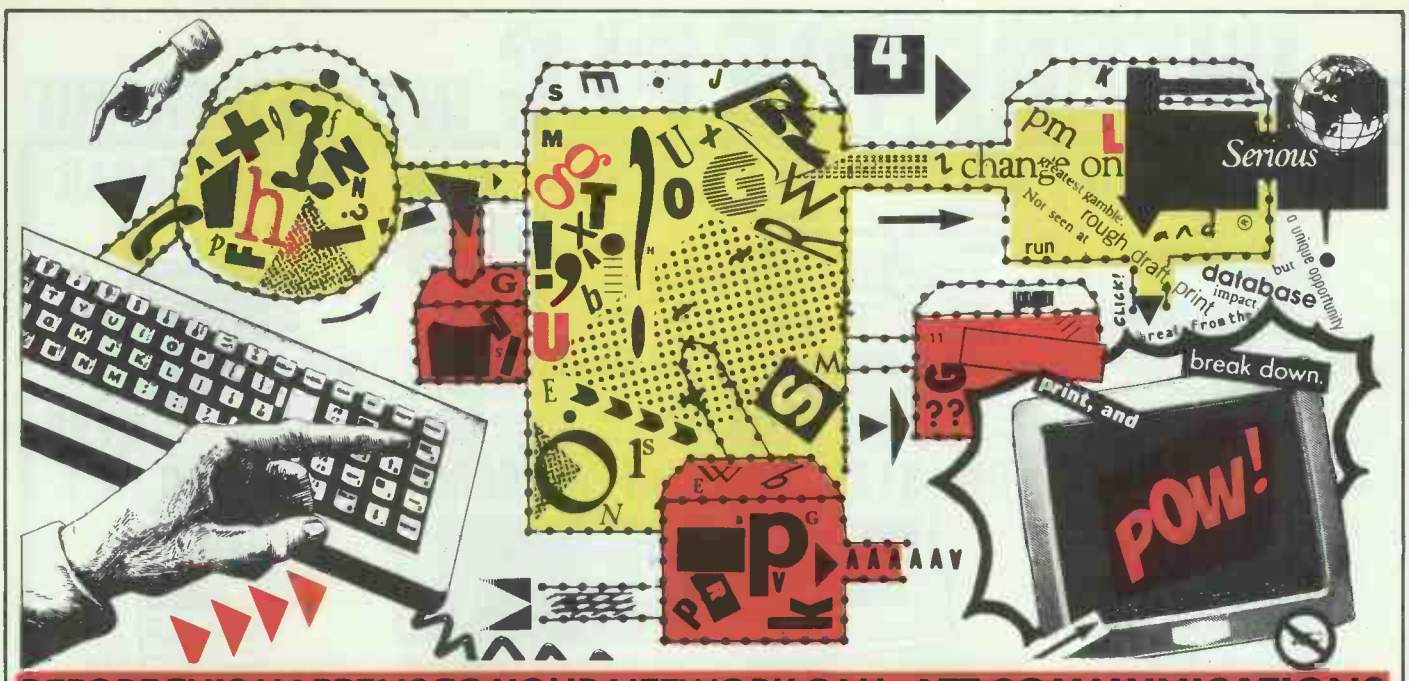

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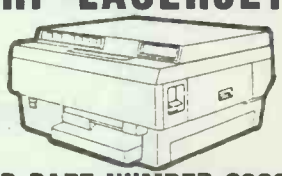

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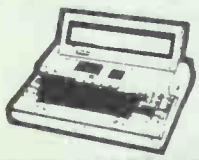

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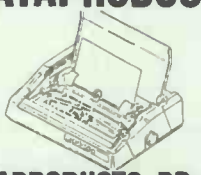

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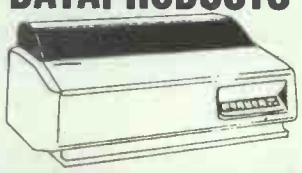

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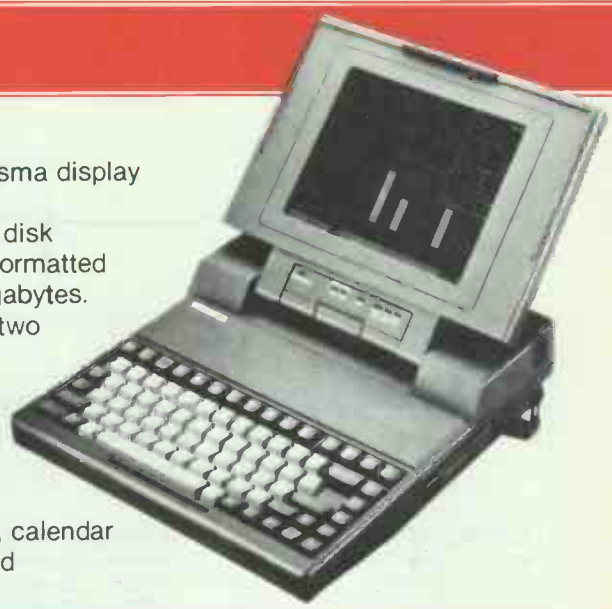

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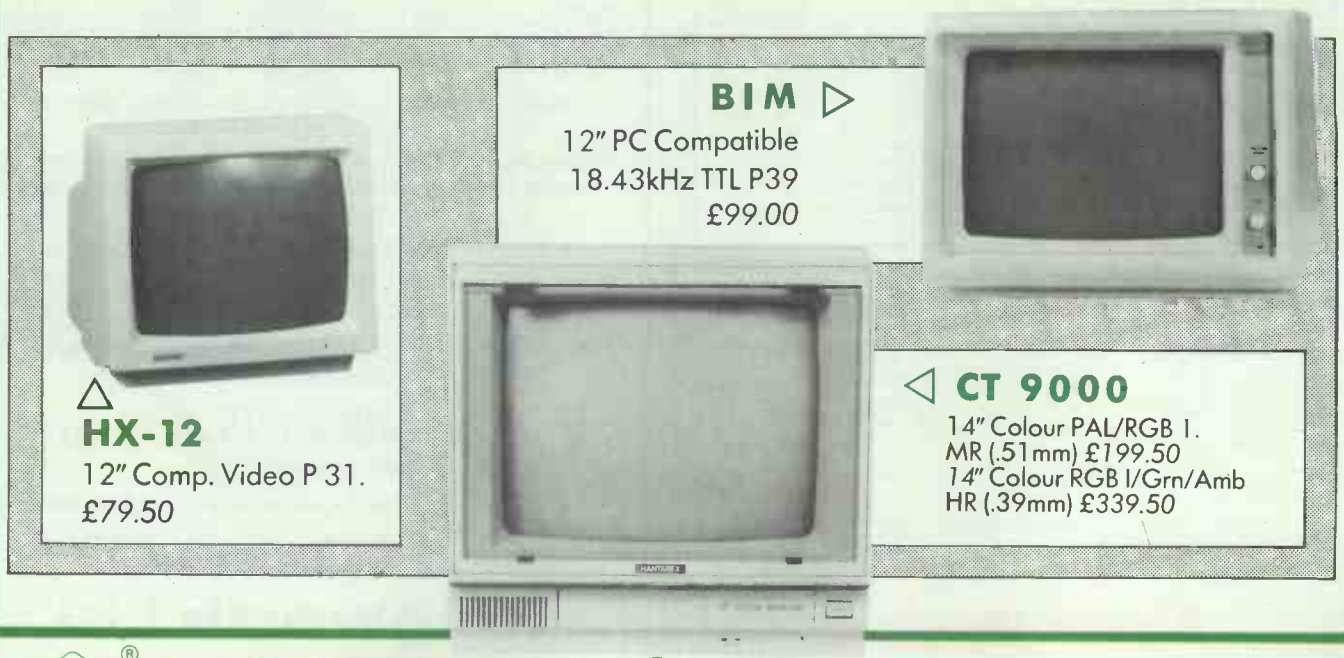

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The Red Box starter system takes you right into the exciting world of home automation from as little as £129.

Just plug in for a more efficient home.

Simple to operate, it plugs straight into your home's ring main and needs no other wiring. You don't need any programming experience to operate it.

The system can control internal and external lighting, on/off switches and dimmers in different rooms in different sequence. It can activate washing machines, tumble driers, dishwashers, hi-fi, television, heaters – in fact, everything operating through your mains via a 13 amp plug.

Prevent daylight robberies.

Most burglaries happen during the day, so the Red Boxes control system works just as hard then as it does at night.

If an intruder enters your home, the Red Boxes control system will see him off sharply.

As soon as its sensor is disturbed, the alarm will raise the roof.

However, more importantly this system can also deter people entering your home by creating an appearance of constant activity.

Turn your home computer into a command terminal.

The Red Box starter system comprises three red boxes.

RED LEADER is a complete 6502 based microcomputer with 16 kbytes ROM, 8 kbytes RAM, peripheral controller with 2400 baud mains modem and host computer link, with an integrated power supply. Its powerful micro-processors turn your micro-computer into a command terminal. This is the heart of the system – its even sophisticated enough to recognise which type of computer you own!

RED ONE is a micro-processor controlled 13 amp mains outlet working under the supervision of Red Leader. With Red One at a socket you have power over domestic appliances and lights connected to that outlet.

RED TWO is a complete micro-processor controlled movement detector which feeds back data to Red Leader via mains borne signals – raising the alarm on intruders as soon as they enter its heat seeking zone.

Unique tamper-proof security.

Our Red Boxes operate a secure communications protocol. Incorporating tamper-proof PIN codes. All 'slaves' – outlets, sensors, switches – are first introduced to Red Leader using their own secret 24 bit address. Secret 'keys' are assigned to every device – lights, TV etc., known ONLY to you, and messages between devices are also encoded using random numbers to further secure the system.

No other Red Leader knows your slave codes; therefore no unauthorised person can interfere with the operation of your system.

Computer to computer communication.

Communication is a vital aspect of our Red Boxes system.

Controllers are not isolated from one another – they are connected with each other, through the mains borne system and so communicate with each other and with Red Leader. If Red Two sends a message to Red Leader indicating an intruder, Red Leader responds by telling a switch unit to activate the alarm.

If you operate two home computers, they can communicate with each other through the system, enabling you to set them more complex tasks. And because Red Boxes have integral micro computers, this leaves your home micro free for normal use outside Red Boxes programming.

The possibilities are endless.

Our Red Boxes are ready for them. With humidity detectors, sensors or additional motors, this system can be used for weather monitoring, aerial rotation, home brewing, greenhouse thermostat control, keyless access via electronic door locks, remote access control via a telephone modem – even a robotic arm for performing simple mechanical tasks like tea making and shoe polishing.

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Trial run.

For a FREE 14 day trial of the Red Boxes control system WITHOUT OBLIGATION complete the coupon and post to: Electronic Fulfilment Services Ltd., Chesterton Mill, French's Road, Cambridge CB4 3NP.

Access credit card holders can order by calling 0223 323143.

Your Red Boxes control system will be delivered within 14 days and if you are not delighted for any reason just return it to us for a full refund.

The Red Box starter system costs £129.

And additional Red One and Red Two Boxes are £34.95 each.

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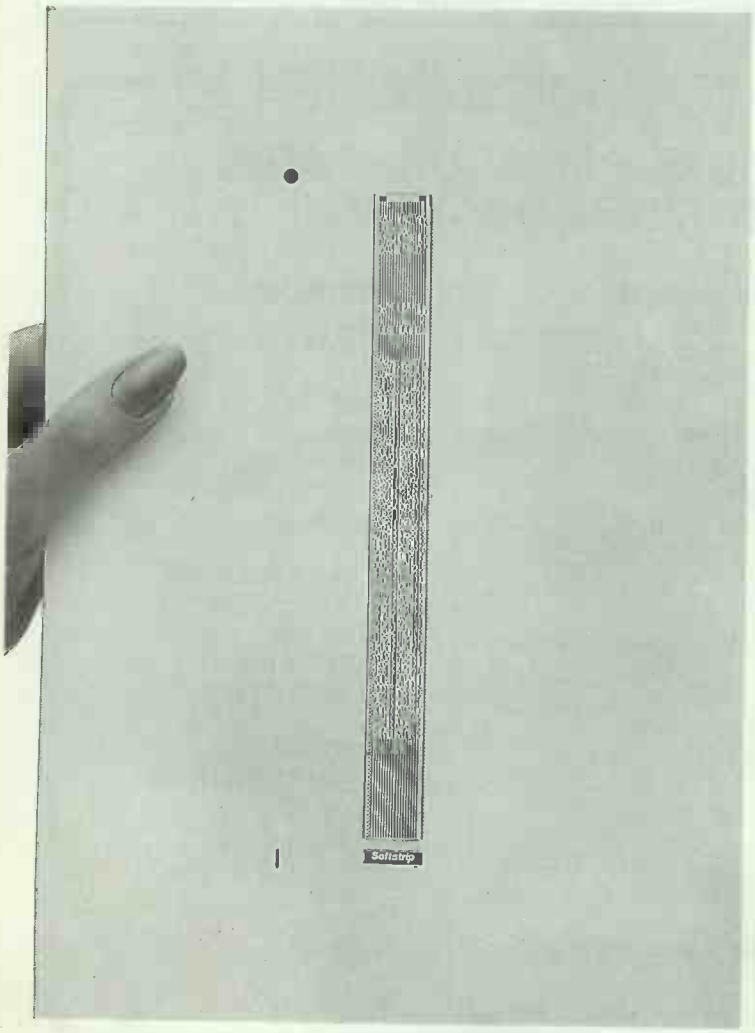
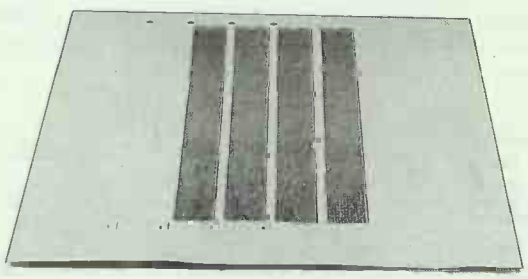
The closer you look at Softstrip, the more clear its advantages become.

Because Softstrip is a revolutionary technology that actually increases the value of paper.

It's print computers can read.





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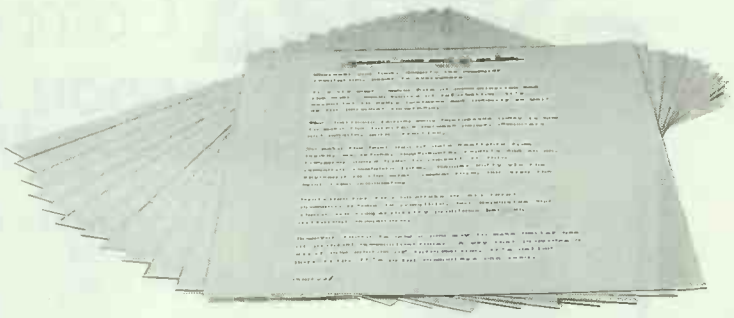

Encoded in the black and white strip is information. It could be anything – data, software, text, graphics, even music.

The printed 'data strips' like the ones shown, can be read directly into a computer.

A single high density strip can hold up to 5,500 bytes of information (about 4 pages of double-spaced typewritten text) and can be read in around 30 seconds.

What makes a Softstrip so valuable?

Softstrip is the most cost-effective way to store, retrieve and distribute computer-readable data.

Because Softstrips are printed on plain paper they can be produced for next to nothing.

And since they're paper, they can be mailed at a fraction of the cost of sending data on floppy disks.

Strips can even be photocopied – making distribution costs lower still.

THE SOFTSTRIP READER COSTS £200 + VAT SRP.*

The savings, however, don't end there. With Softstrip you can turn mountains of paper into molehills. A typical 12 page document, for example, will fit neatly onto four strips.

This not only saves you space, it also saves you time. For when on strip, those same 12 pages can be fed into a computer in two to three minutes freeing you from time spent at the keyboard.

How do you read a Softstrip?

To decipher a coded strip you need a Softstrip Reader (shown above), which plugs into most popular personal computers.

When placed over a strip, the Reader scans the information and transmits it to the computer.

Even if the strip is crumpled, the Reader still works. It can also scan through colours, ink and dirt - even coffee stains.

Print your own Softstrips.

A special software package called StripMaker™ enables most popular dot matrix printers to print Softstrips. And a package for laser printers will soon be available.

Original strips can be photocopied, or should you want to prevent a strip from being copied, simply add another colour across the strip. You can also protect a strip from being read by adding a security code.

What will your business make of Softstrip?

Whatever you want - the applications are virtually endless. You could probably come up with half a dozen ideas of your own.

In the meantime, if you would like to find out more about the Softstrip technology, cut the coupon or phone us for your nearest dealer.

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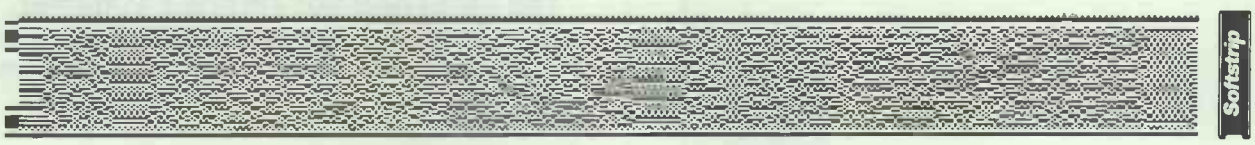

THIS COMPUTER READABLE STRIP CONTAINS AN IBM BASIC PROGRAM TO DISPLAY A DIGITAL CLOCK ON YOUR SCREEN.

What's more, data strips can be read by anyone with a computer and a Softstrip Reader.

A strip containing unformatted ASCII text produced on an IBM PC, for example, can be read by a Macintosh and vice versa.

So copies of data strips can be distributed and read into computers of different makes.

What's the use of Softstrip?

Wherever data is stored, retrieved and distributed, Softstrip provides a cost-effective alternative.

For example, a company's price or product lists could be coded onto strips and distributed throughout the organisation to be read straight into computers.

Confidential information could be put on strips, making it safe from prying eyes.

Research data, budget figures, sales forecasts - all kinds of data can be stored on strips with their original documents and fed back into a computer when needed.

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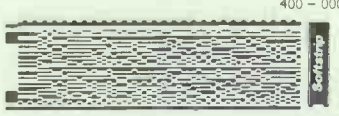

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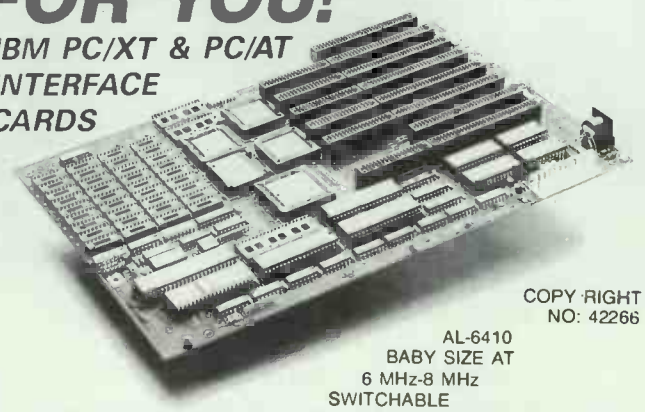

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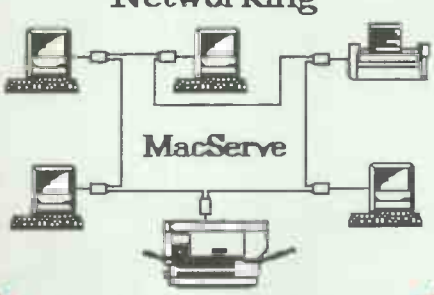

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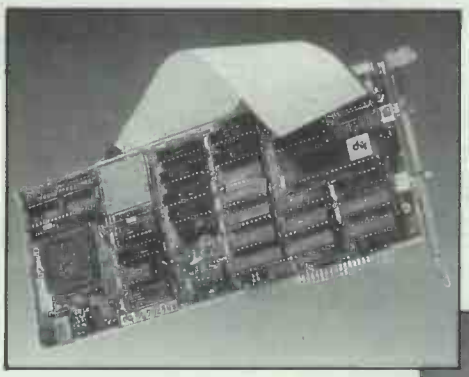

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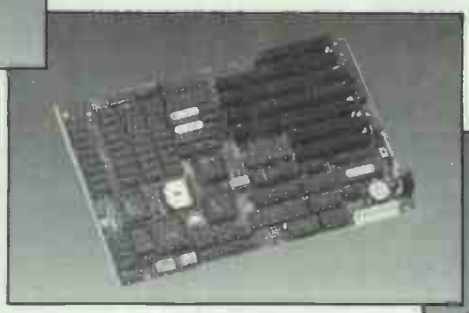

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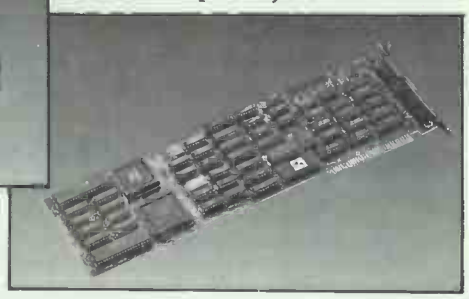

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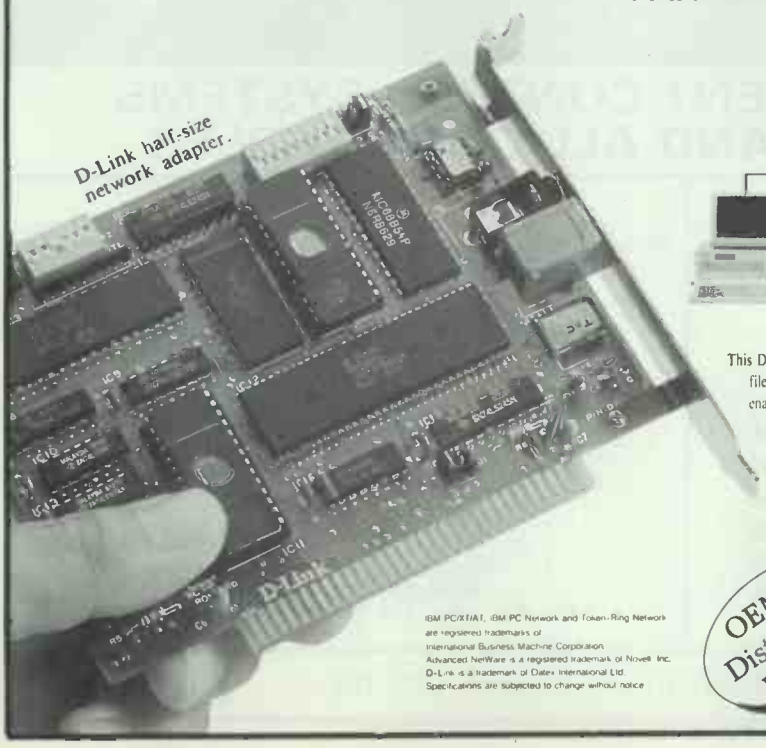

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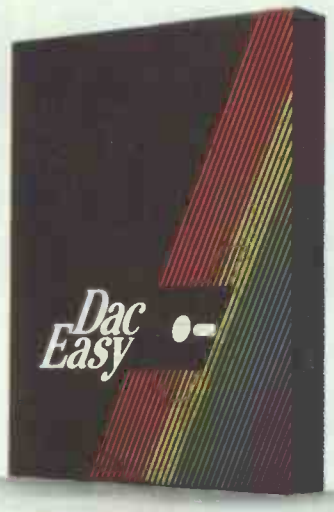

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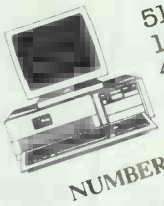

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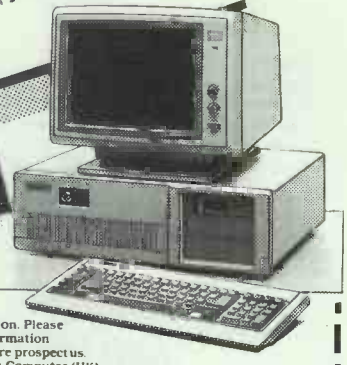

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of the Amstrad PC 1512–

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Trevor Craven

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Managing Director

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A lot! We've been very busy over the summer months, carefully crafting more programming tools for the popular home computers. Our move into new offices (see the address below) with extra space and quiet country surroundings sparked off many new programs, like HiSoft BASIC & Knife86, and improvements to existing ones such as Pascal80 & Write Hand Man. Of course, all the old favourites like C and Devpac are still with us (DevpacST is voted Bruce Webster's Product of the Month in November's Byte magazine) and our free catalogue is fatter than ever (just phone or write for a copy) ..... but we'd like to use this space to tell you something new!

HiSoft Pascal80

Pascal80, our popular Pascal compiler for CP/M machines like the Amstrad and Einstein computers, has changed dramatically. It now includes a fully-interactive editor so that you can edit, compile, correct, re-compile and run all from a simple menu, error messages rather than numbers, variant RECORDs, FILEs of *any* type, register variables, upper or lower case reserved words, CHAINing and more. Pascal80 is now a complete Pascal development system, is still much faster than Turbo Pascal and yet costs only ... **£39.95**

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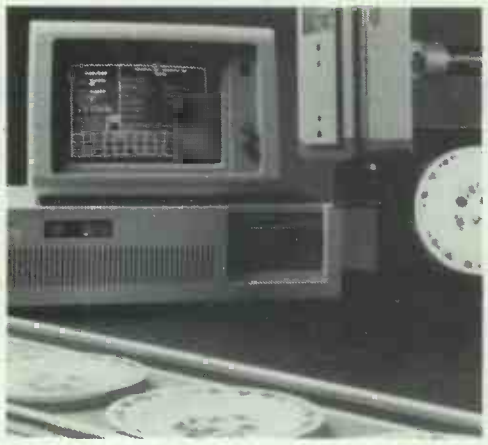

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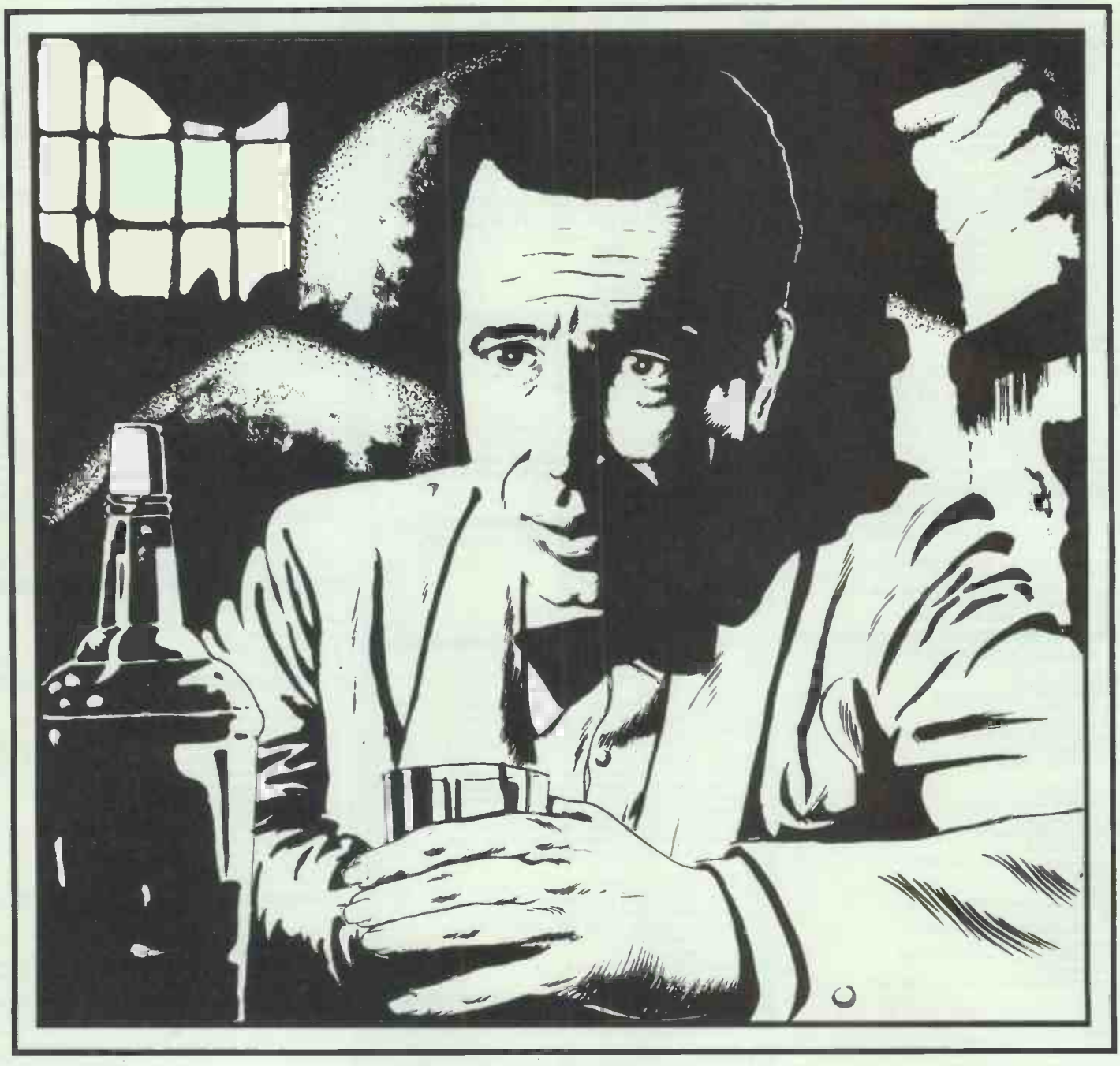

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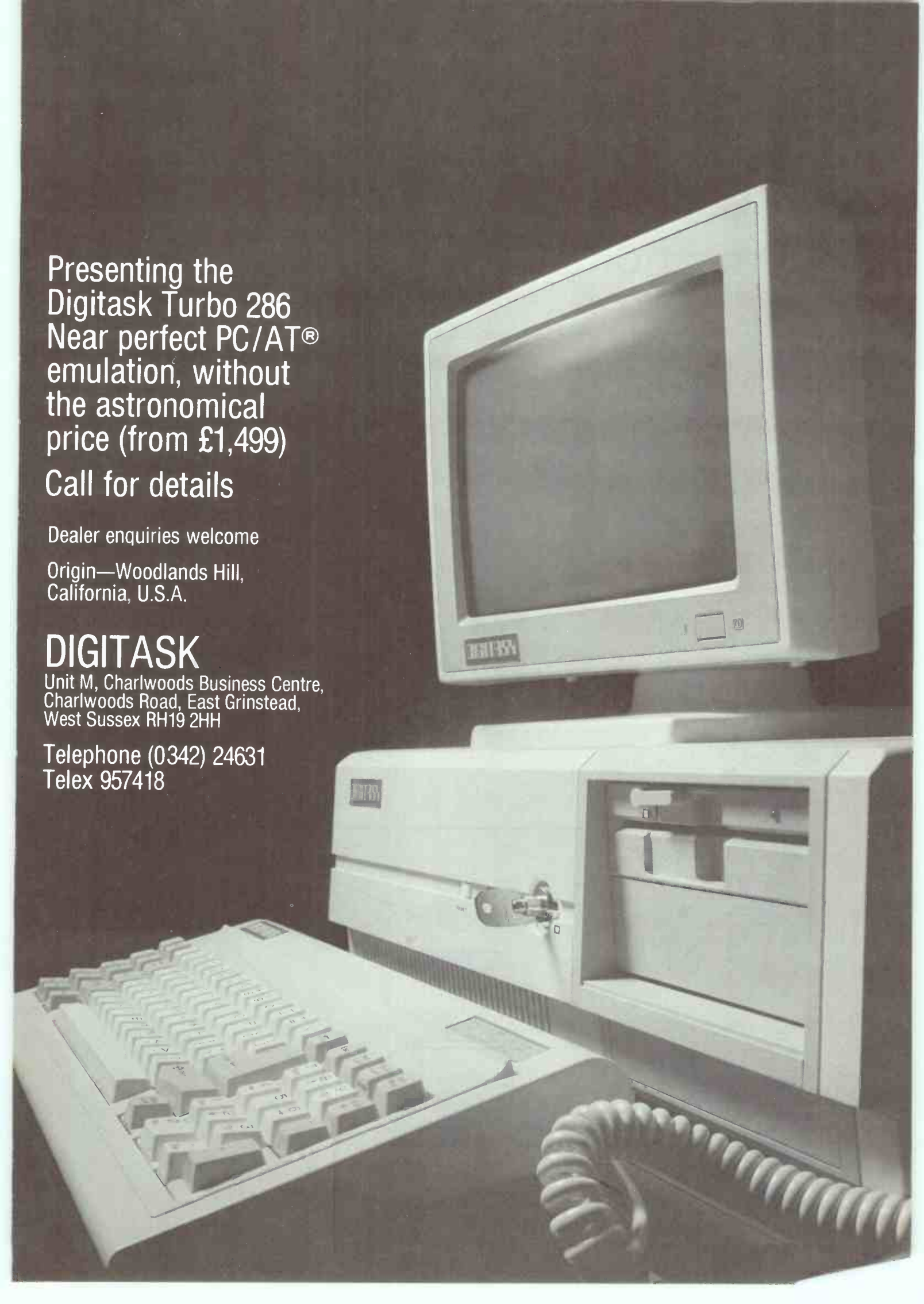
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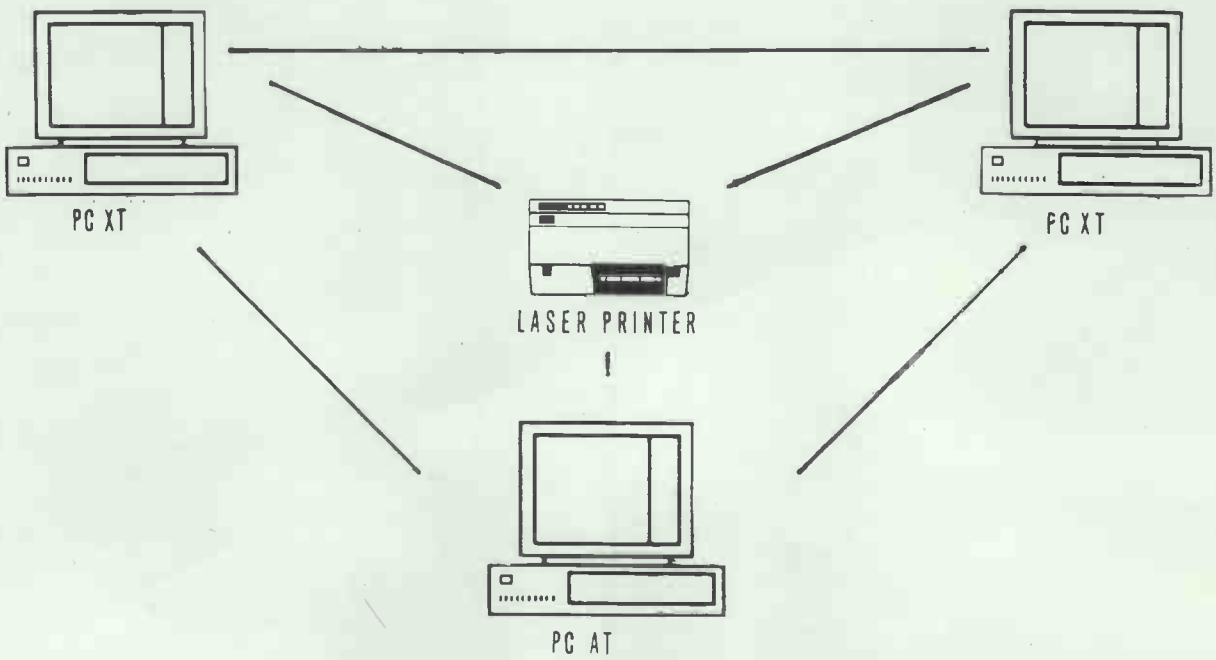

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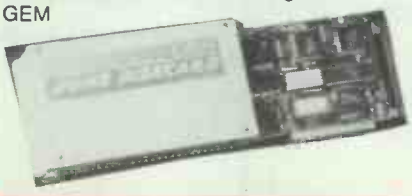

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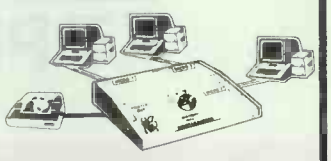

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```
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FDISK     Prepares fixed disk for DOS.
FIND      Searches files for strings of text.
FORMAT    Formats diskettes or fixed disks.
```

```
A>fo_

FORMAT  Formats diskettes or fixed disks.
```

```
A>format /_

[d:]FORMAT [d:][/S][/8][/V][/B][/4][/1]

/S   Copy system files to new disk.
/8   Format disk with 8 sectors per track.
/V   Allows you to assign a volume label.
/4   Format double sided diskettes on high capacity drives.
/1   Format for single sided use.
/B   8 sectors per track with space for system files.
```

```
A>for

FORMAT      Format diskettes or fixed disks.

Purpose:    Initialises the disk in the designated drive to a
            recording format acceptable to DOS; analyses
            the entire disk for defective tracks; and
            prepares the disk by initializing the directory,
            FAT and loader.

Syntax:     [d:] FORMAT [d:][/S][/1][/8][/V][/B][/4]

Comments    Specify the parameters:

            [d:] to specify the drive that contains the disk you want to
                 format.

            /S to copy the operating system files from the DOS diskette.
               (The order is IBMBIO.COM, IBMDOS.COM,
               COMMAND.COM.)

            /1 to format the diskette for single sided use.

            /8 to format a diskette for 8 sectors per track.
               (Format always physically formats 9/15 sectors per track, but
               instructs DOS to use only 8.)

Press return for more help text . . .
```

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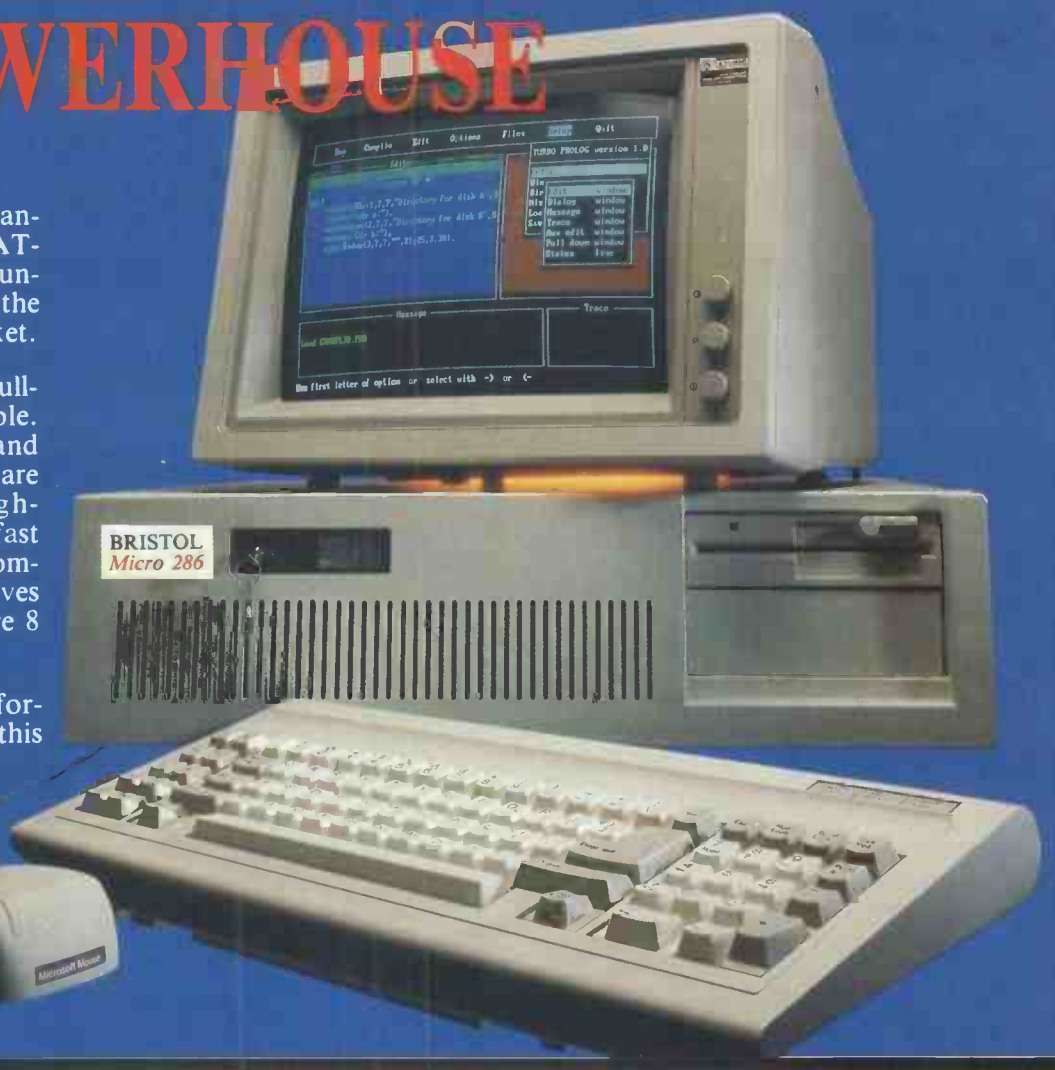

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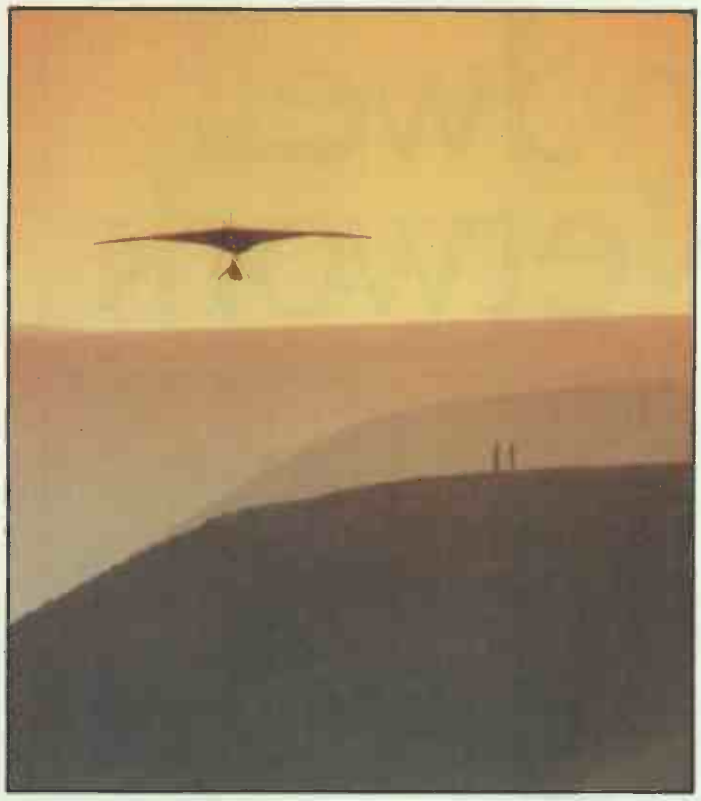

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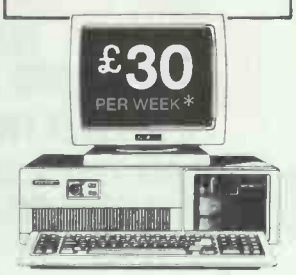

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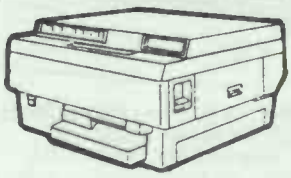

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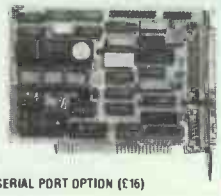

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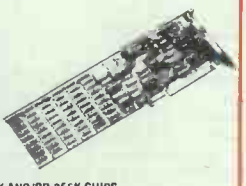

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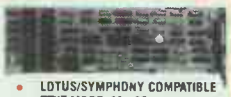

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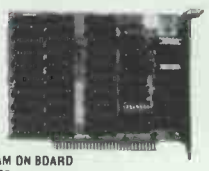

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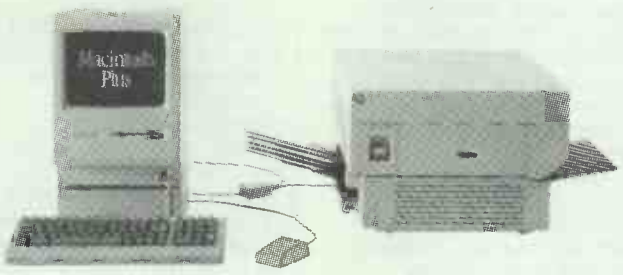

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Access BARCLAYCARD VISA

Amstrad boss Alan Sugar comes under attack for raising the price of the PC1512, while Guy Kewney speculates on the machine's future in the States. Plus, there's an exclusive report from Comdex Fall.

All in a day's work

I am told I should be very angry with Amstrad, for putting its prices up by 12 per cent on the PC1512.

It seems fairly obvious, doesn't it, that the rise in the exchange rate of the Japanese Yen must have been clear at the beginning of last September when the Amstrad PC was launched.

That being so, Amstrad must have known that the £399 price tag (plus VAT) which made everybody get so excited was only temporary. But the company stayed with it.

Tut, tut. Imagine the fuss, if all the things that are being done by Amstrad, were done by IBM! Power supply not big enough to run all the cards plugged in; grumbles about the screen; overheating suggestions from customers; price going up 12 per cent soon after the launch; announcement three months before the machine is actually available in large numbers, endless rumours about the machine long before it was launched, hurting rival sales, suggestions of unreliability on hard disks...

Actually, all those things *were* done by IBM.

When the PC first appeared in the States, you couldn't get one for love nor money in the UK. And supplies in the US were very short.

The display had problems with flashing. To overcome this, IBM put a long-persistence phosphor in its green monochrome display.

The power supply was intended to run a serial card and a display card. At 60 watts (the same as the Amstrad) it used to overheat — and conk out. People used to make a fortune selling new power supplies. Eventually, IBM upgraded the power.

The original hard disks in the XT, I gather, were pretty reliable. The AT's disks, however, were so bad that IBM shipped them without disks. Other people made a fortune replacing them.

And the fibs that the dealers told about the PC when it first appeared! 'This machine runs CP/M,' they said. It ran CP/M 86. 'So it will be able to run most CP/M business software, with minor conversions...' The example given was WordStar, which had been re-compiled. Boy, was it slow! 'It has Basic built in.' So it did, but the Basic was in ROM, and didn't understand disks.

Alan Sugar, boss of Amstrad, has presumably come to terms in his soul with the misery of sharing the hot limelight that shines on IBM.

Obviously, he wasn't expecting such a fuss. As consolation, however, he should get hold of IBM's press clippings — and suddenly, I think he'd see that he hasn't really had a very hard time.

People feel free to say things about IBM and its products which are simply nonsense, pure invention, speculation, and wishful thinking.

And once a particular story has appeared, no matter how silly, it passes into the 'public domain' and everybody else feels they can reprint it — without, of course, admitting that they just lifted it from the pages of a rival paper. And then analysts and observers quote the reports, and industry figures include them in their speeches, and IBM won't say anything one way or the other, and the spurious data enters every database in the world.

IBM can take it, of course. It has financial problems, problems with an old product line and problems arising from its slow planning processes, but none of these problems can be blamed on uninformed speculation.

In this country, I rather think Amstrad can take it too. Let us hope that the company doesn't run away with the idea that success in the US will be equally easy.

That old, hard disk story

The problems with hard disks on the Amstrad PC are problems of supply — there still aren't enough. My own solution to this is simple: get the twin-floppy version, and plug in a Tandon 20Mbyte drive card, costing £400 or so.

Amstrad is buying disks from Tandon, too. In the meantime, it has contacted its distributors and suggested that they don't give a warranty with hard disk systems unless the customer buys a maintenance contract.

That, at any rate, is the way the distributors interpreted the letter they received from Amstrad. Alan Sugar says they are wrong: he is 'heavily recommending' that a maintenance contract is sold. Obviously, he cannot legally supply goods without a warranty until the Sale of Goods Act is repealed (and no-one is planning to do that).

The normal way of getting around the Sale of Goods Act is to tell users that the warranty is 'only valid if shipped back to us in the original packaging.'

Frankly, anyone who buys a business system without a maintenance contract is potty. Anyone who keeps the original packaging is equally so. But if you don't mind being potty about the contract, you should be consistent, and keep the packaging, too.

Seriously, I have no evidence of unusual failures of Amstrad hard disks from one untraceable call from a Scot who claimed to have 200 machines, of which 180 were faulty, a week before Alan Sugar says he started shipping hard drives. For the life of me, with standard disk components, I can't imagine how such a thing could happen, but if I hear from this person again, I'll pass on details.

The claim made for this CompuSonics package, PC/MovieMaker, is that it allows users to record and play back video and audio on the IBM personal computer. With a high-performance disk, the company says, you can get 30 frames per second and high-fidelity sound, from video cameras, video tape, and other sources.

On top of that, it says that it has integrated R:base 5000 (now sold through Microsoft) and the Easy Trieve user interface, so that you can catalogue and selectively retrieve all recorded material.

The system isn't complete yet, but details are on (415) 494 1184.

Hands across the water

After a visit to Comdex last November (report on page 112), I am convinced that Amstrad has no future with the 1512 in the States. Instead, I think Alan Sugar will rush into a new model, based on the 80286 chip, and capable of working with high-resolution

graphics cards — possibly even including an EGA standard output — and launch it in the US.

In the States, prices have always been lower than in the UK, and one reason Sugar's prices look so good is that he is selling in the UK for the sort of prices that Americans have been able to get anyway.

Shipping from the Far East to the US, Sugar could get the same sort of price levels — but then you look through American newspapers, and realise that it simply isn't good enough.

The leading clone in the States is the Leading Edge, built by Mitac in the Far East. Including some applications software, this machine (with 256k and two disks and screen) fetches $1100. With comparable software, a two-disk mono Amstrad would cost around $950 to $1000. The Amstrad would be faster, because of the 8086 chip, and would include GEM and a mouse — but the Leading Edge is brand leader.

As the brand leader, Leading Edge is only slightly below the street price of a genuine IBM machine. I have seen two-disk IBMs with screen and keyboard, for $1200 — and that includes a card to provide serial and parallel ports and colour output, supplied by the dealer. To compete, a new model would have to come in with an enormous amount of publicity effort, or a much lower price.

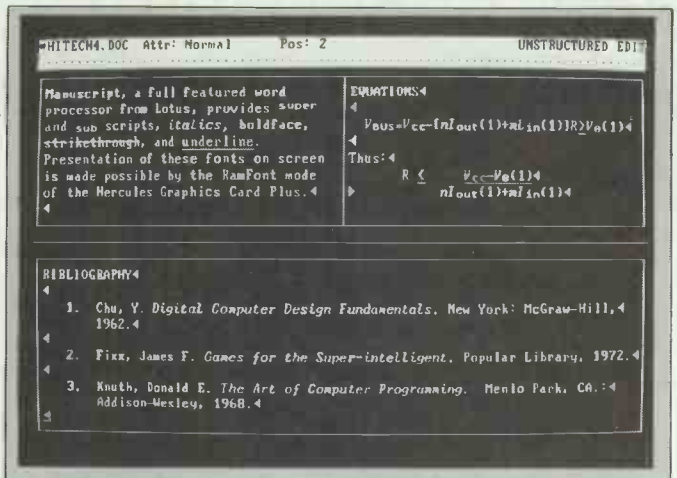
The much lower price is coming from Hyundai of Korea. It has just launched the Blue Chip range of PC clones, without the advantage of the Amstrad's 8086, but without the disadvantage of not being able to run EGA graphics — a big, big seller in the US.

Other well-known clone makers such as PCs Limited are launching AT clones — using the 80286 chip — running at a thundering 16MHz clock speed — the same speed as the 80386 uses today. The price is well below the standard AT level. The company's standard XT clones are very nearly on the same price level as the Amstrad.

GEM isn't an advantage in the American market. Actually, we have yet to have it proved that it's an advantage in the UK market.

David Wagman is head of Softsel, the very big software and hardware distributor in the US (also in the UK, but not so big) which had planned to take the Amstrad PC1512 into the States. Wagman told me that he didn't rate the Amstrad's chances in the US.

But if Amstrad could put together a similar package with AT speed and a 16-bit bus and EGA display, that might be a different proposition altogether.



A demonstration of Manuscript, the new 'document processing' system from Lotus, has been doing the rounds of the software distribution people, both in the US and here in the UK. If the product works half as well as the demo looks, this one must be a winner.

The idea of 'document processing,' as distinguished from word processing, is one which probably overlaps with many of the concepts people have about desktop publishing.

For Lotus, the aim is to give the author control of long, highly-structured and frequently-revised documents. For this purpose you need to be able to see the structure of the document (so an outline processor is essential); you need to be able to see how the document will look, page by page (so powerful print formatting and page preview tools have to be provided); and you need to be able to feed graphics and data into the document from other programs — without having to type them out first.

There is also an indexing function. There is a spelling checker. And very exciting, if it works the way I imagine it will, there will be a 'document compare feature, that highlights revisions.'

What is clever about the product, however, seems to be the way Lotus has totally bedazzled the distribution bosses. People like Pam Fisher of P&P Micro say they will 'get one and start using it for everything.' And people like David Wagman of Softsel are saying: 'Most executives will be using this product.'

Selling to the distributors isn't the same as selling to the end-users. A program called Trigger, sold to and through Softsel, had the entire management of that company absolutely knocked back on their heels, two years ago. Nobody bought it. A Macintosh product called Filevision ran into similar problems, with distributors reducing prices, reducing prices, and then reducing prices again, and finally bulldozing the whole lot into land-fill sites.

Softsel, however, is so convinced of the potential of Manuscript, that the company used it to demonstrate the new Hercules graphics card, the GC Plus — which is why I can show you this nice picture of the product before it is available.

Death to live television

With typical acuteness, just as computer fever reaches an unprecedented pitch in the UK, Thames Television, Channel 4 and now the BBC, have decided that the subject is unfashionable.

I can't pretend to speak dispassionately. I earned a fair income from Channel 4 and Thames when they had their series *Database* and *4 Computer Buffs*.

But the death of the BBC series *MicroLive* baffles me.

One can only assume that *MicroLive* was produced on a weekly basis for no better reason than to look better than the Thames series, which only ran to seven episodes per year. Now that Thames is out of the running (due to behind the scenes scandals totally unconnected with the program or its producers), the BBC obviously feels that it has a neat way to save £250,000+ a year.

And of course, the incredibly popular *Chip Shop* on BBC Radio is a thing of ancient memory.

Just occasionally, you find yourself wondering if television mandarins live in the same world as the rest of us.

We seem to be a nation of pop-music freaks, without a classical instinct among us. We play endless parlour games. We have no interest whatsoever in motorbikes, cars, technology, literature, or architecture, to pick several subjects which you might have thought (mistakenly) to be of everyday interest to most of your friends.

Of course, the cynical will suggest that the real reason television shows this bias is not a question of fashion. They will say that it's because the people who run television stations are an ignorant, technophobic bunch of idle, overpaid snobs.

You don't believe that, do you?

Window on the world

Bill Gates of Microsoft was given a special award — at a ceremony hosted by *PC* magazine — for the 'Most Influential Individual Of The Year'.

How I hate award ceremonies! How foolish they are, and more important, how unerringly they seem to signal a change in the fortunes of the person receiving the award.

And usually, how mis-directed they are, too. If ever there was a time to seriously cast doubts on the future influence of Bill Gates, head of Microsoft, prime purveyor of MS-DOS, and attempting purveyor of Microsoft Windows, this must be that time.

I yield to no-one in my admiration of Bill Gates himself. His mind is keen, his analysis of the future is always accurate, and on top of that, he has managed to create a highly profitable software company which has gone public with its shares, and made a success of it.

But the basis of the award seems to have been that MS-DOS is more important than

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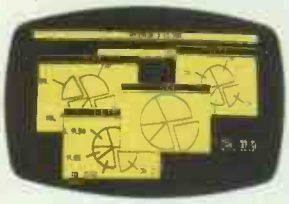

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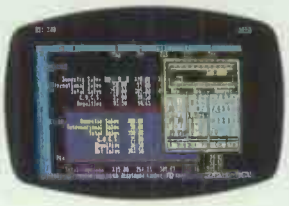

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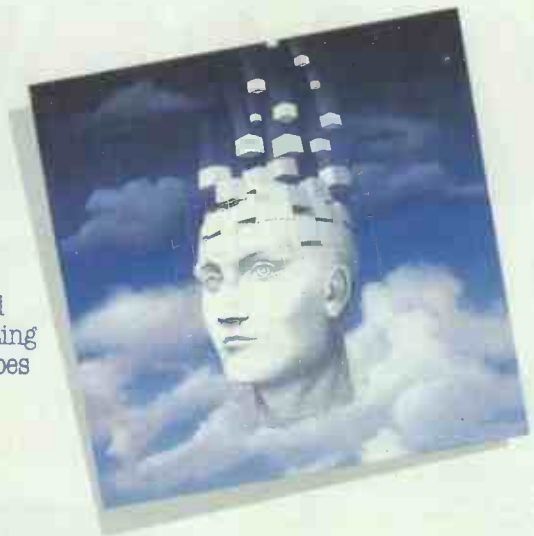

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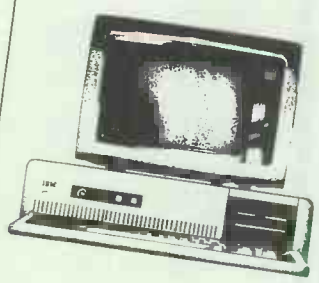

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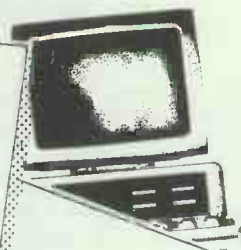

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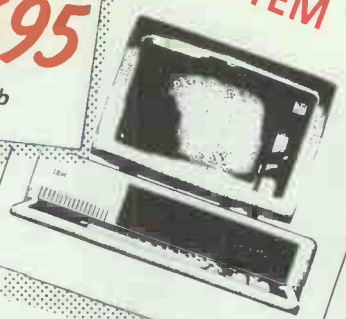

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IBM, and Windows more important than whatever IBM comes up with.

Windows, for those who use Apples or Ataris, is an attempt to tame MS-DOS by giving an intuitive set of commands to the MS-DOS user, rather than the hard-to-learn mnemonics that it uses today. Windows also provides several graphics and other modern 'hooks' for software designers to hang programs onto.

No-one seems to doubt that Windows is a good idea. No-one, that is, except IBM, which has definitely told Microsoft that it will *not* be adopting Windows as a standard on its next generation of hardware. (Of course, IBM *can* change its mind.)

But even those who like the idea of Windows, can't agree on what it will be like on big, powerful chips like the Intel 80386.

Oh, the present version of Windows works well enough on the 80386. In fact, several disillusioned people at Comdex took time out from whatever else they were doing, to suggest that it wouldn't work sensibly on anything slower — an exaggeration. Windows works acceptably on an 80286.

The problem that bothers insiders is: what version of Windows are we heading for — and when?

All the prediction merchants — market research people, presidents of big corporations and writers — are forecasting something called DOS 5.0, or alternatively, something called Advanced DOS 1, in March. And a multi-tasking version of Windows is due in 1987, too, and several people seem convinced that the two go together, and will be available before June.

Some people even seem to be betting their future product line on this.

John Walker, author of AutoCad, is an optimist. He believes in the SDI, Star Wars. On Windows multi-tasking, he said: 'I've written three operating systems in my time, and not one of them was anywhere near ready on time. A multi-tasking operating system that emulates a previous operating system is asking the ultimate from a programming team. It will be late, if it works at all.'

For desktop publishing programs like Aldus PageMaker II, Windows is essential. PageMaker II is an extraordinary piece of design, being a text-manipulation package that doesn't understand text entry. It doesn't have a way of accepting text from the keyboard.

How does the text get in there? You create it on a word processor, and cut-and-paste. To do that, of course, your word processor has to be running at the same time — using multi-tasking. Windows provides this feature.

In the absence of a serious alternative to DOS and Windows, most people are announcing support for Windows.

Tony Bove and Cheryl Rhodes, the American equivalents of our own Henry Budget, produce, like him, a desktop-published newsletter called *Desktop Publishing*.

They describe this 'everybody votes for Windows' phenomenon unkindly, as 'The Windows Conspiracy'.

To quote the latest newsletter: 'Fifteen companies recently announced products to run under Windows, all of them for desktop publishing applications. The news came on the heels of a joint announcement from Hewlett-Packard, Aldus and Microsoft, to promote Windows-based desktop publishing.

'At the press conference and the 'Windows At Work' seminar, however, development work was still not completed — the Windows-based desktop publishing solution was still at least three, possibly six months away.'

The purpose of the 'conspiracy', said Bove and Rhodes, 'was to take sales away from Apple, which is doing very well these days. In August, according to Infocorp, 12 Mac, eight Apple IIe and eight Apple IIc computers were sold through retail channels for every nine PC XTs and ATs.'

That's through retail. IBM does sell an awful lot of machines direct to corporate buyers, so don't take out your calculator until you can get the rest of the picture. But even so, it does show that the IBM world has not got the total dominance of the market that Microsoft would have you believe.

Without Windows, of course, none of these desktop publishers can get a product to market, they say — which is odd.

Lotus has released Manuscript (see picture story on page 107). Despite a previous announcement that future products would use Windows, Manuscript doesn't. If Manuscript isn't a desktop publisher, then there is no such thing.

Xerox has released Ventura Publisher (reviewed in this issue on page 178) which uses GEM as its graphics environment. It seems to work — no full-time test done yet, but I've seen Digital Research using it under fire. Ashton-Tate is working on getting Skisoft's package out. That doesn't use Windows. FrontPage doesn't use Windows.

More to the point, you can use these products on existing IBM PCs and XTs, and equivalent clones. You don't need the 80286 chip — which you certainly do need for Windows.

So, is Windows in a position to compete, yet? Bove and Rhodes think not. At the Microsoft seminar, they noted, AB Dick admitted that the product on display was not complete, nor was the Windows interface.

Xerox was there, with Ventura, under the banner of 'We will support Windows.' But Bove and Rhodes note, sceptically, that this is just a statement of intent — not a single line of code for that project has yet been started.

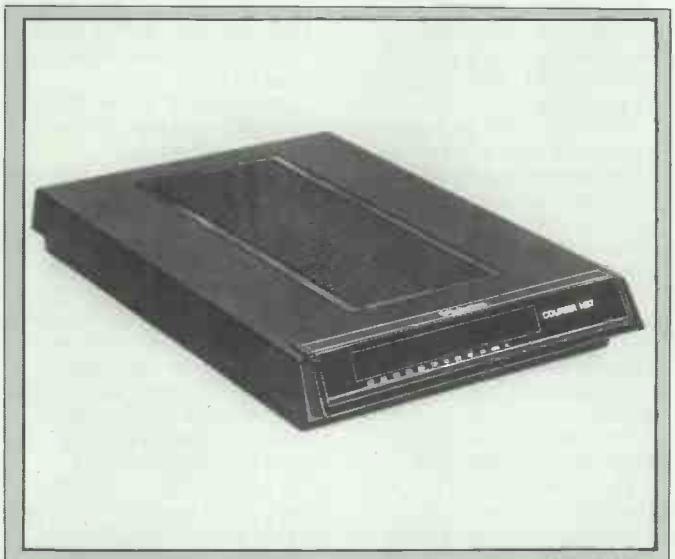
Windows has a lot going for it, if it ever meets the design specs.

In theory, at least, I don't mind giving up some processor power to the job of making the system easy to use. Multi-tasking is a goal which will give amazing rewards to the users, and amazing riches to the first competitor to reach it.

But two things have to be said about Windows multi-tasking. First of all, it isn't ready. And secondly, there is strong evidence that IBM has turned it down, flat, as a product for its own new products. Instead, it wants to sell us a graphics-enhanced version of Top View.

I think this is mad, crazy, sick, and suicidal, but I can't honestly suggest that Windows is a certain enough development that IBM should seriously consider it as an alternative.

For 1988, perhaps. For 1987? I really think there's an opportunity for someone else to step into the gap.



What do you get for $900 in the UK modem market? A 1200 bits per second modem, possibly a 2400 bits per second modem, and nothing to dial into with it.

In the US, you can now get this US Robotics 9600 Courier. It runs at 9600 bits per second, works on standard voice-grade dial-up circuits, user MNP error correction, and (grind those teeth) there are dial-up packet switching nodes to which you can connect.

I need hardly add that selling off BT was in no sense a method of getting money out of something that very badly needed public money put into it. Nobody could possibly imagine that BT had fallen behind on investment on switchgear, networking, and user friendliness . . .

REPORT FROM COMDEX FALL, LAS VEGAS 10-13 November 1986

Taking the wraps off Amiga 2500

Four IBM PC slots, connected to each other and to nothing else, have been included in the latest computer from Commodore – the Amiga 2500, due out in March. It will include the ordinary Motorola 68000, not (as everybody thought) the much more powerful 68020. It will have a new standard, 100-pin Amiga bus. There will be room in the box for a lot more than today's single 3.5in floppy drive – in fact, there will be room for three disks, one of which can be a 5.25in drive.

The machine is officially still secret. It was known as the 'Ranger' until it unveiled in Monterey, California, to a collection of slightly dubious software developers, and it is meant to be the top of the range of three models, with the original Amiga being renamed the Amiga 1000, in the middle of the range.

This 2500 machine has been expected ever since the original Amiga was launched last year. Almost nothing about it is exactly what people expected. Even so, it's pretty impressive, and if Commodore lives long enough to launch it, it could make a big difference to the Amiga family.

Almost no information whatsoever was available on the baby Amiga, however, which surely must be the most important of the three.

Commodore's sales bosses, in Monterey, spoke earnestly about the need for a new strategy. This includes, for the first time in America, apparently, the original notion of spending money advertising it. It also includes the idea of 'migrating' people from their current seven million Commodore 64s (there will be eight million by the time Commodore stops making that machine) to the Amiga.

Logically, that means that the new Amiga must cost something close to £300. I bet you anything it doesn't, but we'll have to wait and see what Commodore does, before pouring scorn on it.

In the meantime, the big 2500 model has enough surprises.

The idea of four expansion slots – suitable for plugging in memory extension cards, hard disk cards, local networks, and so on – is to make the Amiga happy about sharing a world with the IBM PC.

To make the slots 'come alive' however, you need to make the machine compatible. To do this involves buying a plug-in IBM PC card, including 512k of memory.

Both the 2500 and this card were designed in Commodore's offices in Germany, and neither has a price yet. Theoretically, the plug-in card should cost very little indeed to produce, and could be sold for a price of around $200 – theoretically. Also theoretically, the whole system including a hard disk could be sold for under $2000.

At that price, with built-in IBM compatibility (just add a 5.25in diskette, at $100 and the IBM card for $200), the machine would be pretty irresistible.

Not all the people at the conference were totally convinced that the future will unroll in that irresistible way, however.

For a start, Commodore's history on pricing policy (especially in the UK) suggests that the new machine will probably be offered for around £4000.

Next, there is the question of how stable the company is. Commodore says it is doing very well, thank you, with losses down, turnover up, and all signs strong, fewer managers, and an advertising budget, and Gail Wellington, strong honcho in charge of the Amiga's software program, moved from Maidenhead to Westchester in America.

Exactly what Commodore's bankers think is not a question to which I can get an 'on the record' quote as an answer. Commodore's approach: 'They must think we're OK, or they wouldn't continue to back us.' Well, that's true, but the logic doesn't tell us yet whether Commodore's bankers will, after all, continue to back the company. This time next year, we'll all know what the answer would have been, but for now, you believe whosoever you want.

Fans of the Amiga say they don't care. 'Jack Tramiel at Atari badly wants to buy Commodore, the company he originally started up. He urgently needs to give Irving Gould (the man who fired him from Commodore) the sack. And so the Amiga is safe, one way or the other.'

It sounds water-tight, doesn't it?

The trouble is that Tramiel has been indulging in an expensive lawsuit, attempting to prove that the Amiga's special-purpose chips actually belong to Atari, who commissioned the early developments. It is thought by most of those who speak to him, however, that he doesn't really want the Amiga, or its chips.

What he really wants, they say, are the next chips in the Amiga series, which he can plug into his ST range.

The question which this theory answers is: 'Why on earth would Jack Tramiel want two, incompatible, ranges of 68000-based computers – Amiga and Atari? The answer is: he doesn't. He'll kill off the Amiga, and plug the next-generation chips (they say) into the next Atari ST.

So, there are no certainties; which is where we came in, isn't it?

Bits and pieces for the Amiga

The one thing which everyone expected about the Ranger Amiga, the A2500, was a Motorola 68020 32-bit chip.

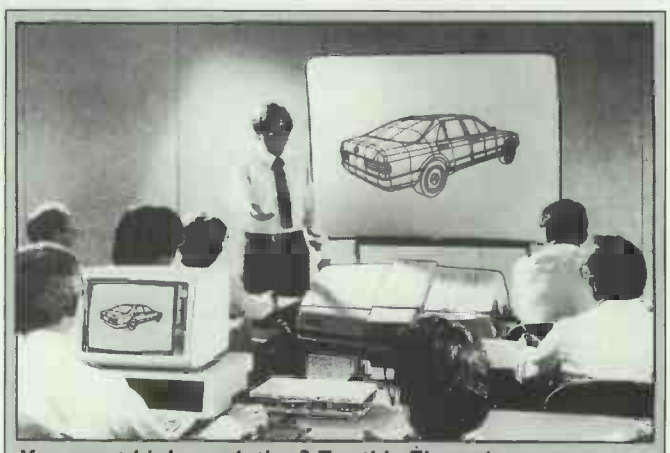
The one thing no-one expected was a new bus standard, using 100 pins instead of 86, and code-named Zorro. So much for expectations and disappointment: at least the new bus works with the 68020 in its expanded form.

That chip is available, in a variety of add-on forms, from several people who showed their wares at the Monterey conference.

Biggest and most ambitious was the Turbo-Amiga launch from CSA, Computer System Associates of San Diego. This company also had inside information — details of the new bus standard using 100 pins — which others at the show felt was a surprise. They also felt it shouldn't have been a surprise.

The CSA add-on is a crate that stands next to the Amiga, effectively using the Amiga simply as a display terminal. Because it has its own 32-bit memory, and up to 8Mbytes of it, it can run a very great deal faster than the internal 68000 processor.

According to CSA, the box



You want high resolution? Try this Electrohome projection system. It runs at twice the scan rate of the fastest Professional Graphics Adaptors available today — at 65KHz. No, I don't know how on earth they took the picture. I suppose fast scan rates make it easier. The cost? A piffling $12,000. Details in Canada on (519) 744 7111. I haven't found a UK source, yet.

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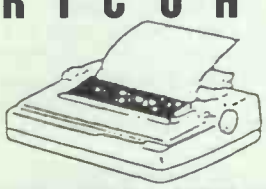

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The local area network supported by Olivetti in this country is the Fox Research 10-Net. These boxes are the methods offered by Fox to attach fibre-optics to a 10-Net installation. Eventually, that will mean enormous improvements in speed and security for network users.

runs 120 per cent faster if you do no more than use the 68020. Adding 512k of 32-bit memory makes it 280 per cent faster. And running a well-known graphics test, the Mandelbrot display, takes less than three minutes — compared with 50 minutes on the standard Amiga — which in its turn is a pretty fast Mandelbrot processor. A standard IBM PC would take around 24 hours to do the same test.

From ASDG, two expansion chassis do much the same job, but one uses the old 86-pin bus, and the new one uses Zorro. Only hints of an add-on 68020, however, and no date. Lots of cheap memory.

To run 68020 code, you need a different assembler — OK, you don't need it to write programs, but you do if you want to use the new extended instructions and facilities provided in the bigger processor. From Quelo Inc, there was a 68020 assembler — native and cross assembler, for Amiga, and PC micros.

Other new items to attract the eye at the Monterey conference included a software package to drive laser printers.

JetSet is available for a number of lasers, including HP LaserJet, and is supposed to allow creation of files for transfer to MS-DOS computers that use the HP printer. The company is C Limited, which also does hard disk and SCSI controllers for it.

Printing what you see on the screen is something everybody wants to do at some time; so I thought Grabbit was neat, at $30. The trick of dumping what you see on an Amiga screen is much harder than on normal micros, because there are several processors grinding away all the time, creating the image. That's from Discovery Software.

The Amiga software which holds out the most interesting promise is the Maxisoft series, which is still dragging through development. Electronic Arts is supposed to be publishing it, but it is holding back on the grounds that the program is full of bugs. Mike Lehman, who is writing the stuff, retorts that if EA had come across with a little funding for the project, he could hire someone to debug it! In the meantime, he's set up Intuitive Technologies, with three products.

The one I liked was Encore, which repeats mouse movements. You set it up to record what you do with your hand — it might be a picture-drawing sequence, or a series of pull-downs and menus. Then it plays back exactly what you did, whenever you like. For example, you can write something in a big fat pen, and then redraw it in a thin one, providing shadowing . . . and so on.

Firebird moves into new terrain

The software produced by Firebird is games software — up until Comdex, when Firebird Licensees Inc (FLI) showed a desktop publishing program called Laser Quill, plus several expert systems shells.

I couldn't find FLI in Las Vegas. However, people who have seen LaserQuill speak very highly of it, and at $200 on the Macintosh, I can see why.

It is described in the *WYSIWYG* newsletter as 'a combination desktop-publishing, page-layout and word-processing package, which can work with up to four documents of up to 698 pages in length at a time.'

Cleverly, Firebird in this country hasn't decided whether to launch them, or when. So for details, contact the American subsidiary, where Marten Davis, the president, is on (201) 920 7527 or (201) 444 5700.

The expert system packages are unique: the technology editor of *Punch*, Michael Bywater, believes that expert systems are 'an obvious vehicle for publishing.'

He's feeding travel information into them, producing the first of 'The Advisors' — packages which you can chat with about where you are, and what you want to do, and what you like doing, and get a recommendation that you don't eat out in this town, but try an all-night disco on 34th street...

Other Advisors will handle insurance, house selling, and so on.

As *PCW* went to press, Firebird said it would make an announcement 'probably before Christmas' in the UK.

Far from logical

The most fascinating demo at the show, however, was the silliest.

Flight Simulator, written by SubLogic and sold to Microsoft, is available on the Amiga with a difference. This is that two Amigas can talk to each other down a serial line, and the two players can actually see each other on their screens. Eventually, they'll be able to have dog-fights.

That's obvious enough. What struck me as absurd was the demonstration SubLogic had chosen for this.

The operator had put three Amigas side by side. The central machine was running the main program. The side-lined machines were running in slave mode, displaying the same position and attitude of aircraft, but using a different view. The machine on the left showed the three-quarters forward view West, and the one on the right, the East.

The effect was very convincing. No-one is ever going to buy three Amigas to run Flight Simulator in 3D mode, of course, but it's interesting to know that it works if you want it.

Aiming too high?

The most amazing colour display I have seen so far is a totally flat-fronted Zenith box, running at 31KHz scan rate.

The salesman at Comdex stood proudly by it (as well he might) and said: 'This is not for sale to anyone except Zenith Data Systems, our computer subsidiary.'

The top right-hand corner of this very, very high-resolution display was a little bit fuzzy.

Suspicious, I checked with other people in the colour monitor business; and yes, Zenith is having slight problems in producing this miraculous device for general consumption. 'It's not that they won't sell it,' said one rival manufacturer (who is in deep negotiations to buy it), 'it's that they still can't make enough of them to sell.'

When the company does, things will be fine. The product will probably work with whatever video standard IBM chooses for its next two machines, too. But since no-one knows what those are, yet, we might as well ignore that aspect of things.

80386 machines hit the market

In no particular order, the people who announced 80386 machines at Comdex included: Kaypro, Mad, GoldStar of Korea, Zenith, American Computer and

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Furthermore, the PC+ is only three-quarters the size, is considerably easier to use, and is absolutely packed with extra features (including colour and graphics). Indeed, it has more built in as standard than any other PC on the market.

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Peripheral (AC&P), Applied Reasoning, and Blue Chip (a threat).

There were others who showed machines but didn't announce them (an important distinction to marketing minds) including PCs Limited. PCs Limited produced a machine which it says will run at 24MHz, when the 80386 will – using fast interleaved static memory to do this. It should maintain the company's reputation for low cost, using only 30 chips on the motherboard (compared to 175 on an Intel system motherboard).

I mention this because the company showed a 16MHz 80286 machine, which considerably undercuts the 80386 systems on price.

Applied Reasoning followed the example of Intel itself, the company which designed and builds the 80386. It offered a board to plug into your ordinary PC.

This one was unique, says Applied Reasoning. Most 80386 go-faster boards fit into an AT, which has a 16-bit bus. The PC elevaTor 386, however, will work in the standard 8088-driven PC or XT. More important still, the company claims, it will work in 8086-based clones – for example, the Olivetti, or the Amstrad. At $2000, it might be worth a call on (617) 492 0700.

The Korean company GoldStar frightened a few people, with the GS-PC 386, because the company is known for its ability to undercut American producers' prices. But the company didn't quote prices at Comdex.

Mad didn't quote exciting prices; instead, it described its 80386 as a high-performance workstation, and sold it as an artificial intelligence box. This is jargon for 'not low priced at all.'

Zenith showed a machine which wasn't ready. The company admitted this, and promised the box for early this year. Kaypro, by contrast, introduced three 80386 systems which aren't ready, and didn't mention this fact except as a sneaky little comment at the bottom of paragraph three.

Kaypro, amazingly, has produced an 'entry level' unit in its Kaypro 386 model A. It includes a 1.2Mbyte floppy disk, no hard disk (but a controller board ready for one) and 512k of RAM.

No, it wasn't fascinating, was it?

IBM is known to be working on the 80386 chip – but was virtually the only company not showing a system with it, at Comdex.

And there was even the start of a race for producing operating software for the machine, with enterprising firms taking advantage of IBM and Microsoft's delay.

Laser Digital showed a Pacer-386 model, remarkable for having its own 22-bit expansion bus – and having two of them.

That system will cost $5500 with a 32Mbyte hard drive, and start shipping later this month.

Multitech has a model 1100 for $4000 with a 40-Mbyte drive, but no innovative bus.

Biggest splash on the software side was from Phoenix, which has sold its 386 operating system to Microsoft.

The plan is to allow PC-compatible packages to run without modification as tasks under Xenix on 80386-based computers, under Phoenix's VP/ix. The big surprise here was for those of us who previously believed Microsoft's assurances that this would happen anyway.

The Software Link of Atlanta announced 'a single user, fully multi-tasking version of PC-MOS/386' for $195. The normal version does multi-user operations: there are now two multi-user formats, one for five, the other for 25 users.

IBC (Integrated Business Computers) showed its Ensign 386:10 running another operating system, Theos. Excitement over this was pretty muted, however, since the software isn't a 386 implementation, but runs on the 80286 AT family as well.

Frankly, when all these have proper graphics support, I'll start taking serious note of them. At the moment, Digital Research has a better chance than any of them, despite my reservations about GEM, and Microsoft Windows virtually requires a 386 chip, so it will probably appear in droves on these machines, just as soon as IBM presses the button.

Where are the real innovators?

Chairman of the board

All you need is another five modems, and five serial ports, and your IBM family micro will be a six-user bulletin board. The software to do it is called Chairman.

In America, where this software was developed, the cost of six modems at $150 each (or less) is roughly the cost of one modem in the UK. In America, they probably think the price of $995 is quite high: here, by comparison with the hardware, it will probably look ridiculously cheap.

The software handles advanced features such as software downloading, binary files and electronic mail. Full details of how you arrange to cope with V23 modems (Prestel standard running at 1200/75 bits per second) are available from Dynamic Microprocessor Associates, in New York on (212) 687 7115.

No, you're wrong; these are not manuals. Inside these 'new diskette storage systems' from Ben Johnson & Co, you will find up to 20 diskettes, stuck in pouches in a ring-binder. Talk to the company on (0904) 798241.

Datavue steals the show

Most people won't design a minicomputer that will run the 8086 instruction set for one of two reasons: either they can't design a minicomputer, or, they can, and they have a much better idea of what it ought to do.

Datavue, a sister company to Quadram, has found a man called Vic Bennett who slips between these two rules. He knows it's a daft thing to do, but he also has worked out that there are several people who'd like an 8086 running at minicomputer speeds. And for his next trick, he proposes to build an 80386 running at minicomputer speeds.

Minicomputer speeds, for the Datavue Technical Systems 86150, means a clock of 150MHz. This gives him about 12 million instructions per second, which he reckons is three times as fast as a Sun workstation, and measured on the Norton's Utilities speed checker, 70 times the speed of a standard PC.

This is the slow version, however. The machine comes on two large boards, and fits underneath your normal AT box. It has its own 512k of fast memory.

But next year, he says, he'll have all this down to nine VLSI chips, using ECL (emitter coupled logic) technology. It will go at least twice as fast then. And very shortly after that, he'll have the 80386 emulator, which (because of wider buses and nicer instructions) will go at least twice as fast again.

The current machine costs $10,000 and is about to go into beta test with a few American enthusiasts. Most of them are Autocad users, most of the rest are dBaseIII users – all of whom have complex jobs on their PCs, which take 24 hours or so to run. In a year's time it will take them around 10 minutes.

And 'this time next year', said Bennett, 'the price will be quite noticeably down, too.'

Details from Joe Maroney at Datavue, on (404) 564 5780. END

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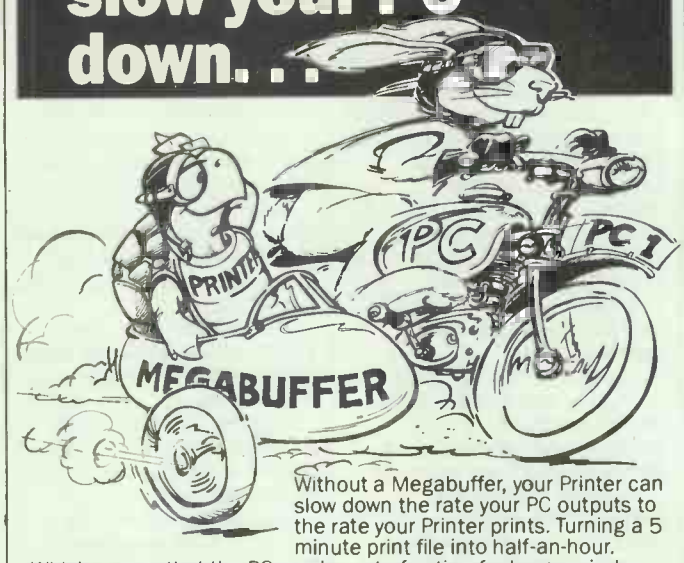

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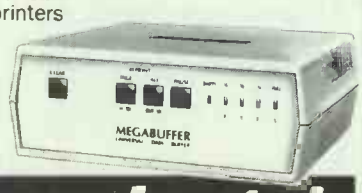

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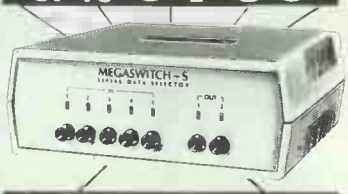

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RINGDALE PERIPHERALS

THE WEST COAST CONNECTION

Our US correspondent, Tim Bajarin, brings you the stories that matter in the world of microcomputing. This month he looks at the third generation of word processors and examines the ever-decreasing size of the micro.

And a final word comes from . . .

To date, the PC word processor has gone through two generations. The first generation gave us basic editing features, and used the power of disk drive technology to allow us to save and rearrange text.

The next generation added features only known to the dedicated word-processing world and which, until the launch of the PC, were only available using mini or mainframe technology. Such features ranged from sophisticated mailmerge, copy and paste techniques to combining text and graphics.

We are now about to enter the third generation of word processing. This is being driven by products on the Macintosh which utilise the Mac-type user interface to manipulate fonts and columns; in general, we are about to see basic features which up until now have only been used in expensive typography programs.

The most significant product to appear is WriteNow! from T/Maker Graphics. This powerful word processor allows the integration of both text and graphics, and allows you to work with separate columns on the screen. T/Maker is licensing WriteNow! from Apple founder Steve Jobs' new company Next Inc. The package sells for $195 and is a great improvement on today's word-processing products.

Right now Steve Jobs is proud of his latest product

Another variation on this theme comes from Orange Micro. Its new product, RagTime, is similar to WriteNow!, but adds a spreadsheet to the program and allows for the use of financial analysis and business graphics in the word processor itself.

But the product everyone is anxiously awaiting which represents this new dimension of word processing is the next version of Microsoft's Word for the Mac. Those who have seen it believe that it will set a standard for word processing in much the same way that Excel has become a new standard approach for the implementation of spreadsheets.

For the IBM world, look for Word Perfect IV, Samna IV and Word 3.1 to continue evolving as third-generation word processors, although I believe the Mac approach will be the one that defines what third-generation word processors should look like. No matter what PC is used, very soon we will have a word processor that will change the way we write.

. . . with a few prompts from Xerox

Another part of this new generation of word processors is what has become known as 'Lexiconal' add-on features, the most popular implementations of which are spelling checkers and a thesaurus.

These facilities are achieved through software that's used either as batch processors or is housed in RAM and accessed when needed.

The slickest method of spell-checking is known as real-time spell-checking and has been popularised with Borland's Lightning product.

This type of software allows the user to type away, and when a mistake is made the micro beeps, so informing the typist of the error. The main problem, however, is that even with a small 35,000-word dictionary, the software takes up considerable code and memory, and leaves less RAM than desired.

Now Xerox has taken a new approach in giving us real-time spell-checking. Selling for $195, PC Type Right comes in the form of a ROM cartridge which sits between the PC and the keyboard. It is based on technology developed at the Xerox Palo Alto Research Centre using very tight codes and AI techniques to provide a 100,000-word dictionary.

With PC Type Right you just type, as with any word processor, and it automatically checks the spelling. It will even allow the addition of words to its dictionary.

New products to watch for

Datavue Technical Systems of Norcross, Georgia, has designed a computer that could have a major impact on the PC market. Utilising designs based on 'Flow Through Logic', the Datavue 86150 CPU has been designed to be compatible with the processor used in the IBM PC — the difference being that it is 20 times faster! The company says that the 86150 can execute up to 22 million instructions per second.

A multi-million dollar Super Computer runs at 100 mips and the new Hitachi economical super-computer (retailing at $400,000 plus) runs at 31 mips.

Datavue hopes to sell this machine for around $10,000. This is one computer to look for: it could blow the PC world wide open . . .

With desktop publishing becoming the hottest application for the PC market, high-resolution screens are becoming more important to the average PC user. Of the new high-resolution systems I have seen, I am most impressed by the Conographic 2800 from Conographic Corporation of Irvine. It displays 2880×1024 pixels on its 19in screen — this is four times the resolution of a typical monitor.

Although the price is not available, I have heard that the monitor with a controller card could sell for less than $3000. Screens like this could have a great impact on CAD/CAM applications, and help move graphics workstations into the mainstream of personal computing.

Apple takes big slice of the pie

When Apple introduced the IIGS in October 1986, the only software that was ready was the paint/draw package from Activision. Although Apple has been very slow in delivering this new ▶

THE WEST COAST CONNECTION

In a small, small world portable computing is high on everyone's wish-list

Since the introduction of the microprocessor, the race has been on to miniaturise the electronic world around us. We now have mini-TVs, mini-microwaves, mini-stereos and mini-compact disc players.

This trend carries over into the world of computers, and the race is escalating to produce a computer that provides the most facilities in the smallest space. The first attempt to provide a lapheld micro came from Epson; this was followed by Tandy with the Model 100.

In 1983, a company known as Gavilan raised over $20 million in venture capital funding and moved ahead with its challenge of manufacturing an IBM-compatible, portable PC.

At that time, this computer was considered the machine that would revolutionise the PC market. But, due to problems in management and manufacturing, Gavilan spent all its funds and was unable to supply the machine as planned.

During this same time, industry pundits proclaimed the lapheld micro as the most important breakthrough since the launch of the original PC, and claimed that by 1987 most PCs would be portable. As you know, pundits can be wrong; and in this case they were *very* wrong.

Although portable computing is becoming more popular, the technology is just not available to allow these miniature PCs to replace those units currently occupying our desks.

But it's not inconceivable that one day they might just replace those large desktop units.

The NEC IBM PC-compatible portable uses LCD twist technology to its full advantage

One of the major drawbacks of the truly portable micro has been the slow development of screen technology. LCD screens are hard to read, and electroluminescent and gas plasma screens are expensive and power hungry.

But progress is being made in this area, and the new LCD twist technology is already a great improvement, with products such as the Zenith Z–181 and the recently launched NEC IBM PC-compatible portable using this new screen very effectively.

And we will soon see low-power gas plasma displays become available; and the Zenith flat mask colour television tube (which is already available) uses a new technology and produces an excellent colour image. The television is as flat as a pancake and the image is sharp, the main problem at the moment being price. At $2784, it isn't affordable by the mass market.

I have also seen prototypes of high-resolution LCD screens that can roll up, and 2in-thick colour CRTs which could allow the portable display to be as sharp and crisp as the standard CRT screen used on current PCs. These could cost well under $495.

Although such displays are in the early stages of development, the evidence is already here to show how these technologies could make the pundits words come true: the portable or lapheld micro could become the only PC used in the very near future.

The two main leaders in today's lapheld market are Toshiba with its T1100 and T3100 models, and IBM with its PC Convertible.

Industry sources believe that two other giants will soon give us their own version of their already popular desktop PCs. Tandy is reportedly working on a machine very similar to the Toshiba T1100, and Compaq is supposed to be close to showing a portable similar to the Toshiba T3100, with possibly an 80386 chip at its heart.

It may still be a while before portables replace desktop PCs, but the PC of the future could very well be small and portable in nature.

◀

computer, due mainly to component shortages, software is now beginning to appear.

When the Mac was introduced, it was many months before there was any software available for it other than that provided by Apple. But with the IIGS, the stakes are higher for software manufacturers. Of the 2.5 million Apple IIs in the world, Apple believes that as many as 30 per cent of these users will upgrade, and software vendors see this as a great new opportunity for them.

Of the packages recently released, a product from PBI Software in Foster City, California, has really caught my attention. Called the Visualizer, it enables the user to produce quality graphs from AppleWorks spreadsheets or through its own Visualizer 'datasheets'.

Visualizer uses all the advances of the IIGS, including super hi-resolution, colour and speed, and it incorporates the Macintosh-style interface.

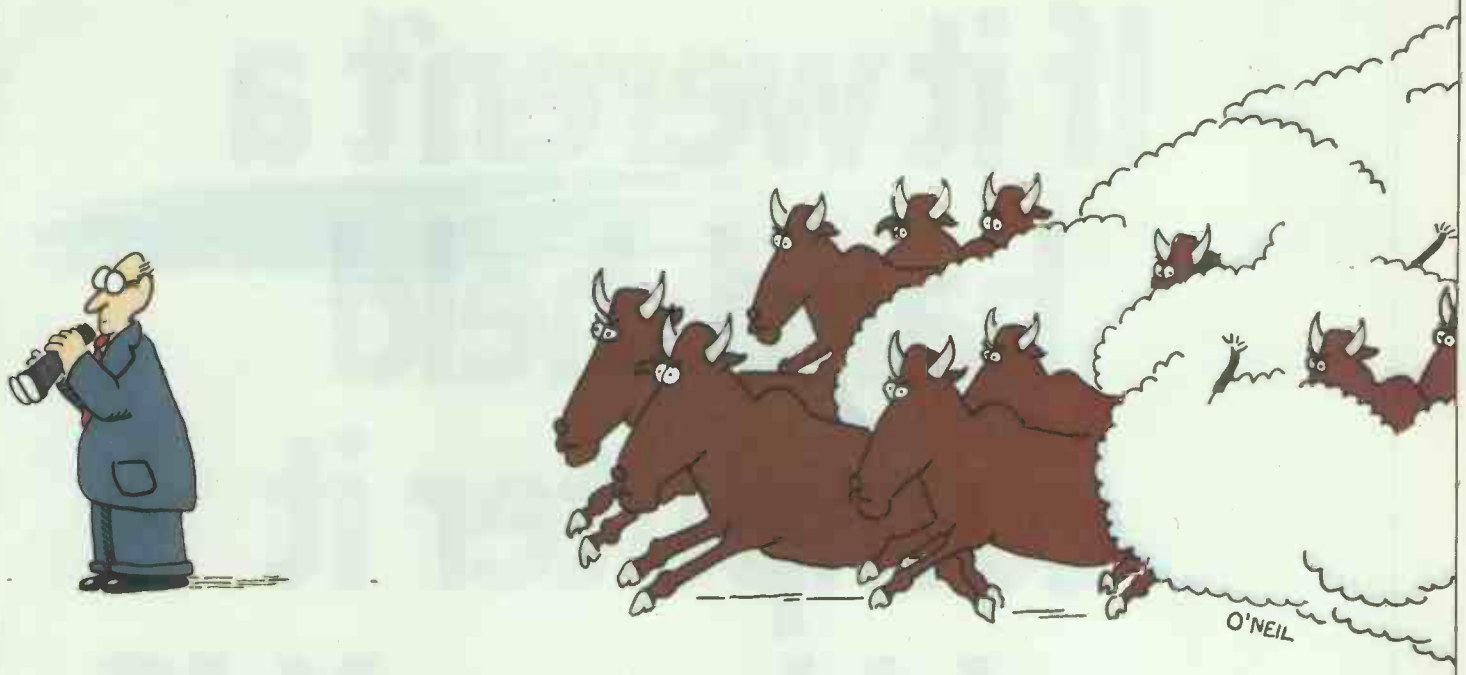
Using this new product is like sitting in front of a colour Mac. And, for those who have thought about buying a Mac, they may want to wait. It looks like software for the Mac will very soon be available for the IIGS.

All the fun, without the aggravation

One of the neatest Mac games I have played comes from Primera Software. Smash Hit Racquetball is a realistic racquet-ball simulation that features 273 frames of animation and 70k of digitised sound. It moves fast and gives you the exhilaration of playing the game without the sweat. At $14.95 it's also unbeatable value.

For the growing educational needs of 7 to 10-year-olds, you may want to look at the Learning Company's Writer Rabbit. Writer Rabbit teaches children the fundamentals of recognising and constructing good sentences, paragraphs, stories and letters. Youngsters can also be led through six carefully-sequenced games by Writer Rabbit, an animated character.

Parents and teachers can monitor a child's progress and determine specific problem areas by studying game scores. The Apple version of Writer Rabbit costs $39.95 and an IBM PC version is imminent. END



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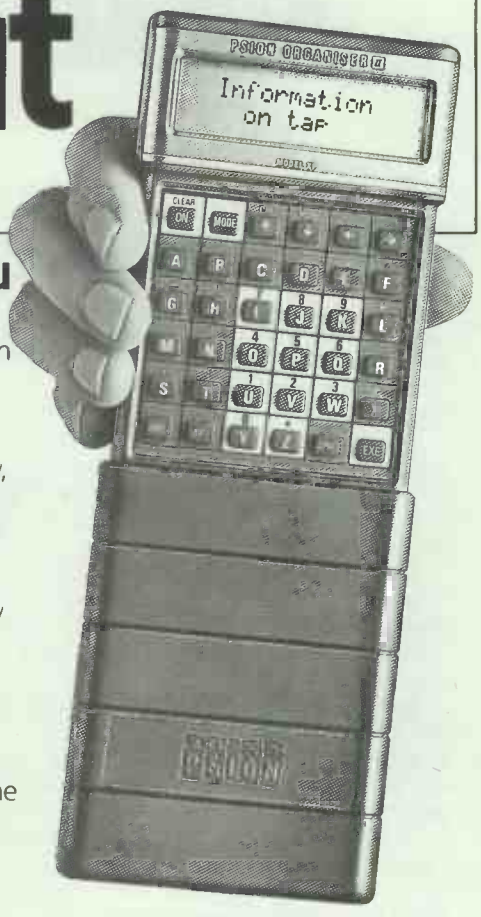
If it weren't a hand-held computer it would be an XJS juggernaut



Psion Organiser II. The machine that thinks with you

Looking at the Psion Organiser II you could well think it's just another hand-held programmable. Hand held, yes. Programmable, very much so. But just another? No way.

Take the memory capacity. A 32k ROM and either 8k (Model CM) or 16k (Model XP) of RAM is built in, and this can be expanded through plug-in EPROM Datapaks to give up to 304k of on-board memory at a time. What's more, the RAM memory is maintained even when Organiser II is 'switched off' (it's even maintained whilst the battery is changed).

Then there's the built-in high level, structured programming language. This has around 120 commands and functions, which include full integer, floating point, string, array, file-handling and machine code facilities. It's easier and more powerful than BASIC – yet runs up to ten times faster. (When we said XJS, we meant XJS).

Psion Organiser II can communicate with desk-bound systems, printers, and messaging services through an RS232 link. And a bar code or magnetic swipe reader can be plugged in to provide a powerful and flexible data-capture unit.

It doesn't end there either. A remind-you-of-appointments Diary, a find-it-for-you filing system and address book, a powerful multi-function multi-memory see-what-you're-doing calculator, a precision clock and eight hourly, daily or weekly alarms are all built in as standard.

So it is not just a hand-held computer. It is a complete system that can stand alone, be dedicated to specific tasks, or be integrated with existing systems... the kind of machine software developers dream about.

If all this isn't good news enough, here's some more. Prices start from under £100, including VAT.

Psion Organiser II. It's fast. It's powerful. It fits the pocket, in every sense. And it is available now from your computer dealer or office equipment supplier. For further information, contact Psion.

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LETTERS

This is the chance to air your views — send your letters or contact us on Telecom Gold 83:VNU200 or PCW Online: PCW 009. The address to write to is: Letters, Personal Computer World, 32-34 Broadwick St, London W1A 2HG. Please be as brief as possible and add 'not for publication' if your letter is to be kept private.

In the public interest

I'm sure that readers appreciated the 'Free software' item in Computer Answers, *PCW* October 1986, which gave PD-SIG as a source of disks. They may also appreciate knowing that it's possible to deal with the legitimate source of almost half of PD-SIG's material, namely PC-SIG of Sunnyvale, California, rather than dealing with an organisation trading without permission on its efforts.

PC-SIG is the world's largest supplier of public domain and user-supported software. Currently, the library has in excess of 600 disks and 3000 programs. PC-SIG has over 30,000 disk customers and 100,000 catalogue customers. The PC-SIG catalogue, numbering system, library disks, newsletter and name are all registered and copyrighted. In recent months a number of organisations have attempted to take advantage of a tremendous amount of work in collecting, cataloguing, quality assuring, producing and supporting this library. These profit-making organisations duplicate original PC-SIG disks, then market them without authorisation or permission, effectively pirating copyright information. As soon as these organisations are identified, PC-SIG's attorneys are contacted and appropriate action is taken.

ISD UK is the only authorised UK distributor of authentic PC-SIG disks and catalogues. The disks cost £10 each in single quantities and decrease to £4 in quantities of 25. All our disks and catalogues are imported directly from PC-SIG in California, where quality assurance is performed on the 15 to 25 disks per month which are added to the list.

Rita V Wolfe, marketing, ISD UK, Sutton Coldfield, West Midlands

It's always strange to hear of people claiming 'rights' to public domain software. PD-SIG and ISD are just two of the organisations distributing PC-SIG software in the UK. Parts of the library are available from Compulink and other user groups as well as numerous bulletin boards.

The aim of public domain software authors is to spread their creations as widely as possible, and we would have thought that the more people distributing the programs at cost the better.

What is more alarming is the way that PC-SIG software is advertised and distributed, with little mention of the fact that parts of the library are 'user-supported' rather than public domain.

The difference is that user-supported software authors expect payment from satisfied customers.

Despite reassurances to the contrary, ISD's publicity material fails to mention that some of the programs in its special packages are not *public domain. Anyone using the programs (as opposed to evaluating them) is expected to send money to the authors.*

Companies that advertise disks of user-supported software without mentioning the extra payments expected are surely misleading their potential customers.

With so much user-supported software coming from the US, there's no easy way for UK users to send their $20 or $50 to the software authors. If ISD really wishes to protect the interests of small software authors, perhaps it could act as a clearing house for those honest users wishing to pay the authors for the software that the company is distributing.

CPL revisited

I found Robert Schifreen's article about CPL on Telecom Gold ('CPL primer', *PCW* October) very interesting. I have never used Gold, but I am familiar with CPL. Gold users may find the following comments useful.

Most beginners' problems with CPL are associated with quotes. Contrary to the article, you do not need to quote a string with spaces in an assignment statement. However, the difference between a quoted and an unquoted string is often not important; it's the few occasions on which it *is* that cause problems. For example:

```
&s QuotedVar := 'One Two
   Three Four'
&do SingleItem &list
   %QuotedVar% type
   %SingleItem%
&end
```

will produce on the screen
One Two Three Four

whereas:

```
&s NotQuotedVar := One
   Two Three Four
&do SingleItem &list
   %NotQuotedVar% type
   %SingleItem%
&end
```

will give:

```
One
Two
Three
Four
```

The difference is that the first loop goes round once with the whole of QuotedVar substituted into SingleItem, and the second goes round four times. Note that type removes one level of quotes before sending its output.

One of the secrets of understanding CPL is the sequence of operations the interpreter performs on each program line. Variable references (in % symbols) are substituted first, then functions are evaluated from the inside out. Anything inside quotes is ignored. Any CPL & directives are then obeyed. Anything left is sent to PRIMOS as a command.

For example, the following line will check your mail automatically, only if Pointer contains the name of a variable which contains the name Smith (not necessarily in upper case):

```
&if [index [translate [get_var
   %Pointer%]] SMITH]^ = 0
   &then mail
```

The article contains a number of minor omissions:

- The &tty directive in an &data block can occur anywhere in the block, but it will take effect only when all other commands in the block have been executed.
- When entering the^symbol with the editor ED, it must be typed twice — ^^ . A single^ is interpreted as the lead-in character for an octal code.

For an improved version of the INVITE.CPL program given in Robert Schifreen's article, see this month's Program File.

Peter Lancashire, Bristol

No sugar on the pill

Is the PC1512 ever going to 'hit the streets'? If it is I'd like to know when, because at the moment I'd like to hit Alan Sugar.

In September 1986 I went to Dixons and paid a deposit of £918.15 for a mono, 20Mbyte PC1512, with the assurance that it would be available before the end of the month. In November there was still no sign of it. Most of the local and national dealers claiming to stock the machine, tell me late December 1986 to early February 1987.

I started messing about with computers about eight years ago, with a modest little Sinclair ZX80 (which I had to build myself), and I have owned a ZX81, a Vic 20, a Spectrum 48k, and a BBC B. Since then I have been to college and worked with such machines as the SDK-85, the North Star Advantage and the Horizon, the Nascom, the UK 101, the RM Nimbus (CNC lathe equipment), and the Zilog Z8000 running Unix system

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LETTERS

ill. All of the machines I purchased did not suffer from time delays such as Amstrad's — not even Sinclair's! Come back, Sir Clive — all is forgiven.

Is Alan Sugar hoarding his precious AIRO until 1987 when his 12½ per cent price increase is enforced?

Meanwhile, Dixons has nearly £1000 of my precious money floating around its bank account when it could be floating around my building society earning interest. The full price was paid at the time because the company demanded at least two-thirds of the price as a deposit, saving me money in my bank account by only writing one cheque.

I am disgusted by Alan Sugar and Dixons.

Anyone wishing to contact me on the matter can write to the address below, with an *sae*. I will return to them a compilation of the comments I have received from other readers of this letter.

JC Sandon, 37 Messok Close, Falmouth, Cornwall TR11 4SH

This is just one of many letters we have received voicing similar complaints. A look at last month's compatibles test shows that there are other machines worth looking at. The question is: How much of a bargain is a machine you can't get hold of? Four months interest on your £1000 could have bought some useful software!

Meanwhile, take some comfort from Guy Kewney's lead story in 'Newsprint' where he explains (but does not defend) Alan Sugar's dilemma.

Cheerful compiler

Bushcat is proud to announce two new software products which complement its range of computers perfectly.

For those Real Programmers whose bumper stickers read 'Real Programmers Use Fortran', 'Pascal Writers Eat Quiche', 'No Loop Too Big', 'If It Isn't A Goto, It's Not Going In' or 'If It's Not On A Box Of Stripey Green Paper Then It's Not Backed Up' and are suffering at the hands of their more structured friends, we present the Bushcat Pessimising Compiler for a wide range of languages. Simply use the pessimising compiler in place of the usual one and your rival's compiled output will be bulky, slow and bug-ridden. At the monthly progress meeting with the boss, you will be able to enhance your career prospects and cripple those of your rivals with such observations as: 'But my version, using only 34 gotos and a bubble-gum sort, gets the job done five times faster with only six more boxes of paper printout.'

For the domestic user who is bored with ever more reliable computers and operating systems, and has fond memories of things suddenly stopping (or worse still, not stopping but going somewhere else instead, such as through the video RAM or disk drive), we present our new operating system, DomesDos. Kills 99 per cent of all known disks. Even backing up the system master is unlikely to be successful. One error message ('Diddly Squat Near Here') covers all eventualities.

Paul Hardy, Bushcat, Bingley, W Yorks

Safety first

I must take strong exception to your advocating the direct electrical connection of the human body to mains-powered apparatus ('It's all in the mind', *PCW*, October 1986).

The risk of electrical shock, though slight, is very real, and the subject would not be able to rid himself of the electrodes quickly — voluntarily or otherwise, if they were taped on. The circuit applies only 0.6V to the skin, granted, but this is assuming that the system is well-maintained and operating perfectly.

If the earth wire were tampered with or removed for any reason (and this happens), leakage currents across the transformer windings in the power supply would not drain away, but might cause shock. Worse, any fault in the isolation of the mains from the low voltage side would apply the mains (via the 10k resistor) to the subject.

Only 10μA (actually at the heart) is needed to cause fibrillation (an uncontrolled quivering of the heart muscle, during which blood flow virtually ceases) in some cases. I cannot pretend to be familiar with the details of the construction of the BBC PSU, but I do not think that the isolation will be rated to the level of safety needed.

Having said all this, I have built and tested the GSR circuit at the University of Aberdeen. It works very well, although I had to alter the value of the 1M resistor to 100k (perhaps my resistance is low!). Before I contemplated using the circuit on the large scale, however, I would design an optically isolated link and power the 'business end' with a 9V battery (the circuit works just as well at 9V).

This is by far the safest way to do it.

Paul Cuthbertson, Inverurie, Aberdeen

The safety aspect has been noted and readers would be well-advised to take the precautions Paul suggests.

The good and the bad

With reference to Peter Jackson's comments on the Comart Quad and the difficulties experienced in configuring it for his review (*PCW*, October 1986), I would like to offer a few observations.

Jarogate believes that a multi-user system should be easy to set up without sacrificing flexibility. Unfortunately, there is a trade-off: the more versatile the system, the more initial configuration that is required.

Unlike other computer manufacturers, we offer both. Every Sprite goes out pre-configured to a standard that has been found to be the most popular. The dealer can then plug in and go without any alterations to the system. However, he can use the configuration program to change all the parameters to typically expand the system as the user's needs grow.

I would suggest that 'plug in and go' should not be viewed as a novel new concept, but as a positive trend that Jarogate and the industry as a whole has been following for years.

Robin Tracey, Jarogate Ltd, Surbiton, Surrey

The correspondence from both Jarogate and Comart (see 'Letters', PCW, November 1986) suggests that the low-end, multi-user market is becoming as fiercely competitive as the PC-compatible market currently is. And the 'plug-in-and-go' machines becoming available make them as easy to buy and install as standalone PCs.

If this means lower prices and better products, then users will benefit. If, however, such competition leads to a repeat of the current plethora of small turnover/short life importers of Taiwanese clones, then the benefits will be harder to see.

Will we see an Amstrad four-user machine next?

Driving without due care and attention

My car can comfortably travel at 60mph on local roads, even in wet and slippery conditions. The next time I crash because I am driving without 'DC&A', I think I shall sue GM or Ford, or whoever: it's obviously the company's fault for selling me the car.

At least that's the logic of a blatant piece of journalistic sensationalism, the like of which I did not expect to see in *PCW*. In the November 1986 issue, David Ahl wrote about a user suing Lotus because of a fault that he, the user, had introduced into the model. Ahl seemed to be giving tacit support for the case with such phrases as 'faulty software', 'glitch in the software', and 'if software doesn't perform in accordance with its specifications'.

The instance Ahl uses to illustrate what, in essence, might be a good talking point, is flawed through and through.

True, you may consider I have an axe to grind. As a Lotus Authorised Consultant, I am only too aware that larger spreadsheets need careful driving. And just as I would not expect youngsters to pick up a steering wheel and venture forth without expert tuition, so the average Lotus user needs guidance.

Using the @SUM function in a sensible manner is a key point on my IT courses, as it is on many others.

Geoff Mosley, Bristol

Could the answer also be to use analytical tools like Javelin to sort out the intricacies? END

BANKS' STATEMENT

The speed trap

Standardisation rears its ugly head, as Martin Banks ponders a low-cost, multi-speed proposal for smooth communications between low and high-speed devices.

I'm not entirely sure that I like surprises. They can be fun, it's true, but they can so often be nasty little things that sneak up behind you when you're not looking and jab their fingers viciously into your ribs when you least expect it. Letters can be like that.

Sometimes one of them can prove treacherous and do something nasty like set me thinking.

One of these treacherous surprises came the other week and set the synapses crawling around in an unnerving fashion. It was from a company called Neutral, in East London, and was a draft proposal for a low-cost local area network.

What stopped its journey to the bin was a bit that I had failed to read first time through. This was the statement 'multi-speed', a statement that had the unfortunate effect of making me think.

Neutral, out of an apparent sense of pure altruism, wants to see its proposals as widely accepted as possible.

It takes not too much observation to see that the current status of the Local Area Network (LAN) business is something of a dog's breakfast. There are nearly as many different types of LAN as there are manufacturers producing them, and even where systems are supposedly the same, such as with Ethernet, they are often, in practice, quite different from each other.

The problem with any differences, as pointed out by Neutral, is the fact that the LANs are all very fussy about what you hang on them. For example, get a nice, tidy network of PC/XTs all working happily together on something or other and then stick a shiny, new PC/AT in as a workstation. The effect — not always, but quite often — will be the creation of some interesting problems caused by the different operating speeds of the machines.

Yet, as Neutral points out indirectly in its draft proposal, the use of these different machines is made possible by simply plugging them, willy nilly, into the same, standard, 13-amp sockets. Wouldn't it be nice, says Neutral, if we could all do the same with networks and the information accessible therefrom?

It was this simple statement that got the grey matter moving that morning. It would indeed be nice, thought I, if it were possible to take any system of any operating speed and plug it into a standard type of socket and get communicating. It would certainly be a potential boon to the smaller network users, who perhaps don't have the financial clout to specify all the expensive bits and pieces needed to make a single-standard network operate. For them, the ability to link together the most cost-effective devices, regardless of their speed, could be very useful.

'It would indeed be nice if it were possible to take any system of any operating speed and plug it into a standard type of socket and get communicating.'

I have no way of knowing whether the Neutral proposal is the best solution for this task. It is, however, worth an airing, for I do feel that this is an area of that thorny subject, known as standardisation, where the advantages of commonality far outweigh any restrictions on technological development.

The Neutral proposal is based on the RS485 standard for multi-drop communications. The idea is for a bus-based system using RS485 based around six-way connectors that are smaller, but not compatible, with the new British Telecom connectors. These would link two or three twisted cable pairs, with one of the pairs running a balanced clock. This is important, because it is this that will allow slow-speed devices to communicate with high-speed ones.

According to Neutral, the system would indeed be low-cost as the key component would be a single-chip, serial, communications controller. This means an interface card for a PC would cost as little as £50 (built-in, the system could cost as little as £10). The wall sockets cost around £4, and connector cables could be made for around £3 each. The hand tool needed for this costs £5.

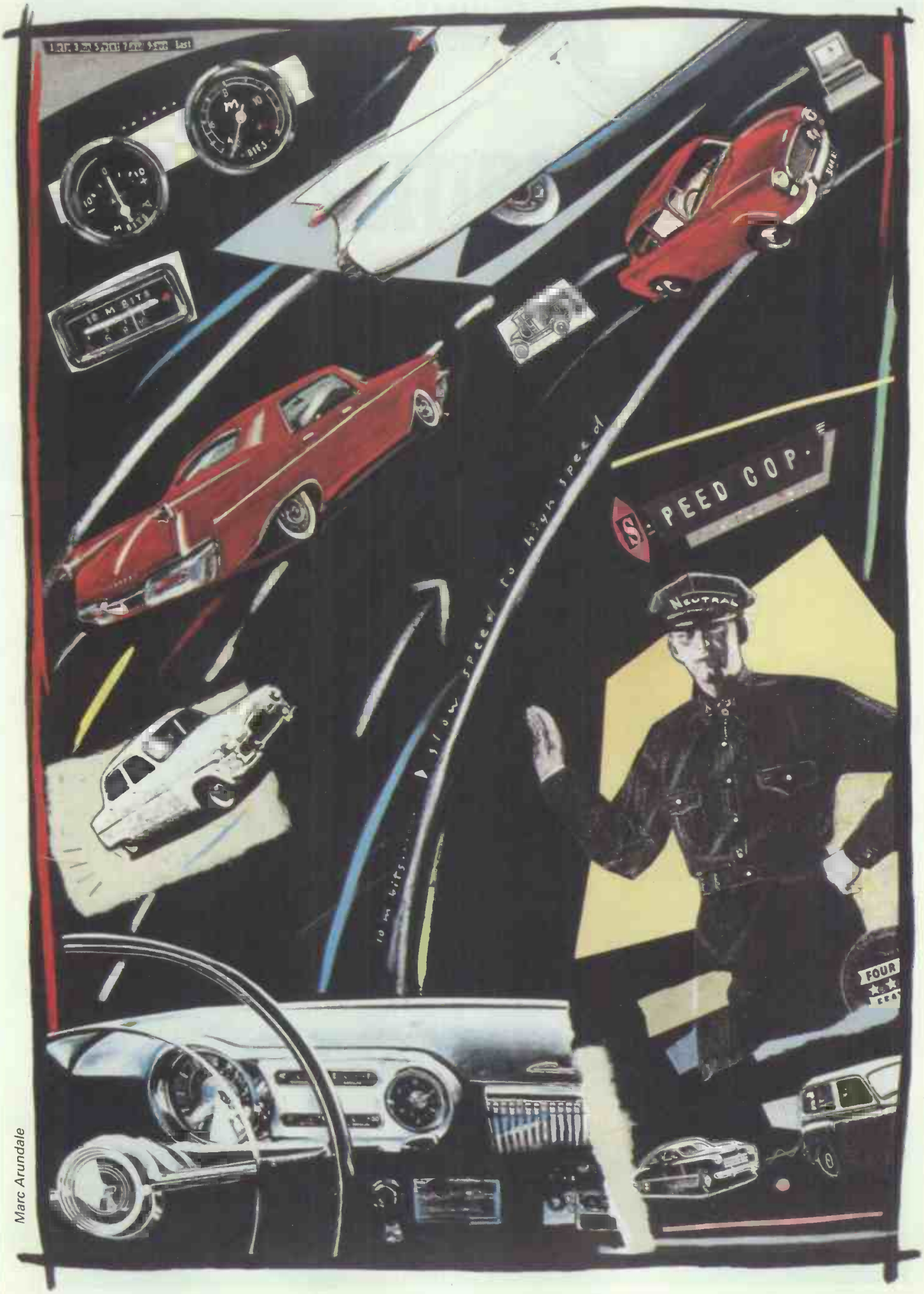
This means that devices could be added to a network for £60 maximum. Yet this would in practice be less, for though the maximum number of nodes per segment allowed is 32, it is quite permissible to connect in more wall sockets than that, allowing users to put in any one of their 32 devices at the most convenient point between the job in hand and a wall socket.

And this would work using an interesting little trick called Dynamic Node ID. The interface, once plugged into the network, would simply start sending out questions . . . is anything Number One? This questioning is continued in numerical sequence until there is no affirmative answer. The unit then adopts that node number as its own. Physically, it doesn't matter where it sits.

The important part of this system is the multi-speed aspect. Neutral's suggestion is a minimum speed of 250kbits per second with a maximum frame size of 64k. The maximum speed allowed under RS485 is 10Mbits per second, but most high-speed devices can be made to run at slower speeds.

High-speed systems will be able to talk to slower ones, therefore, by enquiring of the recipient what speed it runs at and working accordingly. The reverse — slow systems communicating with fast ones — will be automatically controlled by the clock lines of the network.

I can't help feeling it's to the credit of Neutral that it has offered its proposal to anyone who wants to contribute to the idea. The company isn't saying that it has the best or only suggestion, only that something of this sort is needed, and needed soon. I can't help but agree. END



Marc Arundale

Dynamac

The Dynamac embodies the state-of-the-art in microcomputer technology and embraces many of the attributes of the Mac Plus. But despite the power and prestige of this innovative, lapheld micro, the search for the ultimate in portable computing continues. Nick Walker assesses the machine's attractions.

Photography by David Whyte

At 640×400 pixels, the Dynamac's power-hungry electroluminescent screen is 46 per cent bigger than the standard Macintosh unit

It's a commonly accepted fact that microcomputer technology progresses at a meteoric rate. For example, in 1980 a thousand pounds would buy you a 16k, 8-bit machine; in 1982 a 64k, 8-bit machine; in 1984 a 128k, 8-bit machine; and in 1986 a 1024k, 16-bit machine. In reality, however, the facts are not so simple. While it is undoubtedly true that chip-level technology progresses at a meteoric rate, the same cannot be said of many microcomputer-related technologies. Disk drive technology, screen technology and especially software technology are three areas which are currently limiting microcomputer design, an excellent example of which is the Dynabook concept. Developed in the late 60s and early 70s by Xerox at the Palo Alto Research Centre, the Dynabook was designed on the basis that by the time the software was developed, the hardware would be available to implement it. The final specification called for a flat machine — about the size of a hard-back book — with a graphical display and touch-screen control. Much of the graphical display technique was later used by the same Xerox team, now at Apple, in the creation of the Apple Lisa and the Apple Macintosh.

The processing power and memory needed for the Dynabook are now available, as is the software in the form of the Apple Macintosh. But two slow-developing technologies have prevented the Dynabook from becoming a reality. First of all, in the field of screen design, Clive Sinclair and many others have been working for years to find a flat screen of decent resolution and contrast that is capable of being battery-powered. Secondly, in the field of hard disk design, the problem has been making a hard disk which is capable of taking the sort of knocks a book-sized machine will inevitably receive. Although hard disks are of a suitable size, I have yet to find a hard-disk manufacturer willing to accept my hard-disk challenge: assuming that the worst damage a lapheld micro would sustain would be to fall from someone's lap to the floor, that the hard disk should also be capable of withstanding such an onslaught while operating.

The danger for any manufacturer producing a lapheld version of the Macintosh is that it will inevitably be compared with this *mythical* Dynabook, and not the current crop of IBM PC-compatible laphelds. But, despite this drawback, two 'flat-Macs' have been produced.

The first of these to reach *PCW*, and the subject of this review, is the 'Dynamac', which provocatively invites direct comparison with the Dynabook. A second machine, known as the Colby Mac and specifically designed for rugged applications, is in the pipeline awaiting launch. Certainly, the Dynamac has a specification beyond that found on the majority of laphelds: 4Mbytes of RAM, a 40Mbyte hard disk, a larger than normal Macintosh screen and a built-in 2400-baud modem. It's undeniably an achievement to fit all this technology into a lapheld machine, but it would have been a major leap forward if it had all been contained within a Dynabook-size case.

Hardware

My first impression of the Dynamac was one of style and quality. The design is similar to the majority of laphelds on the market, with the screen hinging back to uncover a keyboard and disk drive, but the Dynamac's matt black finish with an amber/gold screen and a high-quality poly-carbonate casing combine to provide an extremely classy-looking and elegant machine.

Although the Dynamac is significantly smaller than the standard Macintosh, it is — in lapheld terms — a large machine. At 16ins×14ins ×3ins it is considerably larger than a similarly-specified, IBM-compatible machine such as the Toshiba 3100. In addition, the Dynamac is strictly mains-power only and has a footprint significantly larger than the average user's lap! It doesn't take too long to realise that this machine is best treated as a very portable desktop machine — or 'luggable' as it is otherwise known.

According to Dynamac Corporation the machine should weigh 14lbs, but because the review machine had a prototype hard disk it was a full pound overweight. My humble bathroom scales put the weight of the Dynamac at 22lbs — I hope it's Dynamac which is at fault, or I desperately need to shed a few pounds.

In order to obtain a Macintosh motherboard, Dynamac is currently utilising the Mac Plus for the necessary parts and throwing the rest away. Negotiations are taking place with Apple for the purchase of motherboards alone which would obviously bring the price of a Dynamac down.

The Dynamac's rear panel is a definite contender for the maximum number of ports in the smallest space 'competition'. This 14ins × 3ins rear sliver contains, from left to right, the following: a mini-phono sound output; a mouse port; a SCSI external disk connection; a Macintosh external disk connection; processor interrupt and reset buttons; an external keypad; an external keyboard; a British Telecom jack telephone out; a modem volume control; a British Telecom jack telephone in; S5/8 DIN-style sockets for printer and modem; an E-machine output; a composite video output; an on/off switch; a mains power in and a 120/230v switch for the power supply. Also on the back in gold writing is the legend 'Designed by EJ'. For those interested in computer design, this is the same design house responsible for the equally classy Grid IBM-compatible, lapheld machine.

As the majority of these ports have been 'inherited' from the Macintosh Plus, the S5/8 DIN sockets are also the non-standard ones used on the Macintosh Plus and unfortunately lack a power out line. For the majority of peripherals this is unimportant as they have their own power supply. But for some modems and unusual peripherals such as the Thunderscan digitiser, they can't be used. More significant is the fact that Apple is flagrantly ignoring the new international S5/8 RS232 standard which was set up to solve the problems of different RS232 configurations. The port labelled E-machine will allow

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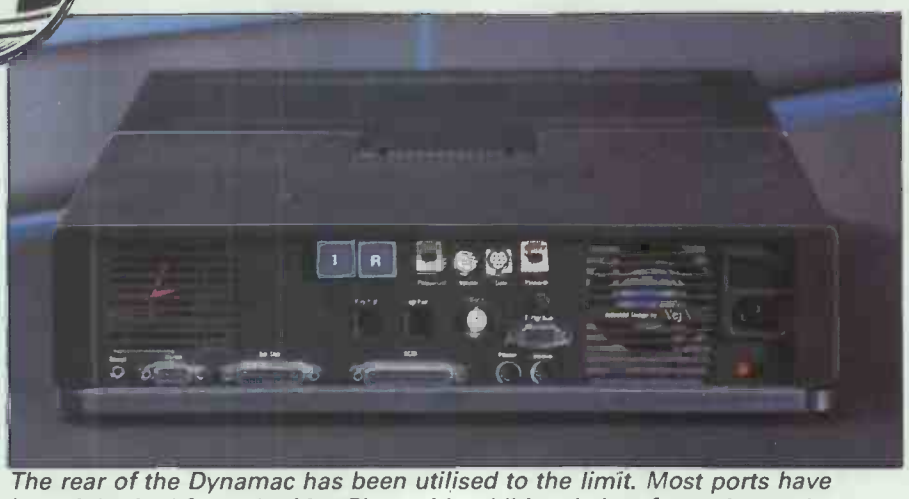
the Dynamac to work with a 'larger than Macintosh' external screen.

When I received the Dynamac, I was given strict instructions not to attempt to get inside it. This is understandable, as it required removing no less than 18 screws and that only gets you as far as a shielding plate. If you were to remove this shielding plate, you would be confronted with the ominous sight of a Mac Plus system board, 4Mbytes of RAM, a 40Mbyte hard disk and a 2400-baud modem complete with external casing.

It's worth describing briefly the Dynamac's architecture, though the use of a genuine Mac Plus motherboard means that it is virtually identical to the Mac Plus. The processor is a 68000 running at 8MHz. The usual 1Mbyte of RAM of the Mac Plus has, however, been upgraded on the Dynamac to either 2Mbytes or 4Mbytes depending on which model you buy. This has been done by replacing the original RAM chips with larger ones. Like many Mac RAM upgrades the RAM in the Dynamac has a slightly faster access time, at 150ns compared with 200ns for the Mac Plus. The effect of this will only be felt by those running very heavy processor-bound applications.

The power supply in the Dynamac is not the one from the Mac Plus, as this would occupy too much room. In addition to being smaller, the Dynamac power supply is also dual voltage (115v/230v) which means you can use it worldwide provided you have the right mains plug adaptor. The standard Macintosh speaker sounds feeble under the casing of the Dynamac, though the possibility of including a larger speaker is under consideration. A small, powerful and extremely quiet fan is included to keep the machine cool.

The review machine was fitted with the 800k floppy from the Mac Plus and an internal 20Mbyte, 3.5in Rodime hard disk, but production models will have just the floppy or the floppy and a 40Mbyte hard disk. Dynamac has an interesting way of demonstrating the durability of this hard disk. At certain computer shows in the States, the Dynamac has been seen operating while held in an electric drinks shaker. All very impressive, true; but nothing like the g force it would receive falling from someone's lap. For some reason Dynamac was unwilling to disclose the manufacturer of this hard disk, but the company did mention that it weighs a puny 1.2lbs, is voice-coil activated and has an average access time of 28.29 milliseconds, so it should be very fast.



The rear of the Dynamac has been utilised to the limit. Most ports have been inherited from the Mac Plus, with additional slots for an internal modem and networking facilities.

The Dynamac's screen is an amber, electroluminescent device. Unlike LCD displays electroluminescent displays emit light, so they don't need to be in direct light in order to be readable. However, that said, there is a price to pay for the 'readability' of an electroluminescent display, and that is in power. Dynamac estimates that the machine could be run from batteries for approximately three hours with an LCD screen, but with the electroluminescent display this is reduced to less than 15 minutes — and so the mains-only restriction. One feature that all flat screens presently lack is sufficient contrast, and this is particularly noticeable on the Dynamac because most Mac applications operate with black text on a white background. The 'black' pixels of a Dynamac are in fact a slightly *darker* shade of amber. While this is fine for a block of black pixels, it makes distinguishing single-pixel lines, such as the letter 'l', difficult.

'Although the Dynamac is significantly smaller than the standard Macintosh, it is — in lapheld terms — a large machine.'

The refresh rate of an electroluminescent screen is slightly slower than that of a cathode ray tube. On all applications except those that have very fast animation, this is totally unnoticeable; the only thing I noticed it on was a game called Racquet Ball. This refresh rate does cause one very nasty problem: under incandescent light (light bulbs and the sun) it's fine; however, a fluorescent light interferes terribly with the screen, causing a really bad flicker. Gas-Plasma technology, as used on the competitive Colby Mac and on the Grid machines, cures the screen flicker problem but was rejected for the Dynamac as it can only generate in a dark red glow, and it's also very fragile.

Apart from being electroluminescent, the screen is very interesting in another way: in pixel terms, it is 46 per cent bigger than a standard Macintosh screen, at 640×400 pixels compared with 512×342 pixels. This has been achieved by replacing the video display with a small PCB and running a cable from this PCB to a clip attached to the 68000 to intercept video calls. The circuitry is the same as that of the Mega-screen and the E-machine, both of which are extra-large screens for the Macintosh. An additional 128k of screen memory is included, so the Mega-screen actually frees some memory for application use. The beauty of this arrangement is that it will automatically work with the maximum resolution of the screen it is attached to — up to a maximum of 1024×1024 pixels. For example, a Dynamac can be attached straight to a 1000 × 800 pixel E-machine screen and will automatically utilise the extra area.

It is a tribute to the original software design of the Apple Macintosh that most Macintosh applications will take advantage of this extra area. Everything I tried which used re-sizeable windows took advantage of the extra screen area, and it proved very useful on such packages as Pagemaker and MacWrite. Packages such as MacPaint which use a fixed-size screen, and games that totally ignore Macintosh windows, will also run quite happily but only in the top left-hand 512×342 pixels. The only program that absolutely refused

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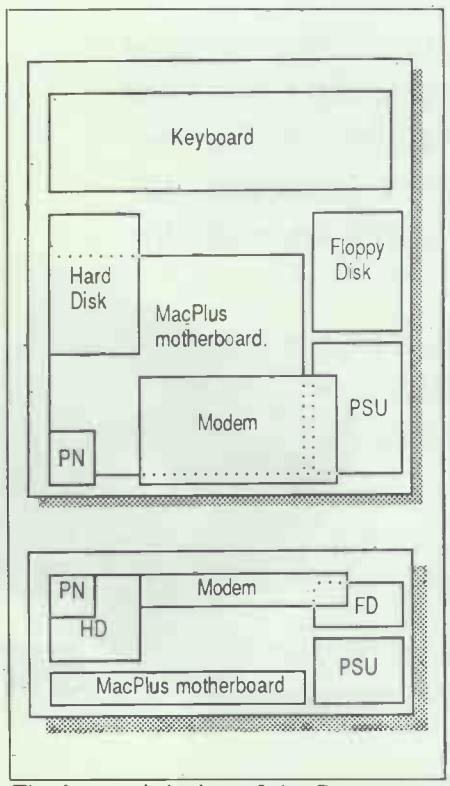
to run was Microsoft Flight Simulator. It seems ironic that the classic test of compatibility for an IBM should be the same for the Macintosh. Possibly, Microsoft has sold more Flight Simulators for its compatibility value and has purposefully written the code in a particularly convoluted way as a result. There is also, apparently, an odd bug with the Microsoft Excel spreadsheet, whereby it will work perfectly on the screen providing you don't exceed A4 size — one pixel under A4 is fine; one pixel over and the system crashes.



The internal design of the Dynamac is the epitome of high-end, lapheld design. All the individual components are separated by heavy-duty aluminium alloy plating to stop interference. The only remaining space, in the centre of the machine, has already been accounted for; an optional tape streamer will be available to fill it

The keyboard is basically a standard Mac Plus keyboard with the numeric keypad removed. The Enter key from the numeric keypad has been retained and grafted on to the right-hand side of the second row on the keyboard, and the Return key has been reduced from an L shape to a standard key to accommodate this. In terms of 'feel' I find the Macintosh very hollow and lacking the positive click of the better IBM and compatible keyboards. In an effort to keep the thickness of the Dynamac down, its keyboard has been mounted without the ergonomic slant of most keyboards. This gives the unusual feeling of typing into a valley, and I'm sure any competent touch-typist will hate it.

The American version of the Dynamac comes complete with an internal 2400-baud modem. To avoid problems with BABT approval in the UK this will be removed, and at least one distributor, MacSerious, will replace it with an approved Apple 1200-baud modem. It's nice to see that Dynamac has still included the external modem socket should you wish to use your own.

Occupying less than two cubic inches in the casing is a PhoneNET local area network controller. This is compatible with Apple's own Appletalk network but can run through an existing office telephone wiring without interfering with your telephone system — so most of the wiring is already installed.

I couldn't finish the hardware section without mentioning the carrying case that will be supplied with production machines. Dynamac assures me that it will be finished in highest quality calves' leather with a ballistic lining — surely an indication of the kind of customers at which the machine is aimed!

Software

As the Dynamac uses a genuine Mac Plus motherboard, in system software terms it is absolutely identical to the Mac Plus. Except for the problems with the larger screen, there is no way in which it could be incompatible. This means that the whole range of Mac Plus applications will work on the Dynamac. A number of major changes were made to the system software when the Mac Plus was introduced, and it is probably worth briefly recapping on these.

The system now formats all disks to 800k and the true hierarchical filing system (HFS) unless otherwise specified. The ROMs in the Mac Plus now total 128k, and contain HFS and updated versions of such things as the QuickDraw routines. This did mean that a few applications didn't work, especially programming tools and public-domain programs. All the packages that failed to work when I reviewed the Mac Plus have now been modified to work with both the Mac Plus and older Macs.

Price

A fully configured Dynamac with 4Mbytes of RAM, a 40Mbyte hard disk and an internal 1200-baud modem costs £6495. A basic system with a mere 2Mbytes of RAM, no modem and no hard disk costs £4495.

Documentation

No documentation was supplied with the review machine, and Dynamac was unable to say what form this would finally take. Considering that a complete Mac Plus has been destroyed to create the Dynamac, you should at least expect a standard Apple Mac Plus manual.

Conclusion

It's all very nice, but what is the point of the Dynamac? The machine is not battery-powered so it needs a mains power supply — and for £2000 less you could configure a Mac Plus to a similar specification. True, the Mac Plus is slightly larger and heavier than the Dynamac, but with a Mac carrying case it is still very much a 'luggable' and it does have a far nicer screen.

Perhaps the most pertinent indication of the kind of market the Dynamac will sell into, can be gauged by the sort of people making enquiries about the machine at the recent AppleWorld show in London: the two serious enquiries I witnessed were from a managing director of a Swiss Bank and a very wealthy Arab. The Dynamac is desirable in the same way that a Porsche is desirable: there are much cheaper ways of obtaining the same performance, but if image is important to you, then money is no object.

The Dynamac is distributed in the UK by Computers Unlimited on (01) 349 2395 and MacSerious Software on (041) 332 5622. END

Technical specifications

Processor:	Motorola 68000 running at 8MHz
RAM:	4Mbytes (plus 128k for screen)
ROM:	128k
Mass storage:	800k, 3.5in floppy drive; 40Mbytes Winchester
Display:	640×400 monochrome, electroluminescent
Keyboard:	59 keys, full-stroke
Standard interfaces:	Mini-phono sound output; mouse port; SCSI external disk; Macintosh external disk; processor; external keypad; external keyboard; British Telecom jack telephone out; British Telecom jack telephone in; S5/8 DIN-style sockets for printer and modem; PhoneNet; E-machine output; composite video
Operating system:	Apple Macintosh

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IBM 6150

The IBM RT (or 6150 in Europe) is a 32-bit RISC machine which is fast and responsive in single-user mode. But what does it offer that can't be achieved with a Unix multi-user/AT-clone single-user combination? Peter Jackson assesses where its future lies — as a fully-fledged member of the PC family, or as an office-departmental unit.

Photography by Terry Beddis

It's easy to forget, as the analysts pick over the entrails of the XT286 and count how many PC386s can dance on the head of a pin, that IBM is already selling a 32-bit PC.

True, those same analysts would deny that the PC/RT — or the 6150 as IBM insists it must be called in Europe — is part of the mainstream PC line. But it does have a high-performance 32-bit microprocessor, it does run PC software with a bit of assistance, it does accept standard expansion cards, it does have its basis in an industry-standard operating system — and in one of its incarnations it does come in an AT-style casing and sits on a desktop.

Indeed, if the PC/RT had originally come from IBM's PC division, and if Intel's 32-bit, PC-compatible 80386 microprocessor had been as late and unreliable as the 80286, then the RT would certainly have taken its place in the PC range — despite its non-standard reduced instruction set (RISC) hardware — as the top-end multi-user Unix system. And even though history cannot be rewritten now, the recently enhanced PC/RT, here referred to as the 6150 in deference to IBM's wishes, is an interesting machine in its own right. With the benefit of hindsight, IBM got it very, very nearly right.

No surprises here — the 6150's standard IBM keyboard

RISC and ROMP

The 'RT' in the 6150's US name refers to 'RISC Technology', where RISC itself stands for Reduced Instruction Set Computers. Recent RISC developments have been thoroughly described elsewhere, notably in Dick Pountain's excellent introduction to the subject (*PCW*, November 1985) and in Hewlett-Packard's background papers to its own RISC project, and do not need extensive rehearsal here.

But put simply, the goal of RISC is faster data processing achieved by cutting down the number of instructions that need to be built into the basic set of a microprocessor. The advantages are smaller processor chips, since they need less on-chip storage for the instruction set; faster signal transfer between devices, thanks to the smaller chip size; and faster instruction execution since the reduced set is designed so that most instructions execute in a single clock cycle.

RISC technology has been a matter for academic discussion for some time, but it's worth taking a brief look at the thinking behind RISC-building from the IBM angle since the engine at the heart of the 6150 is a RISC processor called ROMP — the Research OPD MicroProcessor.

The final acronym, OPD, stands for IBM's Office Products Division, in whose Texas labs the ROMP project started in 1977. A new design was started because it seemed unlikely that any of the mass-market chip makers could come up with a viable 32-bit microprocessor in time to drive the next generation of office systems that was obviously coming, and IBM has never had any qualms about using its own processor designs except for the PC line.

In fact, the ROMP was developed in parallel with another IBM RISC design, the 801 minicomputer, which was being designed in the company's Yorktown Heights research labs. Both chips had the same goals: fast execution speeds, high throughput, and architectures tailored specifically for programming in a high-level language rather than in machine code. The language in question was to be PL.8, an enhancement of the old mainframe PL/I, which was also under development at Yorktown Heights to drive the 801 project.

The two designs changed side by side, since the ROMP was meant to be fully compatible with PL.8. For example, when the 801 design moved up from 24-bit processing to full 32-bit, the ROMP had to follow suit.

But in the end the ROMP and the 801 diverged because of cost and performance criteria, and the ROMP ended up with a mix of 16-bit and 32-bit instructions rather than the 801's complete 32-bit set; 16 registers instead of the 801's 32; and a performance of around 1.5 to 2.1 million instructions per second (mips). For comparison the Intel 80386 chip claims to run at around four mips — but remember that the ROMP was running in prototype form in 1978.

The final reduced instruction set of the ROMP holds 118 instructions, more than the 70 or so instructions of later RISC designs like the Acorn ARM or the Inmos Transputer.

Other design changes included the switching of the ROMP's memory management unit (MMU) functions to a separate chip, since there was just not room for a processor and an MMU on one. Still, when the time came to design a 32-bit workstation, the ROMP/MMU combination was ready. The problem was that the PC had taken off by then, and the ROMP, despite its performance, was not compatible with the 8088/8086/80286 processor family. If the new machine was to be anywhere close to the rest of IBM's PC family, then some careful system architecture work needed to be done. It was, and the results can be seen in the 6150.

System architecture

In effect, IBM was faced with the same problem that Compaq ran into when it decided to build the DeskPro 386 (see review in *PCW*, November 1986). There was a fast, new processor to use in a new design, but it had to be used in such a way that existing software and hardware add-ons could be used with the finished machine.

With similar problems in front of them it's not entirely surprising that both companies came up with similar approaches, although it's tempting to speculate that information could have leaked from OPD's labs over the long development cycle of the 6150. Like the DeskPro 386, the 6150 is really two machines in one. The ROMP/MMU combination and the fast, 32-bit system memory boards form the 32-bit side of the theoretical barrier; on the other side, the 6150 looks and acts a lot like a PC/AT.

The way across the barrier in the 6150 is an I/O Channel Converter, or IOCC, that sits between the 32-bit processor bus and a PC-compatible, 16-bit bus holding the familiar PC-standard expansion slots.

Even with the standard bus, though, there's a problem with making the 6150 run PC software and MS-DOS — the processor incompatibility. IBM's designers got round this simply by building a PC-sized expansion card holding an Intel 80286, and designed to fit in one of the AT-compatible slots of the 6150.

The Daley Thompson guide

100m and 400m

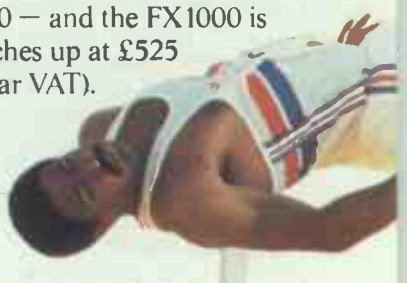
The speed of Epson's new FX800 printer has to come first on two counts.

In draft Elite, the printer sprints along at 240 characters per sixtieth of a minute. (Note: the word s****d has no place in our vocabulary.)

And even in letter-quality mode, it dashes along at 35 c.p.s.. This makes the FX800 an astonishing 50% faster than the popular FX85 machine which it supersedes.

High Jump

The FX800 printer has a far higher spec than the old FX85, it is clear — yet the price has been left exactly where it was. The FX800 costs only £410 — and the FX1000 is just a few notches up at £525 (both RRPs, bar VAT).



Long Jump

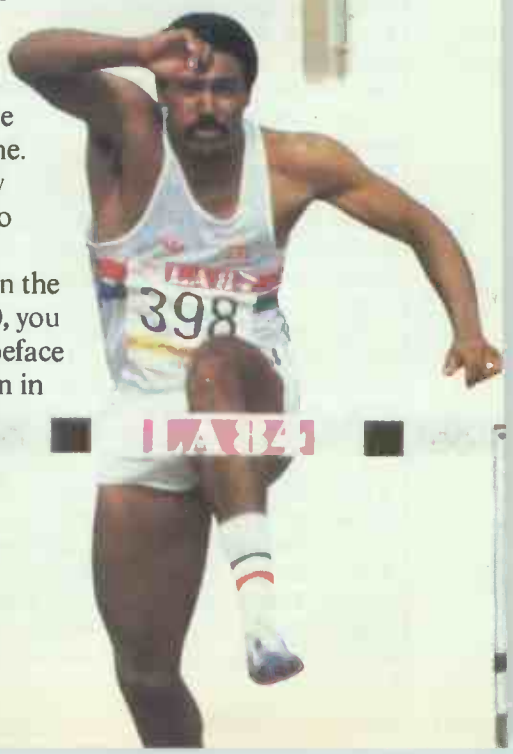
A longer version of the FX800 is also available — the FX1000. This does everything the FX800 can, but has the further advantage of allowing you to run up spreadsheets (up to 0.406 metres flat out).

110m Hurdles

Making quick leaps from one typestyle to another is no problem with the FX800.

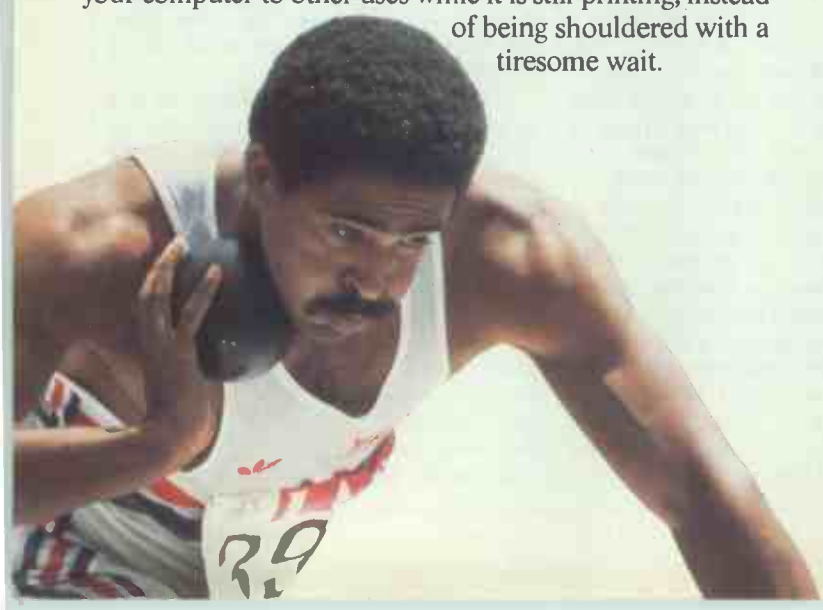
You no longer have to stumble over difficult software commands or trip awkward DIP switches on the back of the machine.

For by simply pressing one or two buttons on the 'Selectype' panel on the front of the FX800, you can change the typeface over and over again in no time at all.

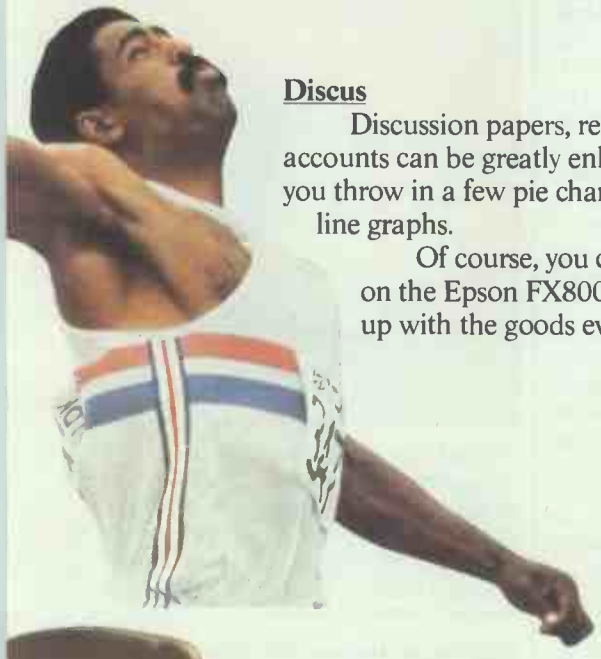


Shot Put

A powerful 8K memory is another of the FX800's great strengths. This enables you to put your computer to other uses while it is still printing, instead of being shouldered with a tiresome wait.



to being a great all-rounder.



Discus

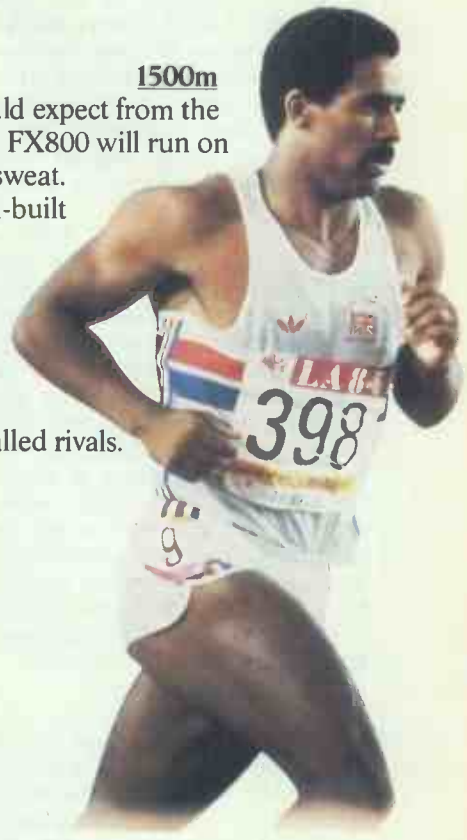
Discussion papers, reports and accounts can be greatly enhanced if you throw in a few pie charts, bar or line graphs.

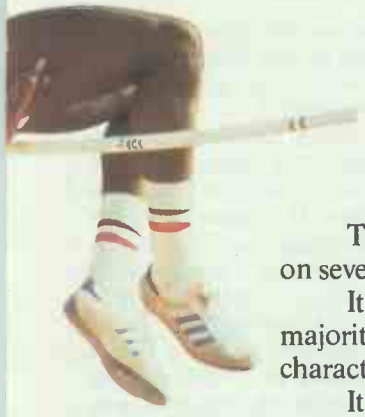
Of course, you can rely on the Epson FX800 to come up with the goods every time.

1500m

Finally, as you would expect from the world's number one, the FX800 will run on and on and on with no sweat.

Indeed, it is so well-built that its print head will pound the paper at least 100 million times before it even thinks of giving out, which means that it stands head and shoulders above its so-called rivals.





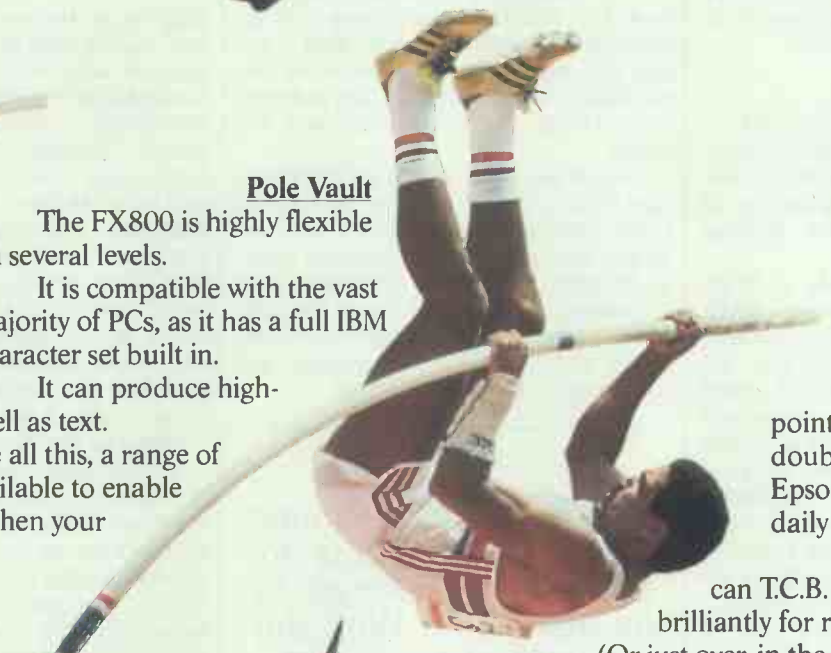
Pole Vault

The FX800 is highly flexible on several levels.

It is compatible with the vast majority of PCs, as it has a full IBM character set built in.

It can produce high-resolution graphics as well as text.

But over and above all this, a range of paper feed options is available to enable you to free your hands when your workload is at its peak.



When you add up all the points above, there can be no doubt that, for its price, the Epson FX800 is unbeatable for daily use in the office.

After all, what other printer can T.C.B. ('take care of business') so brilliantly for rather less than half a big 'G'? (Or just over, in the case of the FX1000.)

If you would like further information, either: write to Epson (U.K.) Limited, Freepost, Birmingham B37 5BR; call up Prestel *280#; or dial 100 and ask for Freefone Epson.

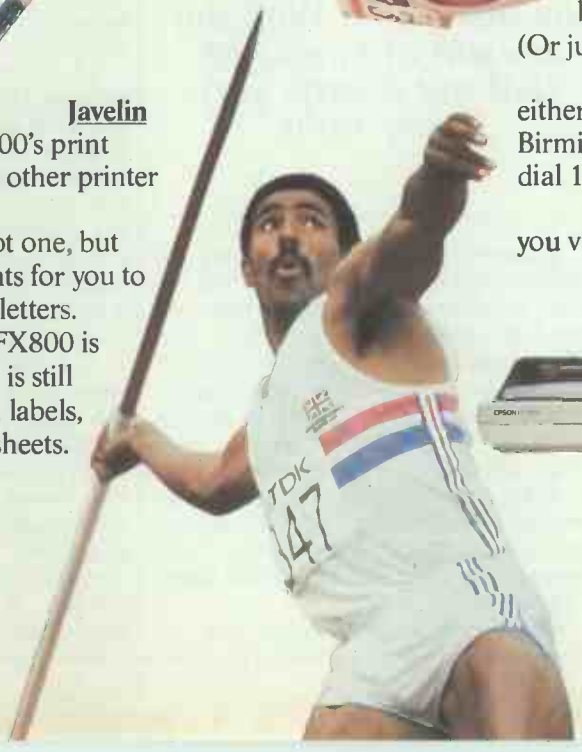
At all events, we will be pleased to send you victorious, happy and glorious details.

Javelin

The sharpness of the FX800's print quality far surpasses that of any other printer in its price range.

In fact, it is armed with not one, but two correspondence-quality fonts for you to use when sending out business letters.

However, even when the FX800 is flying along in draft, the quality is still perfectly fit for internal memos, labels, spreadsheets and general data sheets.



EPSON

This co-processor board was designed to allow PC software to run on the 6150 as if it were an AT, but also needed to include hardware to protect the host machine from the various 'ill-behaved' PC applications when system resources like main RAM were being shared between two processors (more on the practicalities of this later).

But, in essence, the 6150 is intended, like the Compaq 386, to accept PC expansion boards and displays, run PC software (in its co-processor with the advantage of fast RAM), and take advantage of full 32-bit applications software as soon as it's been written. Even the intended 32-bit operating system that will control these applications, a version of Unix, is the same in both cases. The difference is that IBM wants the applications in ROMP code instead of 32-bit 80386 code. It will be interesting to see how the software industry commits itself, or fails to commit itself, to one camp or the other.

Hardware

The 6150 range has two models — the floor-standing 6150 and the desktop 6151, and the differences between them lie in the positioning of some I/O ports and in the storage options available.

The review machine was a 6150, and looked more like one of IBM's bigger System/36 minicomputers than like any member of the PC range. About the size of an AT stood on one end, the box has an almost featureless front panel with a floppy disk drive mounted horizontally at the very top, and a barrel lock and a two-digit digital display about halfway down. Those are all the features there are; the action all goes on internally or in the peripheral devices.

The barrel lock needs to be opened as a first step to getting into the system unit, a security feature that should perhaps be extended to other PCs where protecting plug-in circuit boards and hard disks is more important these days than stopping someone using the keyboard. When that has been done it's simple to remove the entire side panel which would, in a conventional desktop PC, be the top.

Removing the panel reveals that the 6150 has a lot in common with the rest of the PC range; it, too, has a motherboard and an array of expansion slots, although here the physical arrangement is somewhat different. At the bottom of the case the motherboard has four 32-bit expansion slots to hold the ROMP/MMU board, an optional floating-point accelerator board built around the National Semiconductor NS32081 maths chip originally developed to work with the NS32032 32-bit microprocessor, and the system memory boards. Up to two RAM boards, giving a maximum RAM capacity of 4Mbytes, can be fitted in the two slots although the architecture can handle, in theory, up to 16Mbytes. As 1Mbit chip prices fall, and they are used to replace the cheap 256kbit chips used on the system memory boards, that 16Mbyte maximum will be reached on the two boards.

Above the 32-bit slots are two 8-bit, PC-style slots and six AT-style, 16-bit slots, all designed to take standard, PC-compatible, plug-in cards. But by no means all of these are free in the minimum configuration. One of them has to take a display adaptor to drive the system monitor; one of them has to be the AT's Winchester and floppy disk controller board, to handle the 6150's mass storage; one of them takes the 80286 co-processor board if fitted; one of them has to provide the parallel printer port if required; and other boards may be necessary, depending on the number of external terminals that will be fitted.

Things are even worse on the desktop 6151, since there the two serial ports provided on the 6150 motherboard are missing and another plug-in adaptor is needed for those vital interfaces. On both versions, though, the keyboard and mouse interfaces, along with the speaker output, are provided on the motherboard.

'The recently enhanced PC/RT (the 6150) is an interesting machine in its own right. With the benefit of hindsight, IBM got it very, very nearly right.'

Because of the wide variety of optional extras, it's hard to define exactly how many slots will be required for any particular configuration. But the review machine, with 3Mbytes of RAM, two 40Mbyte Winchester drives, a single 1.2Mbyte floppy drive, one external terminal, a parallel printer port, a co-processor board, Small Computer Systems' interface board for a tape streamer, and a console display adaptor, filled three 32-bit slots and five of the eight PC-style slots.

Above the motherboard and its plug-ins is the modular power supply, and above that is the mass storage section with room for up to three horizontally-mounted, full-height Winchester drives and two half-height floppies. The standard configurations of the 6150, the Model 20 and the Model 25, have a single 40Mbyte Winchester and a single 70Mbyte Winchester respectively, both with a single 1.2Mbyte floppy unit. The other Winchesters can be either 40 or 70Mbyte units, giving a maximum capacity of 210Mbytes inside the box, while the other floppy drive can hold either 360k or 1.2Mbytes for PC or AT compatibility.

And if that amount of storage is not enough, two SCSI controllers can be fitted in the PC expansion slots to connect up to 14 external hard disk drives holding up to 400Mbytes each, giving a maximum additional disk capacity of 5.6 gigabytes without any CD-ROM assistance.

All of which is a little ironic; the original OPD design specification for the 6150 suggested that it should be a floppy-only machine, and later designs incorporated hard disks holding only 10 or 20Mbytes each. Within the lifetime of this supposedly 'new' product, technology has driven the maximum available disk space up by a factor of around 90.

All 6150s come with a keyboard and a mouse as standard, but the type of console screen depends on the application required. Three new display adaptors and monitors have been produced for the 6150, all offering what IBM calls All Points Addressable (APA) displays and what everyone else calls bit-mapped screens. The first adaptor, the APA8, drives a 12in, black-and-white monochrome display with a resolu-

The 6150's three new display adaptors and monitors offer bit-mapped screens (shown is the 12in monochrome display), but any standard PC screen can be attached using a plug-in board

tion of 720 x 512; the second, an extension of this called the APA8C, adds 16 colours from a palette of 64 and drives a 14in monitor; and the third gives a monochrome display of 1024 x 768 dots on a 15in monitor. The first two adaptors give a text resolution of 80 x 25 using the IBM standard 20 x 9 character set, while the third gives 38 lines of 113 characters, each using the same set size.

Of course, any standard PC screen can be attached to the 6150 using a plug-in monochrome or colour graphics board, but this is only accessible to the 80286 co-processor if fitted, and only then if there's no addressing conflict with the ROMP-controlled displays. Otherwise the co-processor shares the system screen with the ROMP, using the ROMP's extra speed to emulate PC-compatible graphics on its higher-resolution screen.

A variety of standard ASCII terminals can be plugged into the 6150 using the motherboard's serial ports or a plug-in, four-port RS232 or RS422 adaptor, including the IBM 3101, the DEC VT100 and the VT220, and any IBM PC model using a communications board and terminal emulation software. The review machine had a single IBM 3161 terminal.

Like a lot of IBM equipment, the general air of the 6150 is one of utility. Inside the box there are few concessions to elegance or attractive design, and the IBM custom boards — like the ROMP/MMU and system RAM modules — are solidly built, but with more attention paid to what's on them than what they look like.

It's hard to explain, but the 6150 with its case open looks more like a university research lab's electronics system than a piece of office equipment. That's not to run it down since there's no doubt that IBM builds reliable and solid kit, but is just a personal impression.

System software

The 6150's native operating system for the ROMP/MMU is called AIX, standing for Advanced Interactive eXecutive, but is more familiar than it sounds. In fact it's just our old friend Unix System V with most of the Berkeley 4.2 enhancements, and with quite a bit of IBM tailoring for the 6150 environment.

In particular, the tailoring involved the construction of a software Virtual Resource Manager (VRM) for the 6150 to handle the interface between the Unix kernel and the real hardware it runs on. The VRM was designed to give AIX some virtual memory management help as well as handle the co-processor, disk drives, I/O devices including terminals, and communications over things like IBM's Systems Network Architecture (SNA).

The reason for this approach was mainly that the RISC architecture, by its very nature, has minimal special-purpose hardware, and requires software help to do things like integer multiply and divide and string manipulation. This would normally be an operating system problem, but by providing the VRM — like the ROM toolboxes of the Macintosh or the Atari ST's GEM — the 6150 can accept calls from the operating system at a high, hardware-independent level.

On top of that, the VRM also makes it easier to install different I/O devices without the usual operating system crises. The specification for the new device can be installed in the VRM while it is running, and the right program called and run when the I/O device's particular interrupt arrives, without disrupting the normal running of the 6150.

In the future IBM expects the VRM implementation to allow multiple operating systems to run concurrently on the 6150, just as future versions of Unix will allow on the 80386. And IBM at least has an example of that on the 6150, since the 80286 co-processor and the ROMP can happily process data side by side with the assistance of the VRM.

The virtual memory interface, giving access to up to 1024 gigabytes of virtual memory, is also put in the VRM to provide a standard, high-level interface to the AIX kernel or any other operating system running on the machine.

Although the 6150's rather unattractive floor-standing system box may look out of place in the IBM range, internally it has a lot in common with IBM's other PCs

Changes have naturally been necessary to tune the AIX Unix kernel to the VRM/ROMP/MMU environment. For instance, the kernel has had to be tailored for virtual memory operation and to run on the ROMP without any bottlenecks. But as far as the user is concerned, the major changes are all to do with ease of use and ease of system management, always a problem with Unix.

Even IBM admits that Unix was not designed for use in its target market for the 6150, running on a single-user, multi-tasking workstation using a bit-mapped display, and that changes had to be made in the user interface.

For example, most big timesharing Unix systems have a system manager whose job it is to configure the system and keep track of the various users and what they are doing, allocating priorities and controlling which users have access to which files and programs. In AIX, IBM has tried to get round that by adding a set of menu-driven configuration routines that can be handled by the end-user. The 'vrmconfig' program is used as described earlier, to add devices to the system dynamically; the 'devices' program lets the user enter the device data for the devices attached to the system in as simple a way as possible; the 'minidisks' program, like MS-DOS' FDISK, allows the system's disk drives to be partitioned; and 'installp' helps to get new applications programs running, automatically installing the new device drivers if required.

On top of that there are other user-friendly front-end packages. A 'DOS shell' is provided for users familiar with MS-DOS, giving the standard A> promts and directory displays, and accepting all the usual MS-DOS commands — including batch files and hierarchical directory handling — by translating them automatically into their Unix equivalents. And a new mouse-driven package called Usability has been designed to let users control the system in a simple way.

The problem with Usability is that it must run on the terminals attached to the 6150 as well as on the bit-mapped system console, so there's no way of making it into a Macintosh-style window and icon system. Instead, the mouse is used to select items from a menu and then to select an action from a Lotus-style menu at the top of each screen. Pop-up windows, like those provided in SideKick, are used to provide extra option menus once an action has been selected with the mouse.

Attempts have also been made to simplify the use of the co-processor to run PC software. Typing *pcstart* at

the Unix prompt initialises the co-processor board and loads MS-DOS, using either the system console or a PC display using a separate plug-in adaptor, and typing *exit* in MS-DOS returns the user to the AIX prompt. Of course, the PC software can't be run on any of the terminals attached to the 6150.

Applications software

Although IBM issues a booklet showing more than 150 applications for the 6150, most of these are languages or graphics packages and only four business applications are officially supported by IBM on the machine. These are: Samna+, a word processor that is not entirely satisfactory in a multi-user environment since it has no record locking to prevent multiple access to a single file; an integrated package called Applix, with limited word processing, spreadsheet, database, graphics and communications modules; the Interleaf desktop publishing system, driving IBM's LED-driven page printer; and, most recently, the Tetraplan accounting suite.

However, other standard Unix applications like the Informix database, the Uniplex II and Unify integrated suits, the Q-Office office automation package and SunAccount accounting modules, have also been ported to the 6150.

In use

There's no doubt that in its single-user mode, the 6150 is a fast and responsive Unix machine. However, there are drawbacks to the system thanks to its background as a single-user workstation. Any graphics-based program like Interleaf, and any PC software apart from the rare text-only ones, will only run on the system console and not on any of the terminals. Similarly, the 80286 co-processor board can only be accessed using the system console and the keyboard attached to the motherboard.

The screen display on the system console is black on white, and with the text display operating it looks like nothing so much as the Macintosh during communication with some text-based remote computer. In this environment Usability, thanks to its limitations for terminal operation, is almost unusable and cumbersome; using the mouse to select a menu item and then going up to the top of the screen to select an action is much slower than typing a number to select a menu item and then hitting Return.

The DOS shell works as advertised and certainly eases the pain of Unix by creating a familiar PC environment, while the co-processor really does appear to run PC applications on the system console while the ROMP is running Unix programs on the other terminals. But if MS-DOS is what you want, then the 6150 is an expensive way to get it. And if Unix is what you want, then there are cheaper ways to do that too unless you want one bit-mapped terminal for a specific purpose.

Having said all that, as a single-user machine running a tailored application, the 6150 is impressive. This is particularly true of Interleaf, a desktop publishing package that uses the bit-mapped console to provide a full Smalltalk-like windows and icons environment, with pop-up menus and crystal-clear fonts and graphics. But that is a single-user application only, and could be done just as well on a machine like Xerox's Documenter, or even a Macintosh with an add-on full-page display, cheaper than the 6150 can do it.

Price

A 6150 with 1Mbyte of RAM, 1.2Mbyte floppy drive, a 40Mbyte hard disk, a 12in mono screen, a keyboard, a mouse and the AIX operating system costs £9800.

A 6150 with 4Mbytes of RAM, three 70Mbyte hard disks, a tape streamer, a 12in mono screen, a mouse, a keyboard and four ASCII terminals costs £26,500.

Documentation

The usual standard of copious IBM documentation prevails and includes two AIX manuals.

Conclusion

IBM has worked hard to adapt its RISC technology to a market-place shaped by the PC architecture, and has gone a long way towards fitting a fundamentally-incompatible Unix box into its PC line.

But it's hard to see what you get with the 6150 that you can't get by combining any other Unix box to run multi-user applications, with a cheap AT clone to run single-user PC applications.

There have already been two price cuts in the 6150 range, and hardware and software extensions to differentiate it further from other Unix systems and to show off its higher RISC-driven performance. Now the system is a powerful, clever machine that gets round its design problems just as Compaq's DeskPro 386 does. Whether that's adequate for the market-place, with IBM's own equally-powerful 80386 machine on the stocks, is another matter.

There's one firm conclusion to be drawn from the 6150, though. After all this work, it's unlikely that Unix will be dropped entirely from the IBM PC range, whatever moves the company may make towards proprietary operating systems. END

In perspective

IBM is trying to differentiate the 6150 from the PC line in Europe, partly so that it can pick and choose the upmarket dealers it wants to sell the machine. Systems houses with Unix expertise and a need for a user-configurable machine with some MS-DOS compatibility should be tempted. But the price is high compared with some of the AT add-ons like Chase Research's AT-8 that give multi-user Unix a chance on that machine, and with the Compaq DeskPro 386 running Xenix.

There's a feeling that the 6150 might move even further away from the PC, back into the office or departmental computer market, and leave the PC multi-user business to IBM's new machines.

For now, the competition from 68020 machines from companies like Altos, and 80386 machines from companies like Convergent Technologies, will be stiff.

Technical specifications

Processor:	32-bit reduced instruction set ROMP; 80286 co-processor optional
RAM:	1Mbyte minimum, 4Mbytes maximum
Mass storage:	Up to three 40Mbyte or 70Mbyte Winchesters; one 1.2Mbyte floppy; one optional 1.2Mbyte or 360k floppy
Expansion slots:	Four 32-bit, six 16-bit, two 8-bit; various combinations left free
I/O:	Two serial ports (6150 only); two-button mouse; enhanced system keyboard
Display:	One of three bit-mapped screens with 720 x 512 dots in monochrome or 16 colours, or 1024 x 768 dots in monochrome; optional PC displays for co-processor
System software:	AIX, with MS-DOS 3.2 for co-processor

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McEmulator

Data Pacific's McEmulator enables you to run Macintosh software on an Atari ST, but don't expect to use any serious applications with the cartridge in its present form. Nick Walker assesses its capabilities.

It's an eerie sight watching an Atari ST running Macintosh software. I'm used to seeing any number of IBM clones running IBM programs, but the Macintosh has so much of its fundamental system software in ROM that producing a clone is almost impossible. Nevertheless, those who wandered through the 'Atari Village' at the last *PCW* show will have seen that very sight. After convincing myself that there wasn't a Macintosh under the desk, I sat down to find out more about the little grey cartridge that magically transforms an ST into a Macintosh.

Inside the MacCartridge (as it was then called) there should be two Apple ROMs from either a 128k or a 512k Macintosh, so it isn't quite as 'magical' as it first appears — most of the system software is the original Apple code contained within these two ROMs. The original plan was to sell the cartridge complete with copies of the Apple Macintosh ROMs. Apple understandably put a stop to that by threatening to sue the MacCartridge's US manufacturer, Data Pacific, as the ROMs were definitely copyright Apple. The MacCartridge never saw the light of day as a commercial product but its successor, Magic Sac — a MacCartridge without ROMs — did. Undergoing a spelling change to McCartridge as it crossed the Atlantic and then a name change to McEmulator, it is this product that will be available in the UK from Robtek.

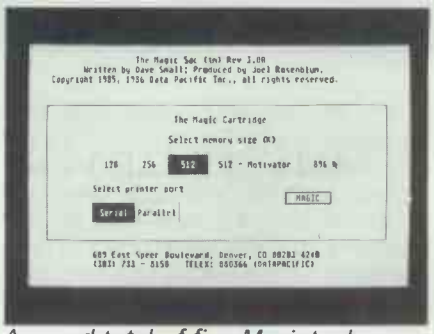
For the Atari ST — a micro still trying to establish itself on the market — the McEmulator can only be good news: suddenly, an extra 700+ applications are available. Unlike the MS-DOS and CP/M emulations that are already available for the ST, these new applications don't mean a trip back to the dark ages of the awful 'A>' prompt.

Photography by Terry Beddis

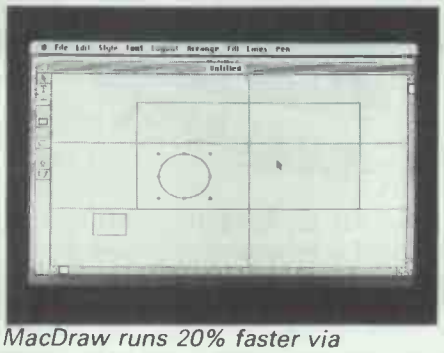
The ST's high-resolution screen and 68000 processor mean that Mac applications can be used to their full advantage in that they expand to fill the entire ST screen. Amiga owners will also be pleased to hear that a McEmulator is planned for that machine, and the very nature of the Amiga's screen and disk means that the McEmulator should be even more compatible.

In selling an empty cartridge, Data Pacific has transferred the problem of obtaining the Apple Macintosh ROMs to the McEmulator purchaser. To further protect Data Pacific's interests, the cartridge is billed as an upgrade for the Apple Macintosh, so officially the McEmulator is only of use to Macintosh owners who are willing to open their machines in order to run Mac software on an Atari ST. This situation reminds me of the modem manufacturers who sell unapproved modems with the proviso that they are not used on public telephone lines.

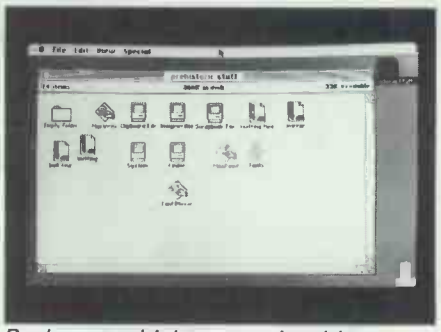
Apple UK's official line on the McEmulator is that the company is carefully monitoring the situation, and the controls it applies to the issuing of ROMs make it impossible to obtain them anyway. Conversations with Apple dealers, however, paint a different picture. As far as they are aware, the ROMs are still available to anyone as part of the Apple parts catalogue.



A grand total of five Macintosh configurations is available on McEmulator



MacDraw runs 20% faster via McEmulator and utilises the Atari's larger screen display



Packages which use resizeable windows will be able to use the larger screen

Perhaps Apple should make the ROMs generally available at a reasonable price, and be grateful for the increased market awareness that move will give the Macintosh and its software. If Apple applies restrictions to the sale of ROMs, people will resort to dealing with the underground network of hackers and pirates.

Before purchasing a McEmulator you'll need the following: an Atari 520ST with a floppy disk drive, or an Atari 1040ST; an Atari monochrome monitor; two 32k Macintosh system ROMs; the Macintosh software you require; and access to a Macintosh to transfer the software across.

Robtek supplies an empty McEmulator, an ST disk, a Macintosh disk, a Mac-to-ST serial cable, and a slim 25-page manual.

Installation & set-up

When you have the two ROMs, installation is just a matter of pushing them into two empty sockets and hoping you don't bend any of the pins. This should in theory take less than a minute, and if you're the kind of person who doesn't read manuals, it will. The manual, however, explains how to put the ROMs in the wrong way round! To check that the ROMs have been installed correctly, run the Macintosh emulation program; if you make it through to the 'Happy Mac' boot-up screen, the ROMs are fine.

It's interesting to note that the Happy Mac screen can be reached without inserting a disk. On the Macintosh it can't be reached without inserting a good Macintosh system disk, so the emulation software must contain some of the boot-up code of an Apple system — something for Apple lawyers to ponder.

After reaching the Happy Mac screen I naively expected to insert a Macintosh system disk and be up and running, but of course things are never that simple. Both the ST and the Macintosh use different format disks, and the very nature of the disk drives makes compatibility impossible. The Atari disk drive is a fixed-speed drive whereas the Macintosh drive is a variable-speed device.

To transfer software to run under McEmulator, you first need to format some disks in a special 'Macintosh-like' format; a utility is supplied for this. Then you need to connect the serial cable to the modem ports of both machines. Robtek supplies ST and Macintosh programs to perform the transfer.

There's no way round using the transfer program for the first transfer of a system disk, but I subsequently found it far easier to use the same Macintosh communications package on both machines. The transfer program supplied does have one advantage — it's a nibble copier. This should be able to copy some of the many copy-protected Mac programs, although that's no guarantee it will run them. Data Pacific is planning to release an Atari hardware modification that will turn the ST into a variable-speed drive, accompanied by a new version of the McEmulator emulation software which will allow the ST to read Macintosh disks directly.

After all the effort, it's quite an achievement to get a Macintosh desktop up and running. It's possible to configure the kind of Macintosh system the Atari will emulate, via a selection menu that appears just before the switch. The options are: a 128k Mac; a 256k Mac; a 512k Mac; a 512k Mac with a RAM disk; and an 896k Mac. Atari 520 owners will only be able to use McEmulator in 128k and 256k modes.

'The ST's high-resolution screen and 68000 processor mean that Mac applications can be used to their full advantage in that they expand to fill the entire screen.'

The other problem I encountered is that the first release of TOS (Tramiel Operating System) ROMs will not work with greater-than-256k configurations, even on an Atari 1040ST. The second-release ROMs, as used in all except the very early 1040s, work in all five configurations.

The Mac has two serial ports: one is usually assigned to a modem; the other is usually assigned to a printer. It has no parallel port. The Atari has one serial port, usually assigned to modems or printers; and a parallel port, assigned only to printers. When you use the 'printer' port with Mac software on the ST, the data goes to the Atari serial port as you would expect. You can change this by selecting the parallel option on the selection menu.

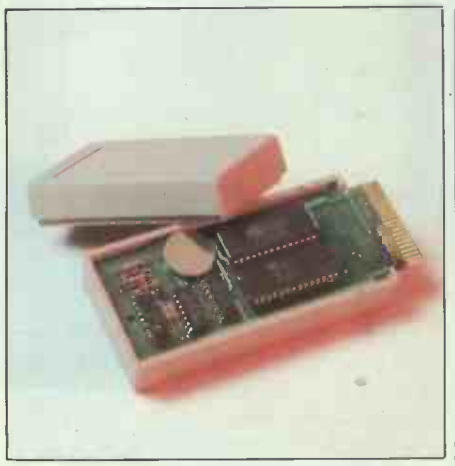
There are a number of other utilities supplied with the McEmulator ST disk, including utilities for copying the 'Macintosh-like' ST disks, and a utility for setting and using the real-time clock in Atari ST mode.

In use

The good news is that the McEmulator not only works, it runs software 20 per cent faster than the Macintosh. It utilises the full 640 × 400 pixel screen of the Atari (compared to the Mac's 512 × 342 pixels) and with an 1040ST, you can have 896k of available memory. The bad news is that, at the moment, it isn't very compatible. When using any application seriously, you get the unnerving feeling that it's just about to crash: you're always waiting for the dreaded diagnostic screen which gives the system status at the time of the crash.

In order for the McEmulator to run at all, a number of fundamental problems have to be overcome — the most fundamental of which is how does the emulation program run the ROMs. Unfortunately, there isn't much I can tell you about that as the author, David Small, is understandably guarded about how it works. He didn't diclose any more than that it traps all the calls that the ROMs make to another part of the system, and translates them into their Atari ST equivalents.

Other problems can be explained in a little more detail. The Macintosh and the ST differ greatly in how they



The hardware of McEmulator is nothing more than a standard ST ROM cartridge without any ROMs. McEmulator Plus, shown here, also has a real-time clock

handle disk ejects. On the Mac a disk eject is automatic, and is only done when the operating system gives permission. On the ST, you can generally eject a disk at any time with the eject button and it won't hurt the disk. If you prematurely eject a disk in McEmulator mode, you could easily damage it. Furthermore, the damage may be subtle and may not be found until the disk starts to act oddly or has problems reading data files.

To eject a disk using the McEmulator, you must first ask the Mac system to 'eject' it. The appropriate Mac ROM routine will then be called which cleans up the disk properly and issues an 'eject' request. The emulation captures this request and turns it into a flashing A or B, corresponding to drives A: and B:, in the top right-hand corner of the screen. You can then remove the disk.

The sound chips in the ST and the Macintosh are vastly different in their internal architecture; accordingly, sound is unsupported on the ST. For some reason, turning the sound control on the Macintosh control panel down to zero reduces the crashes caused by programs trying to access sound.

The ST keyboard emulates the Macintosh's surprisingly well. Two Macintosh keys not found on the ST — Command and Option — are simulated by Control and Alternate. As the Macintosh mouse is a single-button mouse, the right-hand button on the ST is redundant.

As well as the sound problems, there are a number of other limitations imposed by the hardware differences. ST owners with colour screens have 200 lines of vertical resolution, whereas the Macintosh needs at least 342 lines. Therefore, the McEmulator can't be used with an ST colour monitor or TV.

Currently the McEmulator only supports single-sided disks. It will work OK in a double-sided drive but will only give 400k per disk. Plans are under way to produce a version that will support 800k, double-sided disks on double-sided drives.

Neither does the McEmulator support Atari, or any other brand, hard disks. Again, in the future, they should be supported.

The McEmulator requires two Macintosh system software programs — the System and Finder files. The Finder is basically the desktop which appears when you start the system; it manages disk file I/O. The System operates several functions such as fonts, start-up code, various 'system utilities' and desk accessories, and it is used continually.

The McEmulator works with three versions of the Finder: 1.0, 1.1g and 4.1. Versions 1.0 and 1.1g are best-suited to 128k and 256k Mac systems; version 4.1 runs best on 512k systems. It won't work with the latest versions of the Finder (5.0 and greater) which use Apple's hierarchical filing system.

Applications

The official Data Pacific list of compatible and incompatible Macintosh applications is given in the boxes on this page, but my advice is take it all with a pinch of salt. To be classed as a compatible product, it seems that a package has to be capable of five minutes' operation without crashing. The only programs I can recommend as sufficiently robust are MacDraw and MacPaint. If you use anything else, be sure to save your work every five minutes.

For readers with a basic knowledge of Macintosh system software, there are four common reasons why an application causes the McEmulator to crash. These are:

- passing a zero parameter to a Mac system call. Even on the Mac this is bad news, as it means there's something wrong with the code. However, sometimes the Mac can get away with it because the machine has RAM in location 0 (the system call handler). On the ST, however, it causes an instant bus error, as location 0 is ROM.
- accessing Mac hardware directly. Although programmers have no need to access hardware directly on the Macintosh, some still do. Most popular is direct access to the disk as part of a copy protection scheme.
- assuming the screen is 512 pixels wide (like the Mac) instead of using the system screen size settings.
- trying to access the ROM version.

Conclusion

I'm amazed that the McEmulator works at all. In its present form, I couldn't recommend it to anyone who wants to do serious work using Macintosh applications. Even the recommended applications work sporadically.

If you're the kind of user who is fascinated by how software works and would enjoy discovering new compatibilites and incompatibilities, then the McEmulator is a very rewarding product. In six months' time, perhaps, it will be a serious proposition. In the meantime, buy it because it's great fun, and for the pleasure of being involved with its development.

The McEmulator costs £150 (incl VAT) and is available from Robtek on (01) 847 4457. END

Compatible software (as known)

Apple:	Find 1.0, 1.1d and 4.5; MacPaint 1.5; Edit 2.0; MacDraw 1.9; MacProject 1.0; REDIT; disk utility; Switcher 5.01
Others:	Aldus Pagemaker; Assimilations RAM disk; Desktop Software 1st Base 1.01; Bishop Graphics' Quik-Circuit; Haba Systems' Habaterm; Infocom — all products; Manhattan Graphics' Ready-Set-Go 2.1; Megamax C; Microsoft Basic 1.01, 2.0, Excel, Works; Software Arts' TK! Solver

Incompatible software (as known)

Apple:	Switcher 3.0,3.3, MacTerminal 2.0, MacWrite 4.5
Hayes:	Smartcom 2.0
Microsoft:	Word
Penguin:	Transylvania

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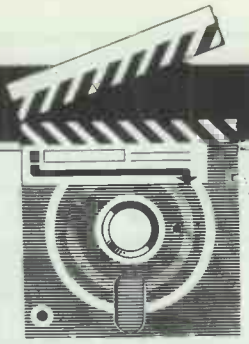
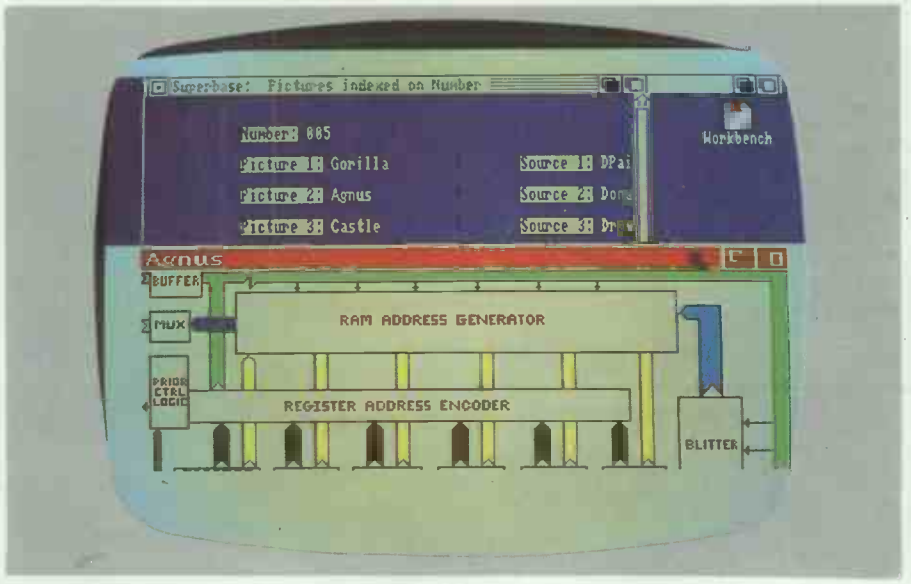


SCREENTEST

Amiga Superbase

Currently only available for the Amiga but with a GEM version in the pipeline, this 'very visual' data management system from Precision Software provides straightforward but powerful facilities for mixing pictures and text. Kathy Lang has tested the package and draws her own conclusions.



Screenshots by Chris Bell

A person who studies software in depth could be forgiven for wondering, occasionally, whether software designers ever talk to real-life users. My own theory is that, since most computer people don't like the rest of the human race, they design the software first, and then go out and talk to a few users to rub off the worst glitches. Such a theory would go some way to explaining that otherwise strange phenomenon, the almost total divorce of character data from graphics in most computer systems. You try incorporating a drawing into a document on your word processor, or a picture into your database, and, with certain honourable exceptions, you'll see what I mean.

One of the few honourable exceptions is under the spotlight in this review — Superbase, a data management system for the Amiga. Superbase has a number of mundane factors in its favour, such as excellent indexing and selection facilities, and a powerful screen display. It also has a novel and very attractive approach to the problems of making reasonably powerful features easy to use. But what makes Superbase really unusual is that it allows you to coordinate the storage of records and pictures. Any file containing a picture drawn with an Amiga painting or drawing program can be referred to directly within a Superbase record, and recalled for display alone or alongside a record which refers to it. So now, instead of just storing boring old text details about those widgets in your stock cupboard, you can display a picture of a widget alongside. And there are many applications in which that could be very useful.

Superbase is currently available only for the Amiga, but a GEM version for the Amstrad PC and other IBM PC lookalikes should be available by the time you read this, and this should be rather cheaper than the Amiga version. For both machines, the current version is known as Personal Superbase; a 'Professional' version, aimed at developers and including some major extra facilities, should be available for both systems in the spring of 1987.

Superbase is a British product from a company called Precision Software. The company, which has an excellent overseas sales record with a product of the same name (but without much else in common) for earlier Commodore machines and for the Apple II, also markets a word processor called Superscript which is very popular both in the UK and abroad. Superbase is already proving very popular on the Amiga: the company claimed sales of 3500 copies in the first two weeks. But how does it measure up in practice?

Constraints

Superbase is remarkably free of constraints; no limit is placed on the number of fields, nor on the size of a record. A record file must be con-

fined to a single disk, but the picture files to which it refers may be spread across several disks. Text fields are limited to 255 characters, but you can have up to 999 key fields! In a number of instances, such as specifying sort fields during a 'Query', or setting up selection criteria in a filter, the only limitation is provided by the ability to define all your requirements within a single command line of 512 characters.

The variety of data types is not great, however — no time-field type, for instance. And data validation is not startling — you can check data entered using a formula for comparison with fields within the same record, but there is, for example, no ability to check while adding data on the screen that a field value matches another in a different file.

Superbase is not copy-protected, so you can make duplicates of the program disk. But in order to run Superbase, you *must* have a dongle — this plugs into a joystick port on the side of the machine, next to the mouse, and provides copy protection.

File creation & indexing

The minimum specification to set up a Superbase file is to create a set of field definitions, and specify an index field. Each field may be character, numeric or date, or a reference to an external file. Character fields may be up to 255 characters long, enough for most purposes apart from applications where it's necessary to store lengthy text fields. Numeric fields may be calculated from others, and any field may be validated against a test set up when the file is created.

External files are used to store data that cannot be handled directly within Superbase itself, usually files containing pictures created with one of the painting programs for the Amiga. (The screenshots contain some examples of pictures displayed within Superbase.) This unusual feature would be a great advantage in keeping track of information which is a mixture of text and graphics — for example, relating files of sketches of sets to the acts of a play to which they relate, or coordinating reference material such as an estate agent's pictures and verbal descriptions of houses.

When a record format has been created, the next step is to create an index. Superbase allows up to 999 indexes — though, in practice, keeping many indexes up-to-date could be expected to slow down updating dramatically. Indexes are used both for direct access to records, and for displaying records in a particular order. You can have only one index in operation at a time, but can change the current index at will; all indexes are kept up-to-date automatically. Index pointers are maintained while the index is open, even when the index is not current, so that, if you open a second index and later return to the first, that first index will still be pointing to the same record.

At any time, the record format can be amended purely by altering the definition; you can change lengths, display attributes and even types, though clearly some loss of data will be inevitable if this is done without care. A price has to be paid for this flexibility; on the basis of some experimentation with field displays, it appears that Superbase stores fields in a way that does not allow you to recoup lost space when field lengths are reduced, until you use the utility to reorganise a file. This approach could also have speed penalties — but more on this in the concluding paragraph.

As you would expect with a WIMPS-based system, the process of file creation in Superbase is highly interactive and makes extensive use of the mouse, pull-down menus and requesters — equivalent to dialogue boxes in GEM. Sometimes the antipathy to the keyboard is taken too far: for example, when setting the length of a field, you cannot enter numbers from the keyboard but must click the digits display — and while you can change units, tens and hundreds separately, you cannot hold the mouse button down to keep increments going, but must press the button once for each unit of change. To enter a field length of 255, for instance, needs 13 key depressions instead of just three!

Data input & editing

Records can be entered and edited interactively, and also amended in batches to provide automatic updating. When entering data, full-screen editing is provided, using the mouse and cursor keys; some functions, such as saving a record, are provided through the pull-down menus, but for the most frequently used you can use the Amiga key in combination with a character instead. A useful addition is the ability to duplicate a record, but you can't repeat just the value of a single field from one record to the next, nor can you provide for a field to have a default value. Entry to a field can, however, be made obligatory. Data can be edited when displayed in any of the three 'Views' of the data described in the next section.

Screen display

Superbase provides three standard ways to display records: 'Record', 'Form' and 'Table' Views. Record View is essentially the default format provided by Superbase, with one record per screen (or screens, for long records), and each line containing one field name followed by its value. Form View provides a similar display initially, but you can modify the layout by dragging the fields and captions around using the mouse. In either case, a record may span more than one screen, and you can use the scroll bars to see currently-hidden information. The Table View is intended for the display of lists of records, and shows one record per line with field names across the top of the screen. In each View, you may select a subset of fields for display during the current session.

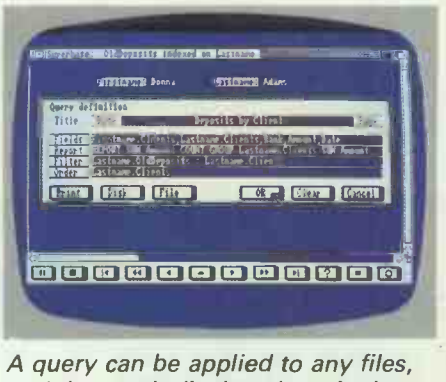
Numeric fields may take a variety of formats, but I could not find one which suppressed the display of the decimal point. Date fields may also be displayed in several ways — no struggling with MM/DD/YY for British users of Superbase!

Printed reports

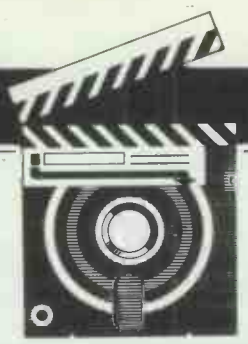
Superbase provides a 'Query' option to set up reports that can be printed or stored in a file. A filter can be

The 'video-recorder' graphic controls work in both Table view (shown here) and Form view

Filters limit the search of subsequent searches. Here, the search is restricted to US addresses



A query can be applied to any files, and the result displayed as single records or as a table



SCREENTEST

Features and constraints

Max file size	Disk size
Max record size (chars)	UL
Max no fields	UL
Max field size	255
Max digits	13
Max prime key length	255
Special disk format?	No
File size fixed?	No
Link to ASCII files?	Various formats
Data types	Char, Number, Date, Picture
Fixed record structure?	Yes
Fixed record length stored?	No
Amend record structure?	Yes
Link data files?	Y
No. data files open	UL
No. sort fields	UL
No. keys	999
Max key length (chars, fields)	255, 1
Subsidiary indexes kept up-to-date?	Yes
Unique keys	Optional
Data validation	Adequate
Screen formatting	Paint-a-screen Default given
Report formatting	Col/row co-ords Default given
Store calculated data	In data entry
Totals & statistics	Extensive
Store selection criteria	Permitted
Combining criteria	And, Or, Not
>1 criterion/field?	Yes
Wild code selection?	Any part string
Browsing methods	Any field
Interaction methods	Menus, commands
Reference manual (max 5*)	***
Tutorial guide (max 5*)	***
Reference card (max 5*)	N
Online help (max 5*)	**
Hot-line?	Supplier, charges

Notes: NA=Not Applicable; NS=Not Stated; UL=Unlimited

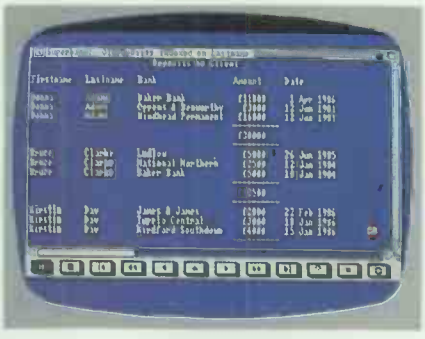
attached to the Query, and you can either specify a subset of fields or use the field selection already in force for screen display. A default format, similar to Table View, is used, unless you specify column positions for the fields. Numeric fields can be sub-totalled and totalled, and records sorted by order on several fields. And you can define calculated fields, and produce summary reports based on totals and statistics only. Fields may come from more than one file, by using a link field — not necessarily of the same name in each file — to join the records as needed. There is also a special label-printing facility, able to print labels up to four-up across the page.

The Personal version of Superbase contains no special facilities for handling free-format text. In the Professional version, simple word processing will be available, including the ability to produce personalised letters by merging text with information from database records.

Selection & sorting

Superbase provides an excellent set of facilities for choosing individual records or sets of records. To select an individual record, using the current index, you choose the 'Key Look-up' button, shown as a question-mark, and enter the value required. Such a selection finds the key value closest to that entered, and warns you if it is not an exact match. Once a record has been located — through Key Look-up, or by going to the start or end of the file — you can then run through the records, in order by that key, using controls that mimic the buttons on your tape-recorder.

With fast-forward, for example, the screen shows each record in turn, leaving it on the screen long enough to enable you to press the Pause button when the record you want appears. Records can then be amended or viewed in the usual way.



The result of applying a query on an example file — a table summary showing numeric fields

The index used can be changed at any time.

For selection of groups of records, or to use more than one criterion, you can set up a filter. This allows you to construct tests using relational operators — a LIKE operator for character variables, the use of AND and OR to combine tests, and parentheses to modify the order of the application of tests. Like Key Look-up, you can display records using the filter in any of Superbase's three Views. But you can also create a complete Query based on a filter and a report format, using the layout features described under the section 'Printed reports'.

When displaying records on the screen, you can show them in order by any index — that is, by any single field defined as a key; ordering set-up in this way is maintained when records are amended. In reports, more than one field can be used for ordering: for example, to sort personal records by surname within department within region.

Calculation

Input calculation is permitted through the derived attribute, in which a field may be calculated from one or more other fields in the same record. In reports, Superbase allows you to output calculated fields, again derived from other fields in the same record, as well as producing sub-totals and totals aggregated across the whole set of records. Quite a wide range of functions is available, including several for correct handling of arithmetic on dates.

Multiple files

Superbase allows limited handling of multiple files. You can update one file from another, provided the two files can be linked through shared fields (not necessarily with the same name). And you can create reports, using the Query facility, that include fields from more than one file, again specifying links between the files concerned. But you cannot display parts of more than one file and up-

External graphic files can be associated with any record and viewed like the Amiga 'rollerblind'

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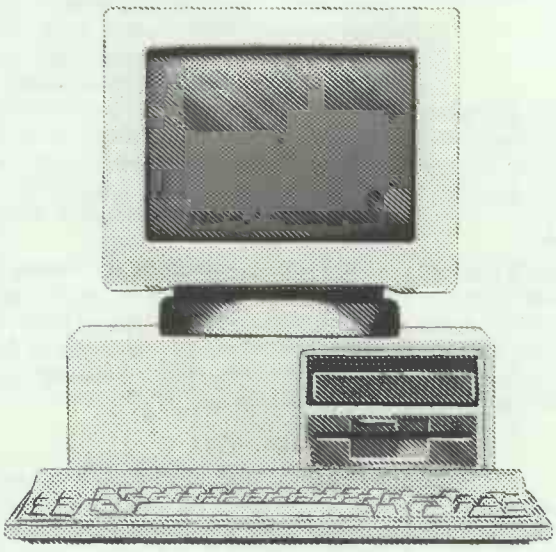

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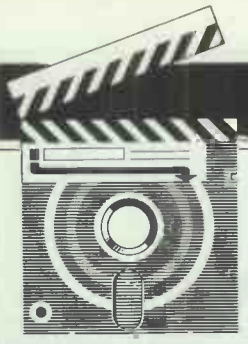

SCREENTEST

date them interactively.

Consequently, while simple applications involving shared information could be implemented, more complex situations could not be handled straightforwardly, especially where it was necessary to check data interactively. For that kind of application, you would need the Professional version of Superbase which will have the ability to include fields from more than one file in a form, and thus carry out interactive updating of several files at once.

The other aspect of Superbase's file-linking concerns the use of pictures and other external files. Essentially this involves storing the name of the file concerned as a text value in a field within the record to which it relates. A record can refer to more than one external file, and such a file may contain more than one image. And it is possible, by manipulating the window size and shape, to show both the record display and the picture on the screen together. Such a facility could be invaluable in mixed text and graphics applications.

Tailoring

Superbase has no programming language; you can set up stored report formats using Query, but there is no facility for recording keystrokes or for the kind of tailoring that would be needed by system developers. (This will be included in the Professional version, which will have its own programming language.)

Housekeeping & security

A data file may have up to three passwords: to control access for reading only; for any action except deleting the file; and for full access.

Links with outside

You can read and write ASCII files in Superbase, with control over the terminators used for fields and records. But there are no facilities for importing or exporting other standard formats, such as the DIF format often used by spreadsheets.

User image

Superbase is one of the most visual packages on the market in its methods of interacting with the user: full use is made of the Amiga's features, of mouse, menus, radio buttons and requesters, windows and scroll bars — the screenshots will give you some idea of the overall effect. Sometimes, however, all this innovation can prevent an experienced user from getting things done quickly; apart from the occasional absurdity, Superbase avoids these pitfalls.

Documentation

A single manual does duty for reference and tutorial on Superbase. It is divided into three parts, covering increasingly complex aspects of using Superbase. Within each part, short tutorial sessions are included, each labelled with the time that should be needed to complete it. For becoming familiar with the package in a systematic way, this works quite well; but it is sometimes difficult to find out where to check on some specific item.

The manual includes an index, but it is rather short and, as is usual, very solution-orientated. There is a short summary of each menu function at the end, but otherwise no reference summary.

Conclusion

Superbase on the Amiga provides straightforward facilities for handling records and referencing pictures. Its selection facilities are excellent, display is imaginatively handled and reporting is good. And the methods of storing records should make it economical for handling information of variable length.

For a variety of reasons I was unable to run my standard Benchmarks on the Amiga, and therefore could not verify a slight suspicion about the speed of operation with a large number of records. These doubts do not relate to interactive operations which, with the well thought out and flexible indexing, should stay fast, but to batch tasks where speed is, of course, less important. By the time this review is published, Superbase should be available under GEM for the IBM PC, so I shall be able to comment on that implementation and carry out some Benchmarks on it, early in 1987.

At the same time, I also plan to look at the Professional version of Superbase. The promised enhancements to provide a development environment through a pseudo-programming language, direct file relationships via forms updating of multiple files, and simple word processing, should enable system developers to exploit the ease of use of Superbase on tailored systems for less experienced users.

Overall verdict

Information: Personal Superbase is basically a flat-file package, but it does have the ability to link more than one conventional data file for reporting, and also when amending records in a batch. It can also link textual records with picture files, allowing you to create a database of linked records and pictures. It would be especially suitable for applications in which you want to display pictures alongside descriptive text, and the use of variable-length records should make it economical for use in applications where the amount of information varies widely between records.

Processing: Records can be selected in a wide variety of ways, providing considerable flexibility in display. Sorted order may use indexes, which are maintained, or be specific to a particular report, in which case sorting must be repeated when records are changed. Calculations are permitted on input and in reports.

Housekeeping: Records may be amended on the screen, or in a batch, and retrieved through any field or combination of test criteria. The structure of a file of records may be amended at any time (even after data has been entered) in a very flexible way, making it easy to get the structure just right. Files may be deleted within Superbase, ASCII files imported and exported, and access to files controlled through passwords.

Control: Personal Superbase is controlled through the usual Amiga repertoire of mouse, pull-down menus and requester boxes, making it very easy for beginners to use. Reports can be automated by setting up a Query to include selection criteria, sorting and layout instructions. Apart from Query, however, there is no ability to store sequences of instructions, nor can you construct tailored environments — for example, using your own menus — for naive users. Superbase would, therefore, be much less suitable as a system developer's tool.

Support: Hot-line advice from the supplier. First 90 days is free, provided you fill in the registration card. Thereafter, £25 per six months or 10 hours' advice, whichever is reached first.

Superbase for the Amiga costs £130.39 (excl VAT) and is available from Precision Software, 6 Park Terrace, Worcester Park, Surrey KT4 7JZ. Tel: (01) 330 7166. END

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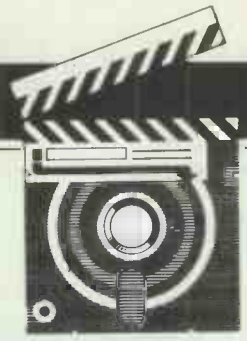


SCREENTEST

GEOS

Just when you thought it was safe to bury your Commodore 64, along comes GEOS, a graphics-orientated operating system which could revive the flagging fortunes of this limited machine. Nik Lumsden checks it out.

The Commodore 64 may be looking rather long in the tooth these days, but every time it seems about to be relegated to peaceful retirement as a door-stop, along comes another piece of plastic surgery to prove there's life in the old dog yet.

In the year of its debut in 1982, when windows were only found in walls and wimps still commuted to suburbia, the C64, with its generous dollop of 64k, was one of the new breed of upstarts which contributed to the boom in home computing. The hostility of its Basic soon proved to be an asset, in that software houses swiftly came to the rescue with friendlier and friendlier little packages, each of which sought to put the non-programmer in conjugal touch with his machine.

Many of these packages were excellent and gave instant access to hi-res graphics, three-channel sound, graphic adventure-writing — you name it. Then came the Macintosh — 'The computer for the rest of us' — and nothing could ever be the same again. The mouse came out of the woodwork and the wonderful world of the WIMP was ours to share — if your wallet stretched to 128k, that is. Microsoft finally threw open its Windows; the ST got GEM on the road; and even the C64 grabbed its share of the rodent population. But to drag the 64 kicking and screaming into a fully-implemented WIMP environment seemed to be begging the 64k question. Then along came GEOS.

The Graphic Environment Operating System (GEOS) comes on a double-sided disk with a well-documented 125-page *User's Guide*. The system assumes you are operating with a set-up which includes either a C64 (or a 64C or a 128 running in 64 mode), one or two 1541 disk drives, a joystick in port one and a printer.

Side one of the disk contains the master program and is copy-protected insofar as the program will only boot from the master disk. Before using the program you must, therefore, make a back-up copy of GEOS to use as your work disk. The reasoning beind this becomes clear when you see that there's no disk space left until you tailor your work disk by deleting any applications you don't need for the job in hand. For instance, if you intend to use the word processor, you might delete geoPaint and any of the fonts you won't be using on this occasion. There are also a number of resident printer drivers and you may safely delete all of these except the one for your machine.

The flip side of the disk contains more printer configurations, a demonstration of Q-link (the American equivalent of CompuNet), and a few games programs.

Getting started

When you've booted the master program, you're in Macintosh territory. A desktop, complete with pull-down menus, icons and waste-basket are all there for you to 'point and click' at with your joystick. The daunting business of preparing a work disk is well-documented in the manual and will help to familiarise you with your new environment. I was relieved and impressed at the speed and efficiency with which this was accomplished: the whole procedure, including formatting and three disk passes, took a little over six minutes.

Stay with the manual for a few more pages and you'll quickly get the hang of 'pointing', 'clicking' and 'dragging' unwanted application icons over to the waste-basket and clearing space on the work disk for your own files. To name your work disk, click on the word 'disk' in the command menu, select 're-name' from the window, erase 'GEOS V1.2' and key in your own name. Each work disk must have its own unique name and must be opened to display its directory on the desktop; it should also be closed when removed from the drive. As long as you keep to these few basic disciplines, the system is now your oyster.

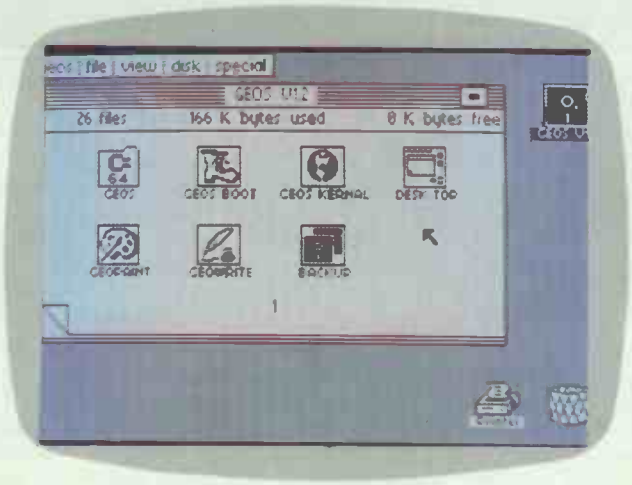
GEOS contains five main modules: deskTop, geoWrite, geoPaint, Desk Accessories and QuantumLink. As the latter is only of use as an American comms link (or to those wishing to add a few zeros to their phone bills), it need not concern us here. However, if GEOS becomes the *sine qua non* it deserves to, it would not be unreasonable to expect a CompuNet equivalent for UK users. The British distributor, First Analytical, expects to have additional software available shortly. This will include a database, a spreadsheet, 20 more font styles, and also drivers for drawing tablets and mice.

deskTop

This is the jumping-off point for the whole system and, as we have seen, is the arena for file and disk manipulation. The file icons are arranged eight to a page and you can flick through the pages by clicking on the lower left-hand corner. Any file created by you will be 'iconised' and will appear on one of the deskTop pages, along with its filename. You can rearrange your deskTop files in any way you choose, simply by moving the relevant icon off the deskTop and inserting it in a free space.

In the same way, you can rename, delete, copy and write-protect files, or view files either by name, data, size or type. A wide range of printers are catered for, and providing your printer driver is present, you can

Screenshots by Dimension Graphics



Familiar to all Macintosh owners — the GEOS desktop

geoPaint works just like MacPaint plus colour

print direct from the deskTop by selecting a document and clicking on the printer icon.

If you need to delete a write-protected file or application from your work disk, the file window will provide you with the means to do this; at the same time giving you information about the file's contents and the date and time it was created. In addition, you can create a disk directory in GEOS format for your non-GEOS disks and display this on your deskTop. You can even exit to Basic (if you feel strong enough) and then hit Restore to return to GEOS (if you don't).

geoWrite

By double-clicking on the geoWrite icon you're presented with the choice of creating a new document, opening an existing one, or quitting back to deskTop. When you've opened a file you can start typing. Move the pointer to anywhere in the window, click the fire button and a text cursor will appear. The default parameters are set up for an A4 page with line lengths of 6.2ins, but margins and tab positions can easily be set or changed by using the ruler at the top of the screen.

The first thing you'll notice is that you're using a hi-res screen, so allowing for the C64's limitations of 320 × 200 pixels, you get a true WYSIWYG (what you see is what you get) representation of your page in the font style you've chosen. As you move towards the right-hand edge of the screen, the window will shift to display the rest of the line, giving you word-wrap when you reach the margin and justifying your text as you go.

To move to another part of the page, either use the up and down arrows, or call up the page indicator and drag the small square to any part of the page you need to work on. Moving backwards and forwards between pages is even more straightforward: simply call up Options and enter the page number. But where GEOS shows its Mac lineage, and the fun really begins, is in the versatility of its online font library.

The package comes complete with six typefaces, each of which can be manipulated in a variety of ways. Display fonts, such as Dwinell (a version of Olde English) can be enlarged up to 24 point size. All faces can be italicised, emboldened, shown in outline, reversed or underlined — or used in any combination you care to try. Some of these combinations are pretty, others are downright dreadful, but with experiment you can come up with plenty of hand-tailored text styles with which to adorn your printed pages. All fonts have true descenders, so users of the MPS801 need cringe no more over their p's and q's.

Editing facilities are also versatile. Text can be deleted, moved or copied by pointing and dragging the cursor over any part of the text area you wish to change. The area now appears in reverse video and can be manipulated from the Options menu. Deleted text is stored in a temporary Text Scrap file from which it may be recovered and re-inserted later. If you want to save Text Scrap permanently, you can create a Text Album (containing anything up to 127 pages), the contents of which may be moved to any document you work on.

The only minor gripe I have is that there is no facility for automatic entry of headers and footers, or for centring a heading on a line. Other than that, you could easily be fooled into thinking that you were using MacWrite.

geoPaint

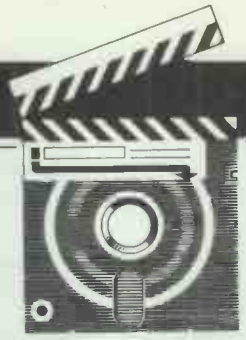
Once again, Mac users will immediately experience a sense of *déjà-vu* on entering the geoPaint module. The display gives you a drawing window measuring 3.3ins × 1.8ins but produces a printed output on A4, 600 dots wide and 800 dots long on an 80-dots per inch printer. All the facilities available in geoWrite are present in geoPaint, plus the additional drawing tools which are now standard in the majority of graphics packages.

The drawing icons down the left-hand side of the screen give you access to pencil, eraser, airbrush, pattern fill, squares and circles (both filled and hollow). In addition, there's a very useful ruler for accurate measurement either in pixels or printer inches. Unfortunately there's no provision for metric measurement: isn't it about time our American cousins did the Continental and turned their rulers over?

There's a wide choice of 14 paint brushes and 32 pattern options which you can use, either in paintbrush mode or for filling or airbrushing. There's no built-in facility for redefining patterns or brushes, but additional textures can be created by overlaying one pattern on top of another. Of course, there's still no way of circumventing the C64's colour constraints and you'll need to take the customary precautions to ensure that each 8 × 8 pixel square only contains two colours. It seems unlikely this barrier will ever come down but, given the chicanery of current C64 programmers, who knows. . . ?

All the fonts available in geoWrite can be clicked into play, but first you need to define a rectangle in the drawing area in which to place text; having done so, the text will word-wrap within the defined region and up to 254 characters can be inserted within each region created in this way. Text boxes may be cut or copied to Text Scrap and used elsewhere in your layout. Any text or graphics within the defined area may also be rotated, inverted, mirrored or erased.

As well as a temporary Text Scrap file, you now also get a Photo Scrap equivalent for cutting and pasting from one area to another. Again, Photo Scrap can be saved permanently on disk by opening a 'Photo Album' which, subject to disk



SCREENTEST

space, can have up to 127 pages. In this way you can move chunks of text or graphics between applications with very little effort. If anything, this facility is an improvement on the ramifications I encountered on early MacPaint/Write equivalents. But beware — disk space is at a premium, and you'll need to plan your working space pretty carefully unless you have two drives.

Desk Accessories

On pulling down the GEOS menu back on the deskTop, there are a number of additional gizmos, any of which can be called up while using the main applications. There's an alarm clock, a calculator, a note pad, the photo and text managers, and a preference manager which lets you customise GEOS.

At the start of a session it's good practice to call up the preference manager screen and set the time and date. In this way, all the files you create before you switch off will automatically receive a time and date stamp when they are saved. The default border, background and foreground colours may also be redefined and saved permanently on your work disk to save time resetting them each time you start up. The so-called 'Mouse' controls actually refer to the screen pointer which can be redefined in a different shape or colour, and its speed and acceleration retuned to suit your joystick.

The alarm clock and the calculator behave exactly as you might expect and can be pulled onscreen while running any of the other modules. Similarly, the note pad is permanently on call for jotting down up to 127 pages, all of which are saved automatically to disk each time it's accessed.

Looking ahead

Berkeley Softworks, the American originator of GEOS, obviously expects a bright future for its brainchild — a prediction which I, for one, fully endorse. With the idea of encouraging independent programmers to make full use of the GEOS environment, the company is currently producing a reference manual which will give direct access to the GEOS operating system and allow anyone to develop their own applications. Another project in hand is the production of an advanced Basic interpreter to take advantage of GEOS capabilities.

The present version (1.2) does not include a mouse driver. It appears that, although an earlier release was compatible with Commodore's own 1350 mouse and certain track balls, the driver was unreliable with other mouse releases. It was tried out at the *PCW* office with the NEOS mouse and, although they rhyme quite effectively, they didn't make very compatible bedfellows. However, a *true* mouse driver is in the pipeline and software updates will include mouse drivers — for those with a mouse driving licence, that is. This will correct the only serious omission in the current version.

Other applications running in GEOS are already beginning to trickle through. A 'real' word processor with search and replace facilities, a database and a spreadsheet should all be available by the time you read this. And there will be regular updates of new font libraries, thus allowing you complete indulgence in the kind of designer extravagance which was previously the coveted preserve of Macintosh owners.

UK support

GEOS is now available through retail outlets. However, if you have problems tracking it down, contact First Analytical at the address below. I should mention that the *PCW* review copy failed to boot after three days' use, but was instantly replaced in exchange for the original.

In view of GEOS's excellent coverage, it seems likely that user groups will soon be burgeoning. If you're wired up to CompuNet, watch out for news and downloads soon.

Documentation

The documentation is exemplary (although there are a few typos) and, apart from showing its US origins in the QLink section, will have you fully in tune with the system within 30 minutes.

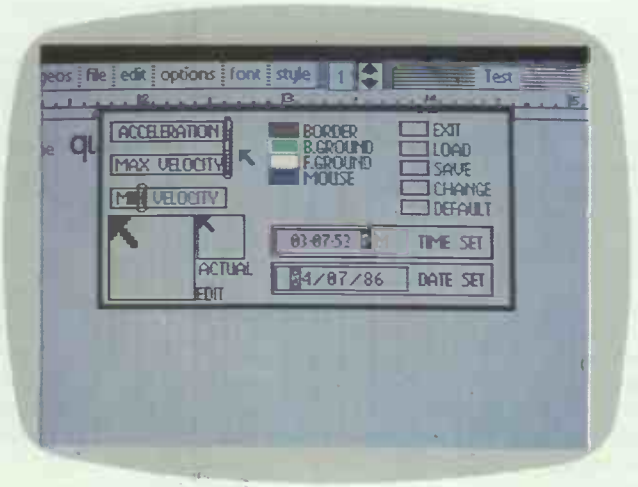
Conclusion

GEOS has given the C64 a complete face-lift and a new lease of life. It proves that the much-maligned 1541 drive, if programmed intelligently, can perform as well as the rest of them.

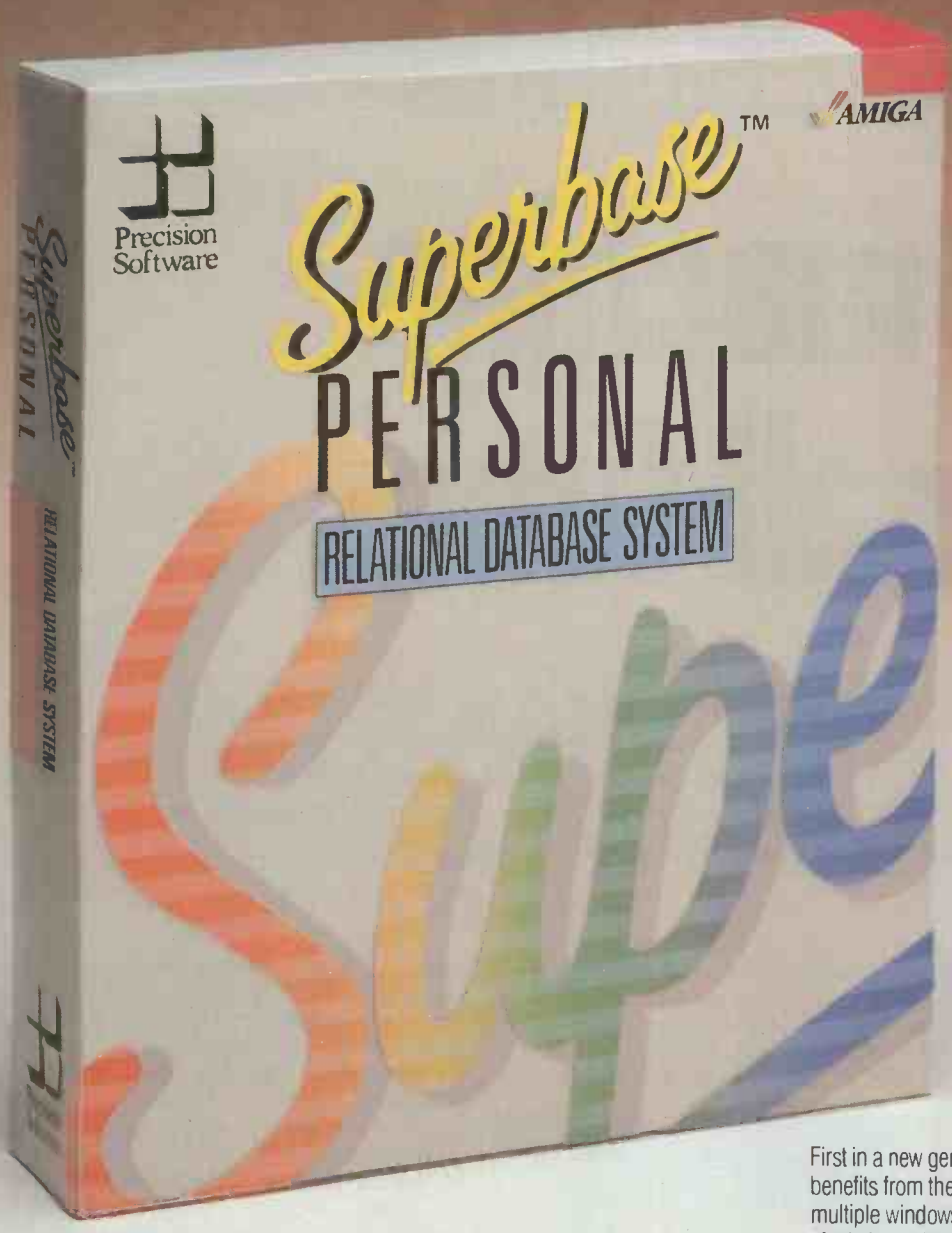
In view of the C64's serious memory limitations, the speed and efficiency of GEOS revolves around ingenious programming of the disk drive; and here the programmers have used every available bit (and byte) of magic to move you in and out of each and every application as smoothly and swiftly as a Lotus gear change. My one hope is that, when the mouse wrinkles have been successfully ironed out, Commodore UK will see the light and bundle GEOS with the C64 and the 64C.

GEOS costs £49.95 (incl VAT) and is available from First Analytical, 6 Newcomen Street, London SE1 1YR. Tel: (01) 524 5630.

Using the calculator desk accessories in geoWrite



The control panel allows desktop configuration



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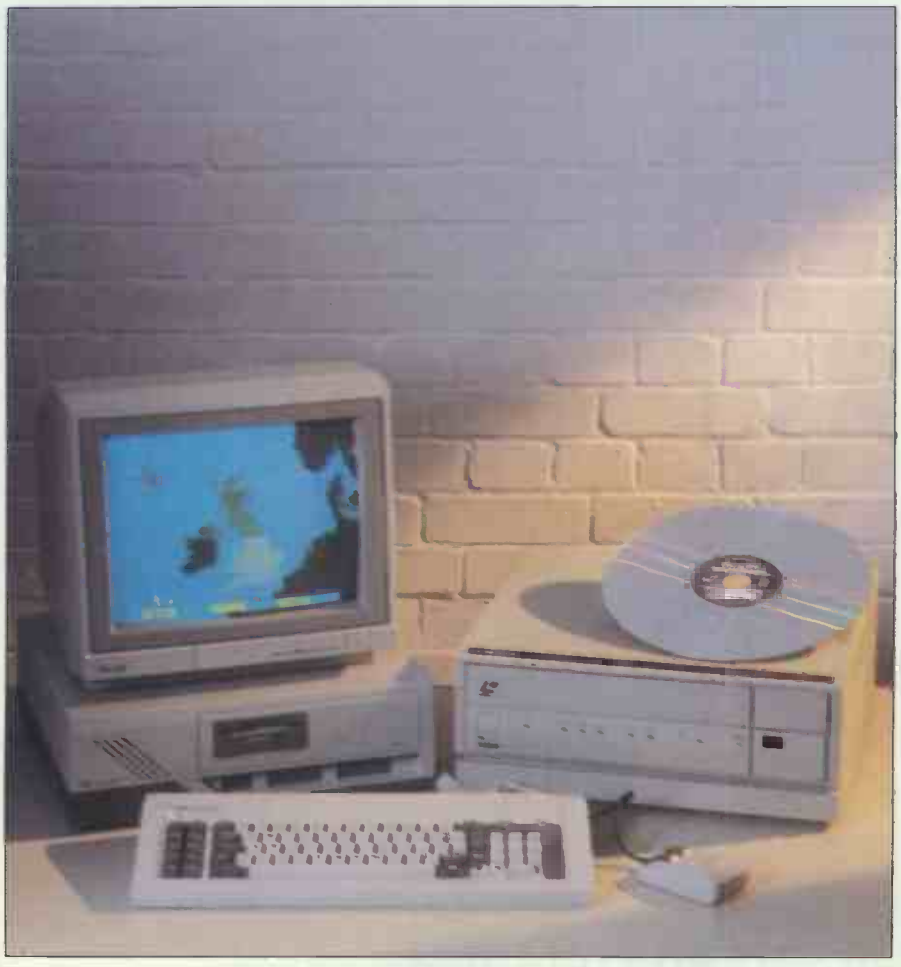
A machine for all times

Conceived by a BBC producer to commemorate the 900th anniversary of the Domesday Book, the Domesday Project will be an invaluable asset in schools and libraries throughout the UK. Owen Linderholm looks at the lessons that have been learned in its making and assesses the implications for the future of the interactive video industry.

In 1086, William the Conqueror commissioned a record of his latest acquisition — Britain. This was a study of the land, what was on it and who owned which parts of it. It was also the first-ever record of an entire society. The record became known as the Domesday Book — a document of extreme importance to historians. At the time it was of great interest to William the Conqueror because it provided him with all the information he needed about his new asset without having to discover it for himself; it was also useful for tax purposes.



Photography by Terry Beddis

In the relatively primitive society of Norman Britain, the immediate uses of the Domesday Book were limited to what William wanted: more money, more power, to know who were the most powerful (and, therefore, dangerous) barons, and so on. It wasn't, however, a complete geographical record of Britain. Large areas were omitted, as were many of the major towns.

Celebration

Nineteen-eighty-six marked the 900th anniversary of the Domesday Book and it was celebrated in several ways. The most important has been the BBC's Domesday Project, which was conceived several years ago by Peter Armstrong, a BBC producer and computer enthusiast. The BBC's modern Domesday Project has a wider audience and wider aims. It is as complete a record of Britain in the early eighties as is possible, and is the major part of the BBC's coverage of the 900th anniversary of the original Domesday Book. The record is held on an ultra-modern equivalent of a book — video disc. It is accessed by computer and will be made available to schools and libraries as well as anyone who wants to pay for it. The Domesday Project was designed not only as a modern equivalent of the Domesday Book,

but also to be the first system to make real use of interactive video. Part of its significance is that it is a research tool that is powerful but fun, and one that *anyone* can use.

It is somewhat misleading to think of the Domesday Project as merely a computer-based method of accessing information. The foundation stones of the project are two video discs, while the computer is merely a convenient and sensible way of getting at the information on the discs. The most important part is the basic concept of storing information on video discs and retrieving it extremely quickly.

The form in which most people will encounter the Domesday Project is what is known as the 'Domesday Machine' — a grandiose and formidable title. The Domesday Machine consists of a microcomputer hooked up to an advanced video disc player and a high-quality colour monitor. It also has a pointing device — a mouse or a tracker ball. But using the Domesday Machine is not the same as sitting in front of a computer. As most of the information is conveyed by photographs, using the machine is more like watching a video; the major difference is that it is a video you are directing and which you are participating in at the same time. My impression, after using one for a time, was that I had been taking part in a television documentary as well as directing it.

The connection between the Domesday Project and William the Conqueror's Domesday Book is more involved than the fact that the modern version was inspired by the ancient, and the Domesday Project is also supposed to present a microcosm of the nation. The Domesday Book has had an impact that is far greater and longer-lasting than could ever have been anticipated, and the same will no doubt be true of the modern version.

In the beginning

And then the King said to his councillors:

'Ride into the country and record who owns all the land and who lives upon it, and all the details of this. Yes, even unto each furlong, and then inscribe it into a book, and let this book be known as the Domesday Book, for it shall be a record as complete as that which will be written on the Day of Judgement.'

Although the commissioning of the Domesday Book might have been organised as above in the days of absolute monarchy, when the King's word was law and his power was enough to make sure that what he wanted got done, the modern Domesday Project had no such start. About three years ago when the ideas was conceived, interactive video was considered to be a technological possibility but, at the same time, no-one was willing to get involved with the technology because it was considered too expensive and extremely difficult.

'It is somewhat misleading to think of the Domesday Project as merely a computer-based method of accessing information.'

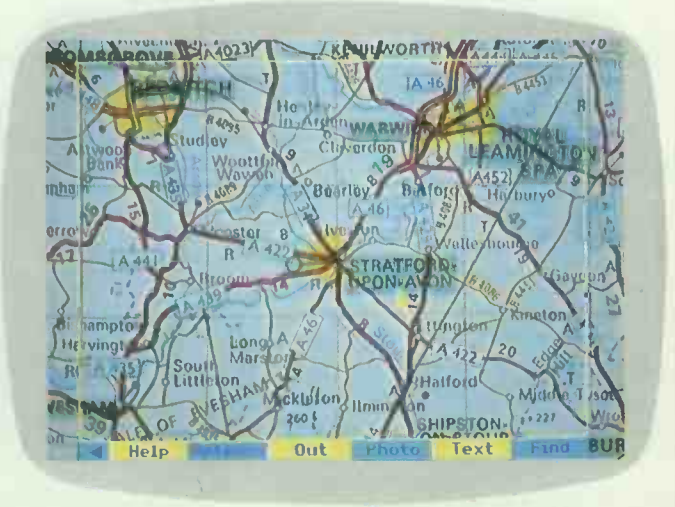
In particular, it was recognised that interactive video systems involving video tape were not sufficiently powerful or flexible to be of value. The problem with video disc technology was that producing master discs for use with interactive video was prohibitively expensive, and also the current video disc technology was simply not powerful enough to allow quick access to the stored information.

Peter Armstrong, the current director of the Domesday Project, was a producer at the BBC who believed in the potential of interactive video. He recognised many of the problems, and realised that the only way to justify developing new technology and paying for the creation of video discs in the right format, was to use interactive video as part of a large project. The 900th anniversary of the Domesday Book and the opportunity to create a modern version was just such a project. The final product would also justify the expense of the inclusion of a highly-advanced laser video disc player in the system. This was necessary since the player was to combine large amounts of still video pictures in conjunction with computer data, and so a new laser player optimised for displaying still frames was needed.

At some point after this proposal had been put to, and was being considered by, the BBC, someone came up with the idea of using schools, with access to a large base of computers in a standard format, to collect information. About two years ago, a significant number of schools in the country got involved in the project and collected data from their localities for the Domesday Project. They also organised photographs and textual information to be used in the community part of the Project.

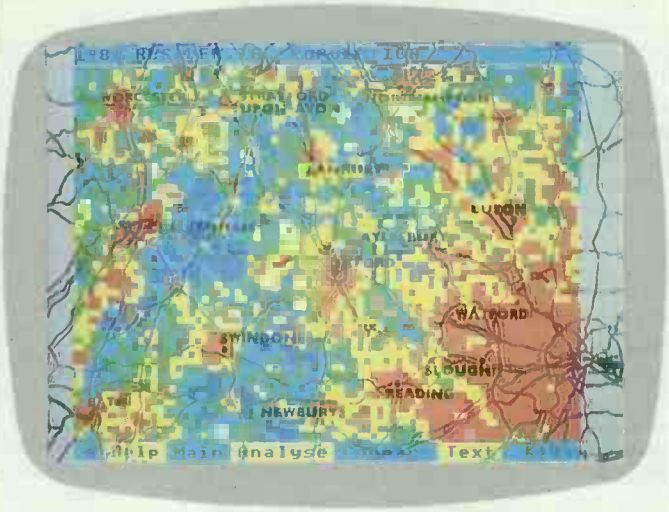
At this point, the BBC had to look into the feasibility of the Domesday Project very carefully, and also had to face the major problem that the whole project would have to be finished before the end of 1986, the anniversary year. Although many believed that the task was impossible and would never be finished on time, the BBC nevertheless went ahead and involved the DTI (the Department of Trade and Industry), Philips,

Enlarged satellite photograph of Southern England and Wales with major towns marked. The pointer is showing where we want to go next . . .



A couple of maps later, we zoom in to Stratford-upon-Avon and the surrounding area. Another map of the town is shown in the top left corner

After looking at the Stratford-upon-Avon map, we ask for photographs — and up pops the theatre!



A map of the Thames Valley showing the density of residential population in 1981. Notice the 'hot spots'

Acorn and Research Machines.

Since then, all these groups have been working extremely hard to produce a Domesday System on time. Logica was eventually brought in to help with software development. At the start of 1986, the basis of the two systems was starting to take shape. The BBC version is based around an Acorn Master 128 with a 65C102 (a speeded-up version of the 6502) second processor, a Philips monitor and the Philips 415 LaserVision player. The Research Machines version is based around its Nimbus computer, in any configuration, and the same Philips monitor and LaserVision player that the BBC is using. Both versions have been completed on time — *just*. The cost to the BBC has been over two million pounds, all independently raised, but the final result justifies it. Unfortunately, no-one is going to be really convinced of this until they have used a Domesday Machine for themselves.

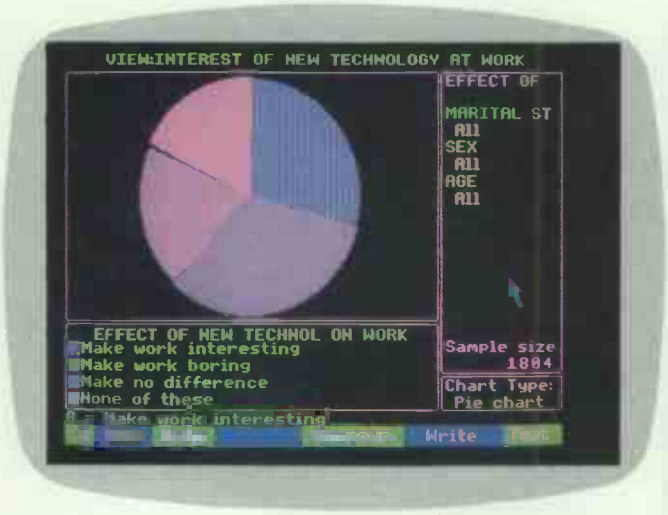
The Domesday Machine

The most important piece of equipment in the Domesday Machine is the laser disc player. This is a high-quality player, very different from the laser disc players being sold in the shops a year or so ago. The player uses a large chunk of ROM and microprocessor control (LV-ROM) to perform all sorts of useful tricks, and it has an interface for connection to a multitude of computer devices and peripherals. This interface is connected to the computer and accessed by software provided for the system being used.

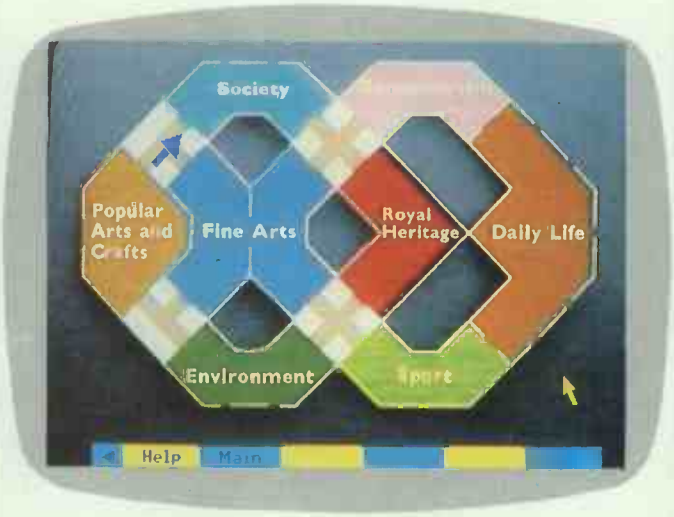
'The aspects of British life covered by the National Disc are incredibly wide-ranging and cover arts, crafts, news . . .'

In practice, all this technology is very transparent. On both systems, you simply switch on and 'boot' the computer. After a short pause, the Domesday Machine starts up, and it is very easy to forget that there is a computer involved at all. The interface for communication with the Domesday Machine is controlled by either a mouse or a trackerball, but it is a very visual one. The mouse or trackerball is used to perform operations on video screens — maps or pictures. In many cases, this seems like zooming in on an area or turning over a page in an album.

The backbone of the Domesday Machine is the video disc. There are two of these: the Community Disc and the National Disc. The former contains a huge database of com-



Graphing data from a survey on the effects of new technology. Any of the variables on the left can be changed to reveal differences in attitude between groups



A plan of the Domesday Gallery. This is a good place to browse through the immense volume of information, but not for a nap — it's too interesting

munity information gathered by schools and colleges or supplied by professionals. This is correlated with a huge range of Ordnance Survey maps. Every part of England, Scotland, Wales, Northern Ireland and all the various islands are covered by at least two levels of maps and two levels of satellite photos. Some areas of special interest are covered by up to eight levels of photos, maps and diagrams. At each level there is a different set of textual information.

The National Disc holds information sets on the British way of life, covering aspects such as society, culture, industry, and so on. It also holds lots of research data ranging from the 1981 census figures through magazine surveys. The information is held as sets of text, pictures, data or film. One side of the disc is devoted to news summaries of the years from 1981 to 1986 held as film clips from BBC News.

When the Domesday Machine boots up from the Community Disc, a satellite photograph of the UK appears and the cursor in the shape of a pointer appears on top of this. As it is moved by the mouse or trackerball over the satellite photograph, the area of the country over which it is moved lights up — so, if the pointer is over the South of England, for instance, that part of the photograph changes to white. When an area of the country is selected in this way and the mouse button is pressed, the photograph instantly zooms in to a larger-scale satellite photo of that area, with the major towns in the area being highlighted. If an area of this photo is clicked on, the screen instantly changes to an Ordnance Survey map of the new area.

This is a good place to describe the other options. At every level many pages of text are available, describing the area of the map or photo in detail. The text is appropriate to the scale of the map or photograph, so when large areas are depicted, the text is written by researchers, professionals, and so on, and describes, for example, the history or geology of the area. When small local areas are shown, the text is written by local people and describes what they think is important about their area. Associated with the text and maps are sets of pictures which can be called up and flicked through as if they were photos in an album. Tools are also provided for measuring distances and areas from the maps and satellite photographs. When a map is on the screen you can draw lines on top of the map and the length of these lines is automatically calculated and displayed in kilometres or miles; areas can be calculated in a similar manner. This facility has all sorts of potential uses in, say, route planning, geography and land use, to name just a few applications.

Everyone will have their own questions to ask of the machine. You might want to look up, for instance, where you were born, and I was no exception in this case. The database of maps, text and pictures can also be accessed by keyword search. This covers all the cities, towns, villages and landmarks in the UK; as well as other features, there are 270,000 names which can be used for searching. Simply type in the name and the correct map appears with the relevant area highlighted; similarly, the text files and picture file are indexed and can be accessed by keywords.

'The Domesday Machine is perhaps most significant for what it heralds, rather than for what it is.'

All this may sound complicated, but the machine's help facilities are remarkable. Not content with several pages of textual help, there is also a demonstration mode which plays a video film of the system in operation, along with a clear, explanatory soundtrack. The video is a close-up of the Domesday Machine in operation — a perfect example of making the best use of a medium to get the message across!

As an example of the speed and power of the indexing and searching, I did a keyword search of the Community Disc on 'Industry and nuclear and coal'. This resulted in a search for items matching all the criteria, followed by combinations of two items, followed by the individual items. Several perfect matches were found, and the total number of items matching all the criteria was about 10,000! In practice, the best 100 matches are brought up. The system took 20 seconds to find these out of the 10,000 items that matched, and this was one of the most difficult cases I could think of! That is astonishingly fast, especially considering that the underlying computer was the 8-bit Acorn machine and that the database being searched is huge — about 324Mbytes of data on three sides of disc.

The National Disc is accessed by keywords, which can be used in logical combinations with 'and', 'or' and 'not'. The disc can also be accessed through 'The Gallery', an imaginary art gallery that you can walk through using the mouse. What appears is a three-dimensional representation of a building and you move about by clicking on appropriate parts of the screen; for example, turn left by clicking on the left-hand side. This can take a while to get used to, as different views are being recalled off disc and the motion may seem inconsistent at first. But in use, the effect is as easy to consider as walking.

The Gallery has several rooms, dividing the data into categories, and within each of these are pictures hanging on the wall. If any of these are clicked on, then a set of pictures and text about the subject shown is recalled. As well as the pictures on the walls, there are also doorways through which can be seen high-definition pictures of different areas. If you 'walk' through these, you enter an 'environment'. You can explore this environment by 'walking' around it with the mouse.

Each step brings up another real photograph as if you had really walked forward or turned left or right. This can also be speeded up so that a film-like effect is achieved. Typical surrogate walks, as these are known, are through the countryside or the towns or even houses. The feel of this is the same as exploring the area in person. Some parts of the surrogate walk even have magnifying glasses which allow you to follow up a particular point in more detail. One of the walks, for example, is around a farm and there is a magnifying glass over a cow in a field. When you click on the glass, the system diverts into a series of pictures of a cow giving birth. In addition, the National Disc can be accessed by using a full name directly or by a hierarchical contents system. These lead you down to any of the picture sets, text items or walks and also provide access to the data sets, of which there are about 4000.

Both the Community and the National Discs store vast amounts of information, the difference between them being that the National Disc holds a large amount of numerical data. This numerical data is principally the results from the 1981 census which have been reformatted to fit in with the map-based approach of the Domesday Machine. Numerical data has also been obtained from other sources, including the schools survey. One of the more interesting data sets is to do with land use and cover, and is the first such study since the 1930s.

The aspects of British life covered by the National Disc are incredibly wide-ranging and cover arts, crafts, news, industry, the economy, lifestyles, places, nature, the environment, the Royal Family, the media, and on and on and on . . .

One other facility available on both

discs is placing a 'bookmark' at any point in the system. This saves your position and allows you to return to it at a later date. Bookmarks can also be saved to floppy disk library of references can be recalled.

There are two basic kinds of data sets. The more common type do not use any video information from the disc, but are displayed as computer-generated graphs and charts. Each of these sets of data has several variables, any of which can be used as a basis for drawing charts. Different parts of the data set can be filtered out or examined more closely, and several different types of graph or chart can be displayed. The range of options effectively allow the data to be viewed in absolutely any form or combination.

The advantages of this facility are obvious. For the first time, census information can be carefully analysed, and meaningful conclusions can be easily drawn and presented.

Another form of data representation is that many of the data sets have been associated with a map of the UK. From these, the Domesday Machine can call up a simple black and white map of any area and overlay the data as coloured points. One obvious example of this is population density. I very easily produced a map of Greater London showing population density, which was colour-coded red for high density going down to dark blue for low density. Not too surprisingly, the areas around London seemed 'cold' while London itself was very 'hot'. These maps can then be correlated with other data sets, allowing all sorts of interesting investigations to be made.

The only real way to get a feel for the Domesday Machine is to use one. The BBC estimates that it would take at least seven years to explore the two video discs if you were to spend 40 hours a week doing it. The discs hold about 324Mbytes of data plus 60 minutes of video film with sound. It is also possible to download data from the video disc to a printer or floppy disk in order to explore the data in more detail.

Data storage

The video disc has been considered as a computer storage medium for some time, and it has been taken very seriously as a possibility for interactive video. The alternatives are conventional tape which, being sequentially based, would take far too long to jump between a section at the beginning of the tape and a section at the end; or compact disc, which poses problems in storing graphical data. It takes a significant amount of storage space to store a high-resolution colour picture and it can take quite a while to retrieve a picture. The difficulty with laser video disc is that the basic form is analogue and some means is needed of storing digital computer data. This has been solved by using the audio track for digital data, and the areas where sound are necessary can be left out.

The format of data storage is very similar to that used on floppy or hard disk systems. In fact, the format used on the video disks in the Domesday Machine is almost identical to that used by the Acorn ADFS chip in its Acorn/BBC Micro range.

'The Domesday Project was designed not only as a modern equivalent of the Domesday Book, but also to be the first system to make real use of interactive video . . . it is a research tool that is powerful and fun . . .'

One problem that arises is that video discs were originally intended to store films in a *sequential* manner. The storage technique used, which is the way the player operates, is called CLV, or constant linear velocity. This allows more film-playing time (typically 60 minutes on a disk) but makes random access data storage very difficult, since it is no longer possible to jump across tracks and keep reading data in synch. An alternative technique is called CAV, or constant angular velocity. This is similar to the way a floppy disk operates and allows the read/write head (or laser beam in this case) to jump across tracks and stay in synchronisation, making data access easy but losing some of the ease of storing analogue information, and therefore shortening the film playing time to about 36 minutes. The problem has been solved for the Domesday Machine by the Philips video player which can do both. This allows the Domesday Machine to take advantage of either method when the need arises.

A great deal of the software needed to access the video disc is stored on the discs themselves. This is downloaded to the Acorn computer (the Research Machines computer does not use this facility) by loader software built into the ROMs that come with the computer. In practical terms, the computer can consider the video disc to be a hard disk and simply download data from it. When it wants a particular video frame to be displayed, the correct command is issued to the player and the frame is brought up and displayed by the player, which also controls most of the interfacing with the computer.

One other thing has been taken into consideration in the layout of data on the audio tracks of the discs. Although video and audio (computer) information is treated independently, in order to optimise speed, care has been taken to store relevant sections of data next to each other — and in a sensible order. This speeds up the process of switching between maps or pictures as video data, and indexing and text as computer data. This has been done so well that it is impossible, even on the slower Acorn system, to see any significant delay.

The video hardware

The Philips 415 video disc player has the capability to access discs in CAV or CLV form as described above. It also has several other powerful features which make it the best video disc player in volume production at the moment. The most important feature is LV-ROM. This is basically a microprocessor control system with large chunks of code in ROM which completely control the player. External devices can communicate with the player via an SCSI (small computer standard interface) and instruct the player. All commands are carried out by the LV-ROM and the player, which can perform operations like genlocking, displaying still frames without loss of bandwidth, video mixing, instant jump, and more.

These operations make interfacing computer graphic output and video pictures much easier. Genlocking is the process of synchronising the display of video output and computer graphic output. To do this, it is necessary for the computer to produce an interlaced display. Interlaced displays involve two vertical passes of the cathode ray over the screen area to produce one image. The two passes are interwoven so that one covers the space between the lines drawn by the other; the advantage being that higher resolution can be achieved, as well as making it easier to synchronise with video output which is interlaced.

Video mixing is the way that computer-produced images and video frames can be overlayed and blended. The video player can con-

trol this to an impressive degree, although the Domesday Machine does not make full use of the facilities available in this area.

Instant jump is perhaps the most significant improvement for computer access. On standard video disc players, the laser beam can only move in steps of one track, so to move more than one track across the disc involves an inevitable pause during which the video picture goes black. This player allows an instant jump across up to 50 tracks without any loss of picture. The laser beam is pointed onto the disc surface by a mirror, and the instant jump is achieved by swivelling the mirror very accurately.

LV-ROM consists of LV-DOS, a laser vision disc operating system, as well as data grabber software and control software for video mixing, and so on. The other extra facilities are to control instant jump, CAV and CLV, and the SCSI interface.

Not surprisingly, modifications to the computers involved were needed in order to access the video disc player. On the RM Nimbus, the modifications were quite small. It already has an SASI interface, which is a subset of SCSI but turned out to be adequate for the task. The only other necessary change was to produce a new graphics gate array to give interlaced video output. This has been done and will soon become standard on all Nimbus machines, and will also be available to present Nimbus owners.

On the Acorn, rather more change was needed. An SCSI interface has had to be added, and an oscillator to help genlock synchronise signals besides interlaced video output has been added.

Programming

Besides these hardware modifications, software to drive and control the video player is necessary. On the Master 128, this is controlled by a new ROM — the VFS, or Videodisc Filing System. This bears a strong resemblance to the ADFS from Acorn, and acts just like a standard ROM in that it can be used in programs and accessed from Basic using '*' commands.

Here is a sample BBC Basic program that produces a simple slideshow from the Domesday video discs:

```
10 *VP 2
20 *FRAME 4000
30 G=GET
40 *FRAME 4020
and so on.
```

The rest of the program to control the Domesday Machine on the Acorn machine is controlled by a bootstrap routine that loads more software down from the video disc. Since the BBC machine can only access 64k of memory at a time, a large amount of which is taken up by the OS, the control software is organised as a series of overlays. Whenever you switch from, say, displaying maps to text, the Acorn downloads a new piece of control software for the new function and stores it where the old code was held. This means that the Acorn software is somewhat slow since new pieces of code have to be frequently loaded in from the video disc.

The 'Kernel' routines of the software are essentially the same for both the Nimbus and the Master versions, and are the overall boot routines and video disc drivers. The 'Root' routines are then loaded on top. These handle the overlays and perform initialisation. Next, one of the overlays is loaded — for example, to handle the MAP routines or the 'Gallery' routines. These overlays are switched in and out as necessary. And, finally, other overlays known as 'Children' may be loaded in if needed. All of this fits into 64k on both machines; the main difference is that the Nimbus loads them off floppy disk or RAM disk, and the Acorn loads them off the video disc. The result is that the Nimbus version runs slightly more quickly because its floppy transfer rates are higher than the Acorn transfer rates from the video disc over SCSI.

Surprisingly, the SCSI interface is the speed bottleneck on both systems. It transfers data at about 50k per second, although the laser player can read information off the disc at about 150k per second. The Acorn machine can only load data via SCSI at about 8k per second.

The difference in approach means that Research Machines, using a more powerful system based on a 16-bit computer, will be able to easily upgrade its control software, making it faster and more powerful, simply by releasing a new floppy version. If the BBC and Acorn want to upgrade, they will have to produce a new video disc — an extremely expensive process. This makes it easier for Research Machines to add in new control facilities. To offset this, the Acorn version is cheaper.

A future Domesday?

The BBC and Research Machines are already looking at many possibilities of expanding the Domesday Project. The BBC will definitely be producing other Domesday discs, specifically one on the ecology of the UK; there are also plans to license the idea, and retrieval software to recover some of the enormous development costs are under way. Already, several other European countries have expressed an interest in doing their own versions of the Domesday Project, and it is intended to keep them compatible so that discs will be interchangeable. Non-European countries have also shown interest.

Other possible spin-offs include software add-ons, specifically to allow users to incorporate their own data; to control slide show presentations; to transfer data to other powerful analysis programs such as dBaseIII or Lotus 1-2-3; and to record and play back sessions.

Research Machines will be launching a generic MS-DOS version of the Domesday Machine so that PC clone users can have access to the system as well. The company will, however, have to install new video cards and possibly other hardware. There are also plans to tailor the Domesday Machine for various other applications.

Prices

The Domesday systems consist of: the two Domesday discs, National and Community; a BBC AIV VP415 LaserVision player (from Philips); a Philips colour monitor; plus one of the two micro-computers: the Acorn Master-AIV (Master 128, turbo co-processor, VFS, trackerball, and so on; or the RML Nimbus PC1 (512k RML Nimbus), 3½in floppy disk, new gate array, and so on.

The Acorn system costs £3990 excluding VAT, or £2995 excluding VAT to schools with an educational subsidy.

The Research Machines system costs approximately £4495 excluding VAT, £3495 to schools.

Conclusion

It is hard to describe how I feel about the Domesday Machine. If I had enough money, I would be tempted to go out and buy one for my own use. But its major use will undoubtedly be in schools and libraries, and I would recommend that any school or library begs, borrows or steals one as soon as possible. In terms of personal use, although the machine has a great deal of appeal, it would be hard to justify purchasing one. However, that said, there are a large number of businesses which could, with a little imagination, make use of the Domesday Machine.

The Domesday Machine is perhaps most significant for what it heralds, rather than for what it is. No doubt it will boost the interactive video market — justifiably — and result in a large number of worthwhile interactive video projects. Indeed, Research Machines is already at work on four *other* interactive video projects, and the BBC and Acorn also have plans in the pipeline.

For more information, contact: BBC Enterprises on (01) 576 0202; Philips Electronics on (01) 689 2166; or Research Machines on (0865) 249866.

In living memory

If machine 'intelligence' seems rather far-fetched, how about computers with logic components compiled of molecules rather than silicon? Nick Hampshire presents the history of, and predicts the future for, molecular electronics.

A computer faster and more powerful than any available today, yet no larger than a sugar cube, could be a possibility by the end of the century — a computer made not from silicon or gallium arsenide, but from organic chemicals similar to those found in all living organisms. The use of organic chemicals for the construction of logic devices is a new technology called 'molecular electronics'.

Molecular electronics will allow complex logical devices like computers to be constructed using individual organic molecules to perform the logic functions. Such devices will be very small, three-dimensional and over 800 times faster than any semiconductor logic device. Molecular electronics is a technology which is likely to become the natural successor to the silicon chip.

The reason why

Since the invention of the transistor in 1950 and the integrated circuit about 10 years later, the evolution of electronics has seen the continual miniaturisation of components; every new generation of components being capable of performing increasingly complex functions at greater speeds. Since 1960 the drive for increased speed and complexity has, every 18 months, halved the area on a silicon chip required for a given electronic function. A single integrated circuit .25ins square, such as a microprocessor chip, probably has more components than the most complex electronic device capable of being built 20 years ago.

A powerful driving force behind the process of increased miniaturisation has been the computer industry. New and increasingly complex programs have meant that processing speed and memory size are always proving a limitation to programmers.

This constant increase in complexity and speed cannot go on forever — soon the fundamental laws of physics will prevent further advances. Already these limits are being reached: many scientists believe that it will prove impossible to build memory chips with a capacity greater than 32Mbits commercially. Even the fabrication of 1Mbit RAM chips has proved enormously difficult and is pushing manufacturing technology to the limit to ensure an economic yield of usable devices.

'Molecular electronics is such a new subject that there is still no agreement on calling it molecular electronics — some prefer the name "biolelectrics".'

In the short term, one of the solutions is to move away from the use of silicon as the semiconductor material and use gallium arsenide (GAs). This semiconductor material should, theoretically, allow the complexity and speed of devices to be increased by at least another order of magnitude, but it has proved a very difficult substance to work with and obtain commercial yields from. Consequently GAs devices are very expensive and usually confined to military applications where their low power consumption, speed and radiation hardness have proved attractive.

Although over $1 billion has been spent over the last 10 years on research into GAs, it is only now that scientists have discovered techniques which should allow it to be applied to the volume production of very large-scale integrated circuits. However, eventually, even GAs devices will come up against the limits of both fabrication techniques and the basic laws of physics. This leaves the question: What comes after gallium arsenide? The answer increasingly being given by scientists is molecular electronics.

Molecular electronics is such a new subject that there is still no agreement on calling it molecular electronics — some prefer the name 'bioelectrics'. This technology has grown from the enormous advances made over the last 10 years in organic chemistry and, in particular, biochemistry. Molecular electronics is the fusion of this knowledge with microelectronics, coupled with the realisation that the inherent capacity of biochemicals to transport electrons on a molecular scale offers the best chance to fulfil future needs for denser and faster circuits.

The proposed use of biochemicals and the technology for their synthesis is one of the most revolutionary and far-reaching concepts in its departure from traditional electronics. Not only will it require entirely new academic disciplines in its development, but it will also require the coming together of a whole range of leading-edge technologies.

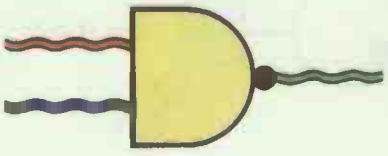
Foundations

The conceptual possibility of constructing molecular electronic devices, or MEDs, has been around for about 12 years; the initial proposals

Illustrations by Steve Cox

for molecular devices having been made in 1974 by two leading IBM researchers at New York University, Dr Arieh Aviram and Dr Mark Ratner. Like so many technologies, it was impossible to take it beyond a purely conceptual stage until other base technologies had been developed and a thorough knowledge of the principles obtained.

A wide range of academic disciplines which are not often closely associated need to be drawn together — physics, mathematics, computer science, biology and organic chemistry. This is now being done at a number of universities and research organisations, principally in the US and Japan. At the forefront of these groups is the IBM-funded Centre for Molecular Electronics at Carnegie-Mellon University (CMU) in Pittsburgh. This group, under the leadership of Professor Robert Birge, has made the major advances which look set to turn the theory of MED into reality.



INPUT A	INPUT B	OUTPUT C
0	0	1
0	1	1
1	0	1
1	1	0

Fig 1 A conventional and straightforward two-input NAND gate with its associated logic table

Basic elements

The research team at CMU has demonstrated the feasibility of using biochemicals to create the basic logic elements utilised in a computer system. The device which has been constructed is called a NAND gate. The development of this logic element has been a major advance, since NAND gates are the fundamental components from which all other logic elements such as flip flops, counters and eventually whole computer systems can be built.

The key to this advance is a chemical known as a porphyrin. Porphyrins are an important group of organic molecules which incorporate a metal ion in their structure, and are fundamental to many biological energy transfer processes. A porphyrin is one of the essential chemical components of chlorophyll, the chemical which allows plants to convert sunlight, air and water into the whole range of complex organic chemicals from which a plant is built.

Organic chemists have observed that given the proper molecular configuration, a porphyrin molecule could act as a molecular circuit with switching induced by visible light. It is this property which has been utilised by the CMU team to construct the molecular NAND gate.

As can be seen from the simple two-input NAND gate in Fig 1, the gate has two inputs A and B, and one output C. The gate will only produce an output, a logic 1, when the two inputs are at a logic 0; any other combination of inputs will produce a logic 0 output.

Architecturally the molecular gate produced by the CMU team is identical to a typical semiconductor gate: it has two inputs, A and B on Fig 2; and one output C. The two inputs consist of cyanine dye molecules bonded to a quinone molecule. The joint of the logic gate is a porphyrin molecule; the output is another dye molecule known as a chromaphore. The whole molecular gate structure is less than one hundredth of the size of the smallest theoretical equivalent gate constructed from semiconductor material.

Whereas the inputs to a semiconductor gate are electrical pulses, the inputs to the molecular gate are in the form of pulses of light generated by a laser (as shown in Fig 3 on page 168). The cyanine dye input molecule absorbs a photon from the laser and, as a result, gains an electron. This electron is transferred from the cyanine via the quinone to the porphyrin molecule. When the porphyrin gains one extra electron it has no effect, but when it gains two electrons — one from each input — it will 'fire' and output an electron to the output chromaphore molecule. This output electron changes the wavelength at which the output molecule absorbs photons. The output molecule's state can then be interrogated by a laser: if the light is absorbed it's at one state; and if it's reflected then it's in the other state.

In systems constructed from many gates, the output of one gate will probably be connected to the input of another. Where this occurs there is no need for the output chromaphore molecule; neither is there any need for the input cyanine molecule on the gate to which it is connected. There will simply be a direct electron transfer from the output of one gate to one of the inputs of the other gate. Where 'wires' are needed to connect two gates, molecules of a polyacetyline organic metal will be used.

One of the major problems in designing the molecule was ensuring

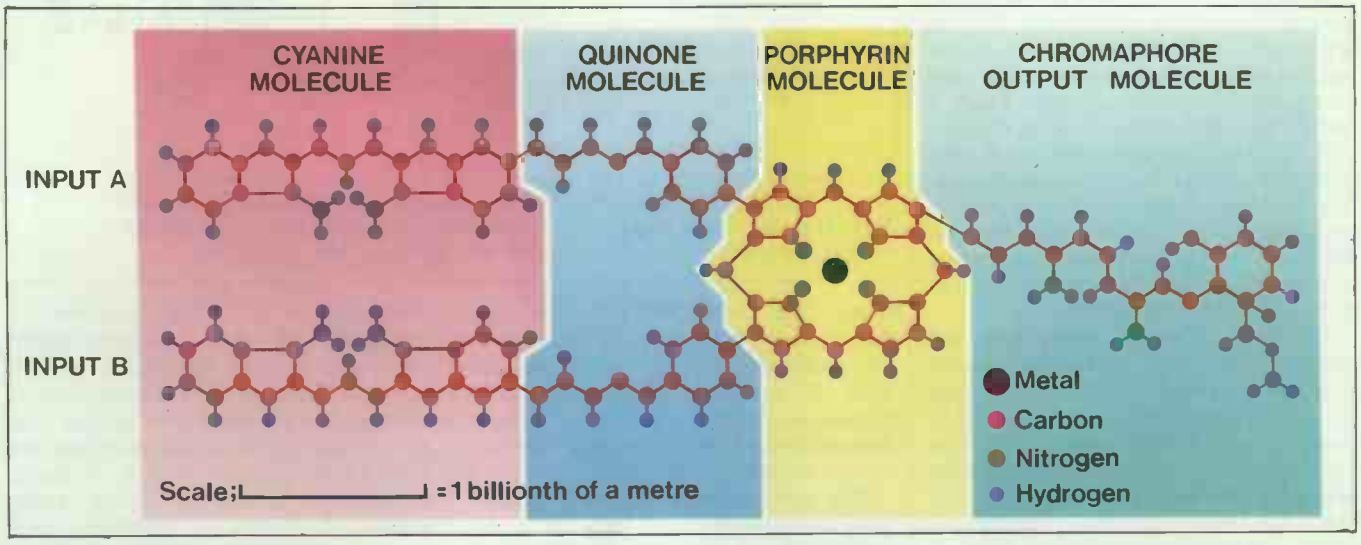


Fig 2 The atomic structure of a molecular NAND gate. The two input molecules are the cyanine/quinone arms marked A and B; light of the correct colour shining on either of these two molecules will generate an electric charge on the molecule. When the porphyrin ring receives two electrons, one from each input molecule, it will output an electron to the output molecule and thereby change its optical characteristics

that electrons only flow in one direction — it would be useless if electrons were to flow from the output to the inputs. What was needed was a molecular equivalent of a diode. Fortunately, the theoretical work on this problem had been done in 1962 by the Russian scientist Pschenichnov. He proposed a mechanism called electron tunnelling, which allows electrons to move through a periodic molecular array only if the electron's energy matches that of each energy barrier within the array. If the electron energy does *not* match, then the periodic molecular array acts as an insulating or sigma barrier. (Pschenichnov's theory was derived from quantum mechanics but was only hypothetical, and was not proved mathematically until 1981.)

An electron passing through an electron tunnel can be given the correct energy by the laser input. Only if the laser has the correct frequency will the electron have the necessary energy to pass through the tunnel. Each molecular group within the periodic molecular array that makes up the tunnel has a sigma barrier which not only functions as a one-way valve, but also acts as a delay. The longer the tunnel, the longer it takes for the electron to pass through it. This delay is important in order that device timing can be synchronised: the CMU NAND gate has been designed to have propagation delays of three trillionths of a second. Designing molecules with exactly the right electrical characteristics has required computer modelling of molecular behaviour, and this has been a very important area of development at CMU.

Synthesis

The techniques involved in the synthesis of molecular electronic devices are critical if the technology is to develop beyond the theoretical and computer simulation stage. Even a fairly modest conventional computer will consist of several million NAND gate structures, and the interconnection of these is exceedingly complex — so complex, in fact, that the design of many integrated circuits would be impossible without the use of computer-aided design.

The task of synthesising first the basic NAND gate, and then joining these gates together into a designed structure, makes the task of silicon IC design seem trivial, especially when you consider that molecular devices are three-dimensional structures, unlike their semiconductor counterparts which are strictly two-dimensional.

The success of the CMU group, and one of the major reasons why it is being backed by IBM funding, is its work in molecular electronic synthesis. Dr Johnathan Lindsay has developed a computer-controlled molecular synthesiser which is capable of constructing the complex molecules which will form the sub-assemblies of any molecular electronic computer.

The synthesiser is based on principles developed in the early 1970s for peptide synthesis, and is known as the Merrifield technique. In this process the base molecule is chemically attached to a small sphere of plastic, and thousands of such spheres are contained in a reaction chamber. A computer and an associated robot are used to add chemicals to this reaction chamber. The computer also controls the temperature, acidity, and so on, and periodically analyses the product to ensure that it is being assembled correctly. Using sequences of chemical reactions, previously calculated using computer simulation, the synthesiser adds new molecules onto the base molecule attached to the plastic sphere. In a process which can take several days

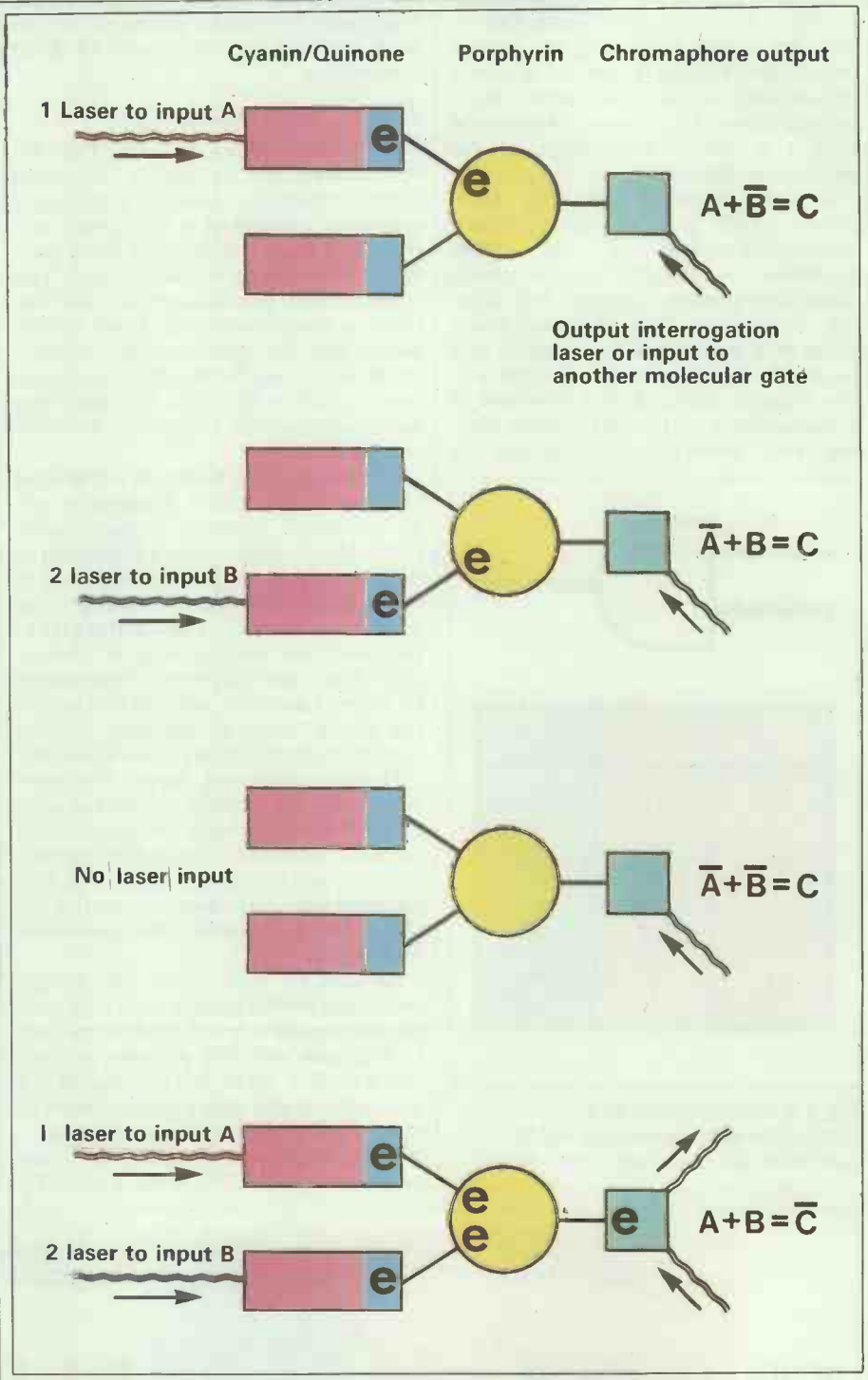


Fig 3 The different input and output states of a molecular NAND gate. Note the two input lasers and the output reference laser. The small 'e' within the molecule denotes the presence of a free electron

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the computer will build up very complex molecules, each being an exact copy of the original design held in the computer's memory.

A modular approach is being used in the synthesis process. In the first stage, the different types of molecular gate are synthesised. These gates are then used in the second stage to construct larger assemblies which would roughly correspond to devices such as flip flops, counters, and so on. These sub-assemblies can then be used to construct the final device such as the proposed molecular electronic computer.

The CMU team is intending to use self-organisational processes where possible (self-organisation means that additional components of the molecular assembly will automatically attach themselves to the correct position). Therefore, the product of each reaction will organise itself automatically so that it steers the course of subsequent reactions in a predetermined manner, and will then pack itself in a space-filling manner to fit the substrate on which the system will be built.

Each step in the synthesis requires an exact understanding of the chemical processes and the molecular behaviour. This is impossible without computer simulation and is another area where advances are being made by CMU. Work by an English scientist, Dr John Pople, has allowed the team to run computer simulations of the proposed devices. Such simulation is, however, not easy, since it involves a very large number of variables all acting on each other simultaneously and can quite easily absorb the full power of the most powerful supercomputer. Simulation of even the larger components of the molecular computer will require the new fifth generation computers now being developed. Fifth generation machines running artificial intelligence will also be required to control the large-scale synthesis.

The molecular computer

Any usable computer system must have data inputs and outputs, plus the timing control pulses necessary to synchronise the system's operation. In a molecular computer, all these connections to the computer are made by means of modulated beams of laser light. The molecules can be designed to be sensitive to only one particular frequency or colour of light, therefore the molecule will not confuse the output interrogation laser with an input. Similarly each of the two inputs to a gate can be different-frequency laser beams, thereby separating the two input lines. This is important, since the molecule is so small that it would be impossible to directly focus a beam of light onto any one particular portion of the molecule.

In a workable molecular computer there will be many inputs and outputs to the system, each consisting of a modulated beam of light shining onto a particular portion of the very complex interconnected molecular structure. To work properly, the orientation of the molecular computer will have to register exactly with the optical connections so that these are focused onto the correct input and output molecules.

This is no easy task, and can certainly not be performed by any mechanical means since the scale of the structure is too small. The only way to do it is to use the same kind of self-organising chemical process used in the construction of the molecular computer.

The interface consists of a substrate on which the various optical I/O connections are positioned. This substrate could be made from either an organic compound such as a plastic or from a metal. The optical connections in the form of microscopic light guides on the surface of the substrate would be fabricated by the photolithographic processes used to manufacture conventional integrated circuits.

'The fifth generation computers . . . with their parallel architectures and artificial intelligence software, are an essential prerequisite to the production of a molecular computer.'

The position of the optical I/O connectors would be determined by the computer simulation of the shape of the assembled molecular device. However, it would be unlikely that all the I/O molecules would directly come into contact with the substrate because the molecular structure would be three-dimensional and the substrate two-dimensional. It would also be very difficult to ensure that the orientation of the molecular device was correct to properly register with the optical I/O connectors.

The solution to the problem is to give the substrate a three-dimensional shape so that it will lock into the molecular device in much the same manner as the way the pieces of a jigsaw puzzle will only fit together in one particular way. The three-dimensional structure would be built up using organic molecules attached to the substrate by means of a laser catalyst.

Once assembled onto the substrate with its optical I/O connected, the molecular device would be mounted in a cryogenic chamber chilled with liquid nitrogen produced by a miniature cryogenerator. Although molecular electronic devices could work at normal temperatures, their efficiency and life are greatly increased by operating at low temperatures. At such low temperatures the molecular structure is frozen, and electrons moving within the structure will encounter little resistance since the system is almost in a superconducting state. This means that the amount of energy required by a molecular computer will be virtually negligible.

Applications

The development of molecular electronics is being taken very seriously by IBM — it has dropped the development of Josephson junction technology in favour of molecular electronics. Industry observers have estimated that IBM is currently spending about $5 million per year on research into molecular electronics and has made it one of the central components of its long-range research. IBM is not alone in its interest in this technology: the US Defence Department is investing heavily in research, as are several other American high-technology companies, and in Japan Sony is known to already have a team working in this area.

The CMU team in association with IBM have a lead in the development of this technology, and have set themselves the goal of producing a thousand-gate device by the end of the decade. If the technology can be advanced in accordance with this time schedule, and bearing in mind the time taken for comparable advances in semiconductor technology, then we should see the laboratory demonstration of a working molecular computer in the mid 1990s. Commercial products should follow about four or five years later.

The architecture of molecular computers will probably bear little relationship to that of their semiconductor equivalents. They will probably be highly parallel machines with each processor having a small instruction set and a large number of inter-processor communications, rather like a Transputer-based system. The richness of interconnections between processors would not be as constrained as that of a similar semiconductor system, due to the three-dimensional structure of a molecular

'The CMU team in association with IBM have a lead in the development of this technology, and have set themselves the goal of producing a thousand-gate device by the end of the decade.'

computer. In addition, since all processors should be contained within the same molecular assembly, the limitations normally imposed by packaging and interconnection would be absent.

Another difference between the proposed molecular computers and their fifth and sixth generation semiconductor counterparts lies in the organisation of the system's memory. Both RAM and ROM-type devices can be assembled using molecular components and, because of the very high component density, there is no reason why the system should not benefit from very large quantities of memory — a gigabyte or more would not be impractical. The three-dimensional structure of molecular computers will give designers the added potential benefit of not being tied to using conventional storage location addressed memory structures. It would be feasible to implement large contents-addressable memories or neural network-type memory systems, both of which would be an enormous aid to the development of advanced artificial intelligence software.

The fifth generation computers currently being designed, with their parallel architectures and artificial intelligence software, are an essential prerequisite to the production of a molecular computer which will belong to the sixth generation. Fifth generation supercomputers will be required to design the molecular computer and will also be needed to develop the software which will run on the molecular computer. It is unlikely that the lower-level operation of a molecular computer will be accessible to programmers since it will probably be designed with built-in, general-purpose, artificial intelligence. This would accept programs in a conceptual form rather than the strictly logical form currently used. It would then build onto and modify the conceptual model using its existing database and data acquired from on-going experience. It would thus be a direct descendant of the rather primitive expert systems in use today.

The application of molecular electronics will also open up a whole range of new technologies. The sensitivity of molecular electronic devices to light will allow scientists to create new classes of intelligent image sensors which will more closely resemble the human eye in function than a conventional TV-type image sensor. Indeed, it has been proposed that it may be possible to create molecular electronic image sensors which could act as a medical implant capable of restoring a kind of vision to the blind. A molecular electronic vision prosthesis has the added advantage that since it is constructed from organic molecules, it should be far easier for doctors to connect to existing nerve cells. In fact, molecular electronics could give doctors a whole new range of neural prosthetic devices.

Molecular electronics devices could also be employed as chemical sensors. In this kind of application the molecular system would have numerous inputs, each of which would be designed to be responsive to one particular type of molecule and *only* that molecule. This input selectivity would be achieved by making the input molecule's shape conform to that of the target molecule so that the two lock into each other and thereby produce an input. This kind of device could find a considerable number of applications — for example, in environmental monitoring, industry and medicine.

A possible medical application for such a chemical sensor would be an implantable body function monitor. This would be capable of detecting any chemical imbalance in the body brought about by illness and advising on the course of action necessary to alleviate it.

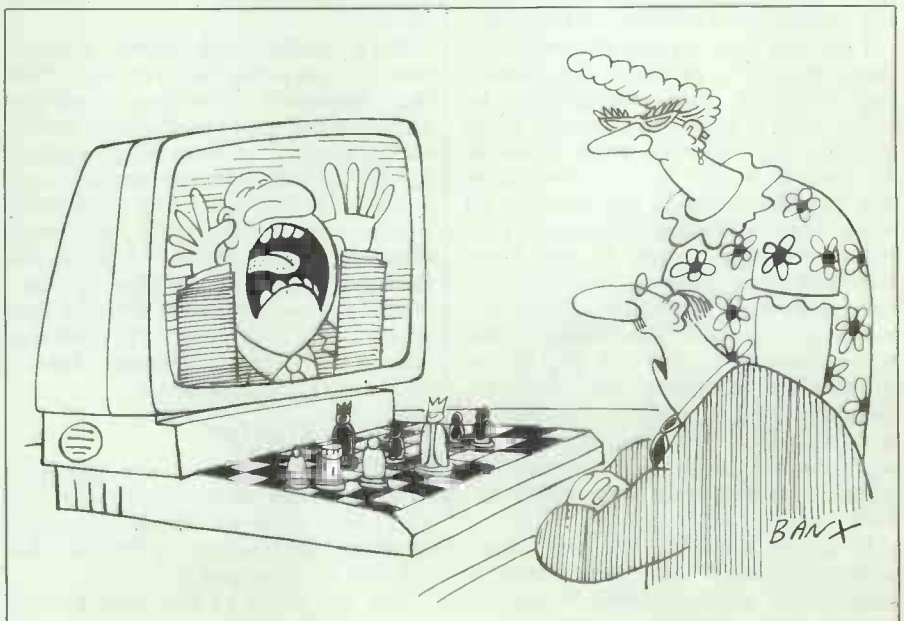
Molecular electronics devices are not only sensitive to light, they can also be made to *produce* light. The very small size of molecular devices means that very high-density displays could be produced. By changing the molecular design, it would be possible to output different colours. Displays produced using molecular electronic devices could be the conventional two-dimensional type or a true three-dimensional display. This could be created by arranging the molecules in a three-dimensional matrix, using an optically transparent medium to support the molecular structure.

Conclusion

Molecular electronics is a technology born from the merger of biochemistry with microelectronics, and offers the potential of a quantum advance comparable to that of the development of the transistor. This article is just a brief summary of the advances in molecular electronics being made now, and some ideas for the future.

Most of the technology described in this article is theoretical, since the scientists at CMU have only just succeeded in demonstrating the components of a simple molecular gate. However, the demonstration of this gate is an enormous achievement and should open the doors for a flood of new developments.

Molecular electronics is a technology which still needs an enormous research and development effort to bring much of its potential to fruition. This potential has been recognised and the funding for that R&D effort is now forthcoming. The results of this research effort will probably be more wide-reaching than we can at the moment imagine. END



'It's a major new development in computer chess technology — it's programmed to psyche out its opponent.'

Ready, steady, go!

Despite being a late starter, resident software is now an integral part of most users' libraries. Dick Pountain assesses the functions and the future of this multi-application environment.

Resident — often called 'pop-up' — software has become a fact of life for most users of IBM PCs and compatibles. Every time I boot my computer, four resident programs are loaded. Two of these are merely small extensions to DOS: DOSEDIT provides full command-line editing and re-use of previous command lines; while a Mouse Menu program integrates the Microsoft mouse with my other software. The other two are pop-up applications, namely Borland's SideKick and Caxton's Smartkey.

In use

What are resident programs and how do they work? A resident program is one which is loaded into memory but is not overwritten when a new program is loaded. Instead it sits underneath whatever other software is running, and can be summoned by a special command. Of course, in a sense, DOS itself is a resident program since it's always there whatever application program is running.

From the user's point of view, resident programs produce the subjective effect of multi-tasking (that is, being able to do more than one thing at once). For example, when SideKick is loaded, it can be summoned at any time by pressing the Ctrl and Alt keys simultaneously. Whatever program you are using at the time, whether it be a word processor or spreadsheet or compiler, SideKick's window appears in the middle of the screen and you may use any of the utilities it provides (a notepad, calendar/diary, calculator, ASCII chart and phone dialler). Pressing Ctrl Alt again makes it disappear and you are back doing what you were doing before.

However, this is not true multi-tasking because your application is suspended while SideKick is on the screen and only one program is actually being executed by the CPU at any time. If you pop-up SideKick in the middle of an operation such as a sort, search or compile, the operation will be no further advanced when you pop SideKick down again; it did not proceed while SideKick had control of the computer. In a true multi-tasking application, the operation would have continued to execute 'in the background' while you were using SideKick, and might be completed by the time you finished with SideKick.

True multi-tasking is achieved by sharing the processor's time between various programs (usually by giving each one alternate 'timeslices' of a few milliseconds), and it normally needs to be supported by the kernel of the operating system. MS/PC-DOS is not such an operating system. With the single exception of the background PRINT utility, PC-DOS only supports one task executing at a time. The only well-known personal computer operating systems which multi-task are Commodore's AmigaDOS, Digital Research's Concurrent DOS and DOS Plus, and, of course, Unix.

Most applications spend most of their time waiting for user input from the keyboard. Therefore, resident software can give most of the beneficial effects of multi-tasking, without the complication (and often the unreliability) of the real thing. The areas where real multi-tasking are desirable are those where the computer talks to a slow peripheral, or performs a slow operation, without user intervention: for example, printing, communications, database sorting and program compilation.

A late starter

Resident software has only appeared in the last few years mainly because the older 8-bit personal computers were not well-suited to its use; but the IBM PC changed all that.

The real spark to the development of resident software, though, was that (in PC-DOS versions from 2.0 upwards) Microsoft provided a DOS function call called 'Terminate and Stay Resident' (function number 31hex). When a program calls this function, it is terminated (that is, it stops executing) but the memory it occupies is not reclaimed by DOS. The next program to be loaded and executed loads at a higher address and leaves the first program's code intact. This provides half of the means for writing resident software at a stroke. Resident programs are usually called 'TSRs' by professional programmers (after the Terminate and Stay Resident call which makes them possible).

Interrupts

However, making a program stay resident is only half the game — it must also be possible to reactivate the terminated program at will. This is achieved via another feature of PC-DOS, namely the software interrupt.

PC-DOS is basically an interrupt-driven operating system. This means that operating system activities take over from one another by interrupting the previous activity (whose state is saved on a stack so that it can be resumed), rather than by simple subroutine calls as in older systems like CP/M. For example, when you press a key at the keyboard, the keyboard interrupt stops whatever DOS is doing until the keystroke has been stored in the input buffer.

DOS function calls are usually made by issuing interrupt number 21hex with the function number held in a register, rather than by a jump to the routine's entry address. Interrupts allow application programs to use the operating system's facilities without knowing the absolute addresses of the routines they are calling; a table of interrupt 'vectors' at the bottom of memory tells DOS which routine to execute whenever a given interrupt is received.

Since DOS interrupts are vectored, it's relatively easy for an application programmer to 'capture' a particular interrupt by putting the address of his own routine into the appropriate slot in the vector table. This provides

Fig 1 How resident programs sit in memory

the means for reactivating terminated resident programs. Most often the programmer will capture the keyboard interrupt and examine the keystrokes typed by the user. For example, SideKick captures the keyboard interrupt and keeps a lookout for the Ctrl Alt sequence; if this is not found, then it hands over to the normal keyboard interrupt service routine. If, however, Ctrl Alt is detected, then control is transferred to the dormant SideKick program which pops up and does its thing.

as an ordinary .COM or .EXE file which is executed from the command line in the normal way. It contains two parts, a loader and the TSR code itself. When executed it loads the TSR program into memory, and patches the appropriate interrupt vector table entry to point to it. Then it calls the DOS TSR function, and stops and returns you to the DOS prompt. Normally you would put the program name into your AUTOEXEC.BAT file so that this all occurs automatically when you boot the

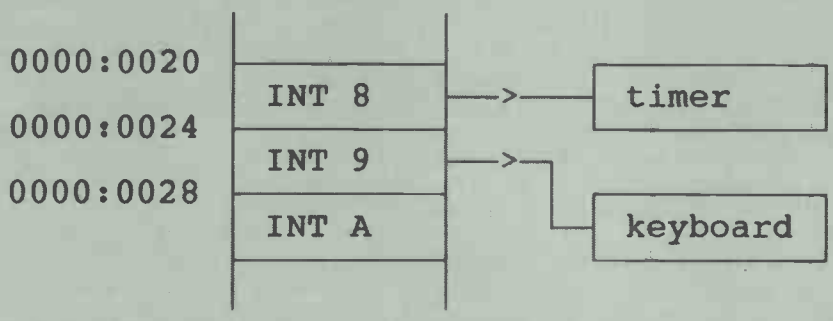


Fig 2 A portion of the DOS interrupt vector table. The slots contain addresses of DOS interrupt handler routines

Sometimes it might be desirable to capture a different interrupt: for example, the IBM PC has a periodic timer interrupt which controls the timing of system functions. To write a pseudo multi-tasking TSR, you can capture this interrupt and do a piece of your own program before handing control back to the DOS interrupt handler. A program to display a clock permanently in the corner of the screen could work this way.

Blueprint

The blueprint for writing a TSR for PC-DOS is this. The program comes

computer.

If this is a well-designed TSR it will also want to throw away the loader code which is of no further use, since the TSR stays resident until the system is rebooted. This is easily achieved by putting the loader code after the TSR code and beginning the program with a jump to it. The TSR address is set so that the next program to load will overwrite the redundant loader code, the only memory wasted being that single jump instruction at the beginning (which must *not* form part of the TSR code).

I don't intend to get into actual

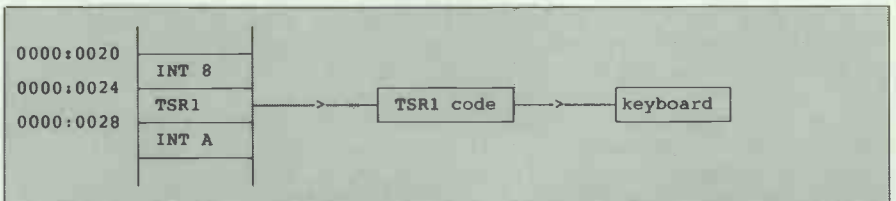


Fig 3 A resident program, TSR1, has put its own address into the INT 9 slot

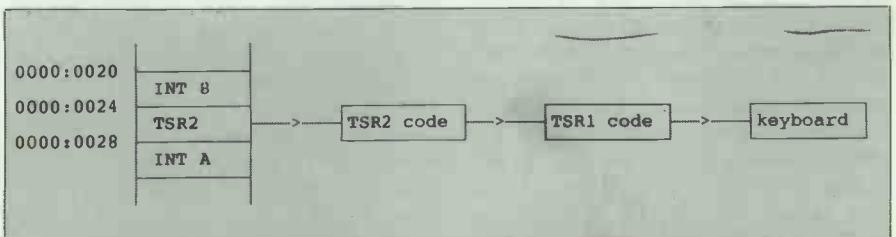


Fig 4 A second program has taken over INT 9 and has chained to TSR1

coding of TSRs as that would be subject enough for a separate article. In general, you will need to be an accomplished system-level assembly programmer and have a well-thumbed copy of the *IBM Technical Reference* to write one from scratch; you will also need a good debugger, nerves of steel, lots of luck and preferably a comfortably upholstered Reset button. There are, however, easier ways, as we shall see later.

How is it possible to have several TSRs in memory at the same time? The answer is that sometimes it isn't! Any heavy user of resident programs will tell you horror stories about ones which clash with each other and hang the system, corrupt files or worse. But, in general, well-designed TSRs work with each other quite happily, as well as with most application programs. For example, I can pop-up Smartkey to define some keys while inside SideKick with no problem, and I can use the mouse while both of them are active. Smartkey does occasionally interfere with the mouse (sounds vaguely indecent!) in a subtle way which is too obscure to explain here. The reason TSRs can co-exist lies in the nature of interrupts. By their very nature, interrupts must preserve the state of the activity that they interrupt. The same should apply to captured interrupts if the programmer has done his homework properly.

When a TSR captures, say, the keyboard interrupt, it POKEs its own address into the table and saves the address of the original interrupt handler (to which it must return control if its 'hot key' is not detected). If another TSR is loaded on top, then it will in turn patch its own address into the table and save the address of the first TSR's handler. In this way it's possible to have a long chain of captured keyboard interrupt handlers, each of which returns to the one before and finally to DOS, so that all the TSRs get a peek at each keystroke. All should be sweetness and light in the best of all possible. . .

Of course, it doesn't work like that in practice. For example, I can't call SideKick from inside Smartkey, even though the reverse works. The order in which they're loaded matters. In fact, SideKick 'feels' a Ctrl Alt but it just beeps — its signal that Smartkey is doing something it doesn't like. It's quite rare these days to find TSRs which hog the keyboard interrupt and don't pass keystrokes down the chain at all.

There are plenty of other potential problems, though. Many applications which were written in pre-TSR days (or whose writers just don't care) hog the hardware keyboard interrupt for themselves, rather than doing I/O through DOS or the BIOS. Word processors like Samna III and XyWrite

are guilty of this, and they cause agony for TSRs.

Also, there are more issues at stake than I have outlined so far. The latest generation of TSRs are fully-fledged applications in their own right. They may open and close disk files, use the printer, and some, like Homebase, even use the serial port. What this means is that before such a TSR can pop up it must be sure that it's safe to do so — that is, sure that DOS isn't doing something like a disk access that might be upset.

DOS wasn't really designed to work with sophisticated TSRs (even though it provides the 'loophole' that permitted them) and so it doesn't provide any single, unambiguous signal that everything is safe. Accordingly, many TSRs have to take over several interrupts to monitor the state of various DOS activities. Ready!, the popular resident profile editor, takes over the timer, video, disk, keyboard (both hardware and BIOS level) and print spooler interrupts in order to be sure it's safe for it to take control. Such programs don't just pop up in the simplistic way I've suggested when their 'hot key' is pressed: they set a flag that says 'pop up at the next safe opportunity' and carry on monitoring.

Turbo Task

I've recently been testing a piece of software which allows you to write your own TSRs in a high-level language (Turbo Pascal), in a very simple way. The software is Turbo Task from Tangent Technologies in the US. It's a library of Turbo Pascal utilities, one of which is a binary file called TTASK.BIN which does all the dirty work of loading a TSR.

When you have included TTASK.INC in your program, you may make a single call to an external procedure defined therein called Turbo_Task(). Turbo_Task() takes a single parameter which is the code for the desired 'hot key' to pop-up your TSR. For a program to be made resident, it must have a very well-defined structure. You can have as much initialisation code as you wish, to set up variables, array windows and files. This is executed when your TSR is loaded. However, after the point at which Turbo_Task() is called (only once per program), the program must take the form of an endless loop which does the job. It must never terminate or the whole system will crash. Here, for example, is a simple pop-up clock:

```
program pop-up clock;
{$1 ttask.inc}
{$1 regpack. lib}
{$1 timedate. lib}
const
  ctrl_@=$0300;

begin

Window (60,2,70,5);
TextBackground (white);
TextColor (black);
turbo_task (control_@);

{Everything from here on is the pop-
  up code}

  repeat
    GotoXY (2,2);
    Write (Time);
  until false
end.
```

(Time is a function that returns the time of day from the system clock, as a string in pretty formatted form, and is defined in my 'timedate.lib' file).

Turbo Task only adds 5k to the size of the Pascal code, but a Pascal program is already much larger than an assembler program would be; this clock program compiles to 17k, which is a lot for such a simple utility.

I've written some quite powerful utilities using Turbo_Task, including a pop-up version of Debug, but regrettably they are not altogether well-behaved.

Improvements

Resident software is so well-established and popular now that things can only improve. Writers of new applications must be acutely aware that their brainchild will be used with the popular TSRs and make sure that it behaves itself accordingly; any application which doesn't work with SideKick these days is 'Dead On Arrival'. Similarly, TSR writers are getting together to agree standards of behaviour for their programs that will ensure that they don't interfere with one another. A group of US programmers are even working together in Borland International's Special Interest Group on Compuserve to define a generic 'shell' for TSRs to which programmers can add their own functions.

Meanwhile, resident software continues to grow in power, so it's possible to imagine that very soon all a person's software needs might be catered for by a set of pop-up programs. There are already resident word processors available which lack few of the features of a stand-alone program (for example, the PC Outline profiler). Resident spreadsheets and graph-drawing programs like Graph-in-Box have been around for a while. The latest version of Ready! can work with Extended Memory boards, and many other programs are following suit which will mean that you can stuff all the pop-ups into extended memory and have the whole 640k of DOS memory free for ordinary applications. Resident communications programs now exist, some of which (for example, Mirror) can receive and transmit in the background in a truly multi-tasking fashion. Pop-ups which allow DOS housekeeping functions (disk formatting, file copying) to be performed from inside an application are also emerging.

From another direction, people are churning out programs like Software Carousel and Resident which make ordinary application programs co-resident in memory and permit switching between them at a keystroke. This approach has the advantage that you can use your favourite program, rather than having to live with the features a TSR writer has provided (there is as yet no pop-up editor which I prefer to PC Write).

There are even resident programs that exist only to manage other resident programs. Referee, for example, lets you define a list of pop-ups which will work with each application, and disables all the others.

PopDrop is a utility for unloading pop-ups from memory without having to reboot. Although many TSRs have the ability to disable themselves, it isn't usually possible to reclaim their memory unless they are the topmost program in memory; hence PopDrop. Personally, I find it hard to imagine myself using enough pop-ups at once to justify either.

Conclusion

What is the future for resident software? The next generation of microprocessors (for example, the 68020 and the 80386) have on-chip support for multi-tasking, and will be used with proper multi-tasking operating systems. This would seem to remove much of the rationale for resident programs, since you will be able to execute as many applications as you want simultaneously.

I'm not so sure, though. There is something very ergonomically attractive about utilities that pop-up at the touch of a button. I suspect that the outward form of pop-up utilities will survive, with the difference that instead of suspending the main application, they will, if appropriate, allow it to continue running in the background. Equally, they themselves could continue executing in the background after popping down!

What we could be looking at is a new style of user interface in which you can switch activities at any time by a single button press — a modular applications environment consisting entirely of pop-up programs. END

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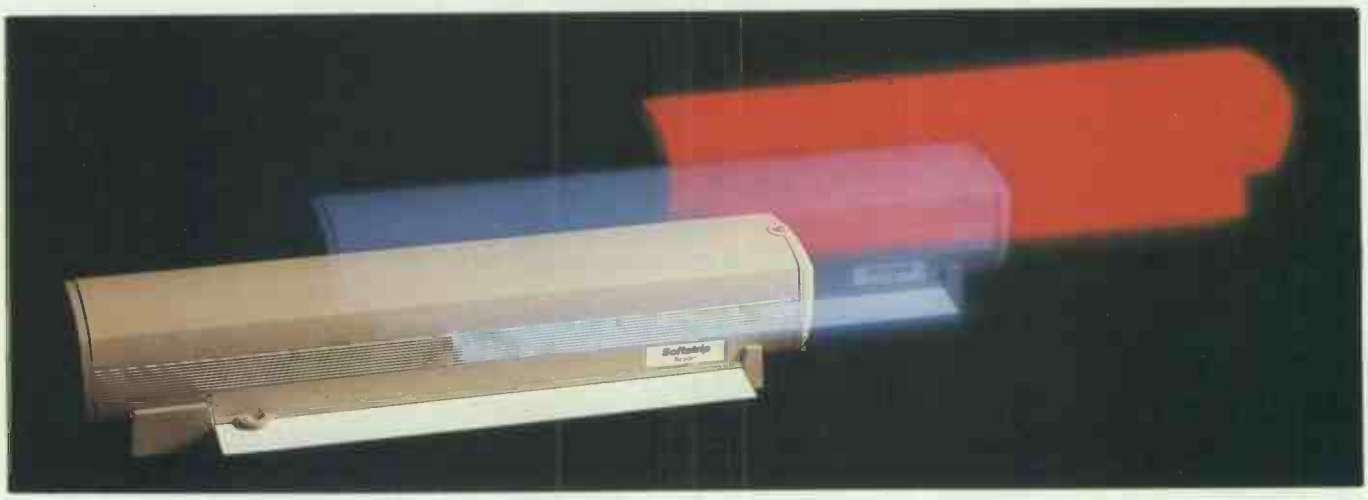
Cauzin's Softstrip

Aimed at serious business users but without any clearly defined niche, Cauzin's Softstrip is a practical, if expensive, high-precision device for reading small amounts of data and programs. David Tebbutt finds it a temporary home.



'All dressed up and nowhere to go.' That phrase keeps coming into my mind when I look at Cauzin's Softstrip system. When I was editor of *PCW*, I used to wonder how we could publish program listings in a form which would enable cheap direct input to your computers. The nearest I got was an idea involving very narrow bar-code strips and a design for a DIY reader. Like lots of my wilder ideas, this one was quietly shelved.

Softstrip is a more practical development for reading small amounts of data and programs. The information is printed much more densely than bar code and must be read by a high-precision scanning device. The system works beautifully but, at the UK price of £200, I'm having a devil of a job deciding who could justify the price. To date no-one has come up with the winning formula. If, after reading about Softstrip, you reckon you have the answer, you could be well on your way to fame and fortune.

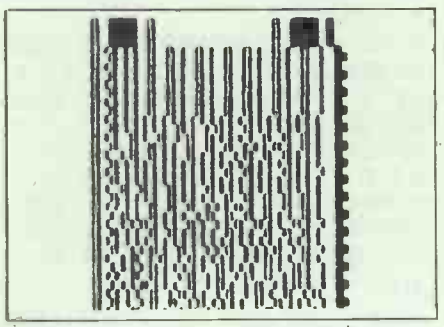
The Softstrip system

Cauzin provides you with a strip reader — a combination of optics and electronics sealed into an oblong box, a disk containing the driver software and a manual containing the instructions and programs printed (surprise, surprise) on Softstrip data strips. One of these programs allows you to produce your own data strips, provided you have a printer with the appropriate graphics capability. I was lucky and everything hung together beautifully on my combination of an AT clone, serial port two, with a Star NL-10 printer on the parallel port.

The figure opposite shows the top inch or so of a low-density data strip at twice its normal size. The header information tells the reader how many bytes will be contained in each horizontal line of data and how high each line will be. The header is also used to align the optical mechanism and to gauge the contrast between the black ink and the background colour (referred to as 'white' hereafter).

This is followed by the length of the strip, its checksum, its identification number and its sequence number. Then comes a directory of file names, types and lengths for up to 10 files.

Black boundary lines run down each side of the strip with marks to their right to synchronise the activity of the reader. A 'chequerboard' pattern is used on the left and a 'rack' on the right.



A low-density Softstrip data strip blown up to twice its normal size

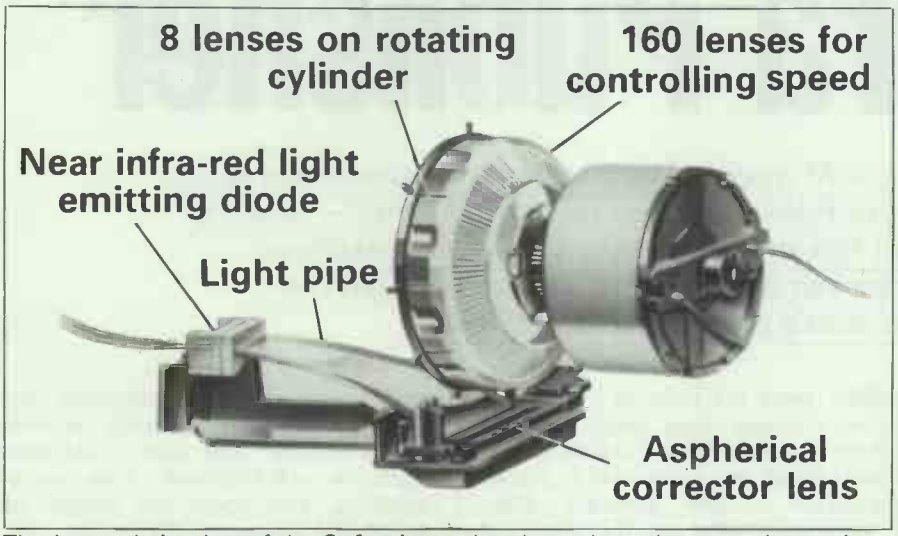
The rest of the strip contains the data described in the header information. The data is straight binary, so you can encode program sources or object files, spreadsheet cell contents, textual information — anything, in fact, which can be encoded as a bit stream. Strips can contain between 900 and 5500 bytes, depending on the printing method used.

Each bit is represented by a pair of rectangles — one black, the other white. Zero is black followed by white, and one is precisely the opposite. These pairs of rectangles have

Photography by Crispin Thomas

been christened 'DiBits' by Softstrip. The most readable data strips are those whose DiBit rectangles are the most precise and whose contrast is maximised between black and white.

The data is encoded on a line in two interlaced groups: odd bits (1, 3, 5, and so on) and even bits. Each group has a parity bit associated with it. If only one bit in a group is unreadable, then the parity bit is used to recreate it. The checksum is the sum of all the information in the strip. When reading is successful, this will match the checksum printed at the start of the strip.



The internal circuitry of the Softstrip reader shows how the opto-electronic system works. A 'near infra-red' light is shone onto the paper (the strip). This is picked up by an aspherical lens which in turn focuses the reflected light into a curved plane from where it is picked up by one of the rotating lenses as it moves around

The reader

The system comprises the reader, a base unit to protect its underside when not in use, three Velcro feet to secure the base to a convenient horizontal surface, a power supply and a serial cable. The whole thing is a doddle to set up — a minute or two at most. I did notice, however, that if the power supply was located too close to my monitor, the screen got the jitters. It is now 16 inches away where it causes no problems.

The plastic reader has a slot in its base just over one inch wide and almost 11 inches long, through which it scans the data strip, which can be up to eight inches long. One side of the case comprises a straight edge, at the end of which is a small projection with a hole in the middle. Each data strip is printed with a blob at one end and a small vertical line at the other. The reader is aligned by placing the straight edge against this line and the projection hole over the blob. Alignment doesn't have to be too precise, as the reading mechanism can handle a fair amount (¼in or so) of skew.

The reading is performed by an opto-electronic system mounted on a truck which trundles up and down inside the plastic case. A 'near infra-red' light is shone onto the paper and the reflection picked up by an aspherical lens. The colour is supposed to 'see through' many stains and colours, so I scribbled on top of data strips with a blue marker pen, a red felt-tip pen and an ordinary black ball Pentel (fine point). I also marked a solid block using a very dark blue marker. The reader happily read through everything.

The aspherical lens focuses the reflected light into a curved plane where it is picked up by one of the rotating lenses as it moves around this plane. Eight protrusions on the outer edge of the lens assembly help synchronise the electronics with the optics.

Each reading lens is accompanied by 20 further lenses through which light is shone and sensed to give control of the motor speed. As well as rotating the lens assembly, the motor drives the truck forward in a smooth continuous motion at .0025in per scan. Depending on the resolution of the strip, each data line is scanned between four and 16 times.

The device worked flawlessly on all strip densities, including those produced with a grey ribbon on my own printer.

Software

The reading software, CAUZCOMM, may be loaded as a transient or a resident program, where it takes up 19k. In its present incarnation, there is little need for the program to be present all the time and it does tend to get in the way of other resident programs. I found that my version of Basic crashed when CAUZCOMM was loaded on top of Smartkey, SideKick, Dosedit, Graphics and Lightning (what do you mean, 'Serves me right'?), although it was fine if I loaded CAUZCOMM first.

The program allows you to read strips, to execute them when loaded, to set and save configuration details and to unload the program. Program control is through a three-part pop-up window. One part displays the options available, another the files read and the third the messages. The messages are so explicit, you just can't go wrong.

The other main program, Stripper, comes in Softstrip format and allows you to make strips on your own printer. Like CAUZCOMM, it hogs your machine while it's in use, which is a pain when printing large files. A 21k .COM file took over 50 minutes to print, took up 26 strips in low density and took 20 minutes to read back in.

Applications

The Softstrip machine was launched in the States as a hacker's device but, in the UK, the pitch is at the more serious user. The manual has been rewritten and put in a large binder so that the overall impression is that of a fairly substantial product. The sample data strips which come with Softstrip reflect this more up-market image with things like Lotus 1-2-3 models, critical path analysis and cost-of-sales calculations.

Softstrip offers a cheap way of disseminating information in machine-readable form, either by photocopying or by printing it. Illegal duplication of Softstrips can be overcome by overlaying the strip with a coloured band which would prevent readable photocopies being made.

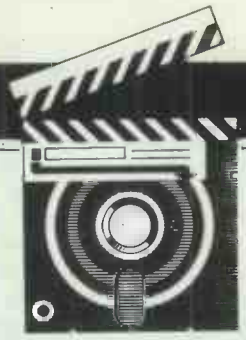
Among the applications suggested by Cauzin for the Softstrip are:

* fonts, icons and other graphic devices for desktop publishers;
* free software in educational establishments;
* strips included in school-books to bring examples to life;
* updates to price lists, stop lists and parts lists; and
* strips added to invoices, orders, and so on, to make them legible to both machines and humans.

Conclusion

Here is a very clever piece of technology looking for an application. At £200 it is out of the reach of most UK enthusiasts, so Softstrip has to look towards the business user. Unfortunately, no single business application has yet leapt out which says: 'At last, the answer to our problem.' Some of the future variants of the product — miniprinters, credit card-style readers — could open up specialist markets, but in its present form I still maintain that the Softstrip product is 'all dressed up, with nowhere to go.'

Softstrip is distributed in the UK by Softstrip Intl on (01) 631 3775. END



SCREENTEST

Ventura Publisher

The introduction of GEM gave a Macintosh-like environment to the IBM PC, but Ventura Publisher goes one step further — desktop publishing on this predominantly text-based machine. Mac enthusiast Ian McKinnell casts a critical eye over Ventura's page make-up abilities.

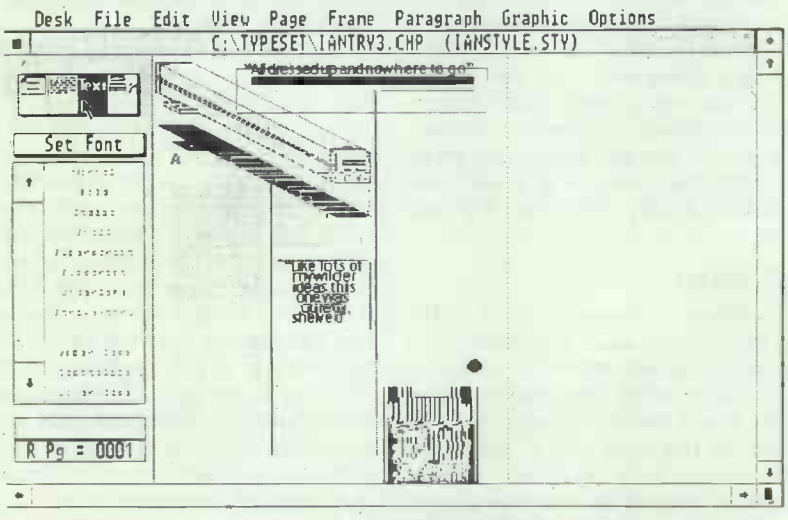
It would be best to start this review by putting my cards firmly on the table. I was one of the first people in England to buy an Apple Macintosh, almost three years ago. I consider myself a visually orientated person, and the Macintosh was a machine that thought and worked like I did — so I took to it immediately. Although the Macintosh had a few small problems, I was able to forgive it because it was fun and easy to use. For me, an IBM PC with its arcane, unintelligible gobbledegook, crude display and sickening colours had all the attraction of the enormous breeze-block it resembled. Life is just too short to have to memorise IBM manuals. Macintoshes were for guys in jeans; IBMs were for men in suits. Therefore, no-one was more surprised than I when *PCW*'s editor phoned and asked me to review a piece of software — IBM software. After I made sure he'd got the right number, I protested that I didn't even know how to switch on an IBM, let alone carry around in my head those ridiculous cryptic commands needed to make it perform. 'No problem,' said Derek, 'it runs under GEM and it's just like your Macintosh.' My protestations were eventually overruled, but it was still with trepidation that I approached that ominous grey box.

Success story

From its early beginnings, the Macintosh has grown at an incredible rate. That growth began slowly because the Macintosh was such a different machine — it required a new way of thinking. You could not simply rewrite IBM software: Macintosh owners were a different breed who would not tolerate a user interface modelled on Gestapo interrogation techniques, and they expected to be able to use software as soon as it came out of the box. The eventual success of the Macintosh philosophy can be seen not only from the vast amount of software now available for the machine, but also from the fact that almost every other machine has tried to emulate it.

This new thinking asked questions such as: What is the Macintosh good at? And received answers like: Well . . . graphics, and word processing, and charts, and presentations, and things like that. Soon these areas were combined in packages for the presentation of documents — the design of information for the printed page — which still ruled despite (or perhaps because of) the microcomputer revolution. All that was needed was the introduction of Apple's amazing LaserWriter and for some clever marketing person to come up with the concept, and, hey, presto! — Desktop Publishing — an entire industry was born. And it was Apple's, all Apple's.

Desktop publishing (DTP) was not just selling software, it was selling Macintoshes — lots of them. Offices previously solely occupied by big, grey boxes suddenly had small corners where little beige Macintoshes were appearing, with a bigger white



Ventura Publisher operates through four icons: 'frames', 'paragraph tagging', 'text' and 'graphics'. Here the text icon has been selected and clicking 'Set Font' on its pull-down menu brings up a list of all options

box, the LaserWriter, at their side. People wanted DTP — and they were even prepared to forego compatibility to get it. And as people began to discover the power of mega-spreadsheets such as Excel, and realised that they didn't have to sacrifice their squash or evenings in the pub to memorise the manuals, the little beige boxes began to breed. The guys in jeans were no longer alone. Soon the men in suits realised what was going on: they had been outsmarted by the yuppies and there was only one answer — if you can't beat 'em, join 'em.

A brief glimpse around the huge Appleworld show in London at the end of October 1986 showed where some of the men in suits have gone; the rest have stayed at home and tried to make their PCs look like Macintoshes. It took a while before the concept of DTP arrived on other machines, and most of the early attempts did little but discredit the whole concept. But serious DTP programs for the IBM are now on the near horizon, and include the eagerly awaited, but yet to be released, version of Pagemaker for the IBM, and, the subject of this review, Ventura Publisher ('Ventura') from Xerox.

At the start

To be of any real value DTP programs have to be easy to use, and because the IBM doesn't know what mice, icons and windows are, Ventura has been designed to run under the GEM operating environment and generally behave as much like a Macintosh program as is possible on a PC. The choice of GEM over Microsoft's Windows will doubtless be a great boost to GEM should Ventura succeed, and presents an interesting paradox to those who recall Xerox's famous PARC/Smalltalk project (see 'Defeating the object', page 184) where many of the principles that were to become the Lisa interface, (and thus the Macintosh), were developed — of which GEM is a slavish copy. Only the GEM operating system is supplied with Ventura — neither the desktop nor any other GEM programs are included, as with many other GEM applications.

Using the GEM interface has many advantages, for while the software may not be portable between the IBM and the Macintosh, the users can be. The screen bears a great similarity to the DTP programs on the Mac, and I found I could use Ventura immediately, only occasionally tripping up when GEM strayed from Apple's example — for instance, GEM's annoying system for selecting menus which is necessary because Apple has patented the sensible way of doing it.

The choice of GEM also allows Ventura to be installed on a wide variety of hardware configurations.

It's difficult to give a page much impact when you are restricted to a maximum of 24-point type, but in close-up, the text is perfectly acceptable for LaserWriter output. The spacing between words and letters is good and the justification is generally well-executed — note where the automatic hyphenation has taken place. However, the tones in the drawing imported from GEM Draw have virtually disappeared, along with the finer lines. (Example text has been taken from the Cauzin Softstrip review, page 176, this issue.)

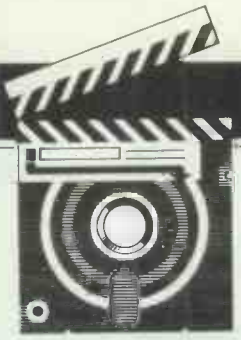
As a Macintosh user, I have always thought that 'installation' is what central heating engineers *do* and *avant-garde* artists *make*, so it came as an unpleasant surprise to realise that what for a Macintosh user takes perhaps 20 seconds at the most (and then only if you have a hard disk), is an incredibly convoluted process that can take over 20 minutes on the IBM. Were it not for being surrounded by those with the knowledge, this prospective page designer would certainly have fallen at the first fence.

Ventura Publisher is supplied on an 11-disk set and the installation procedure is invoked by typing 'vpprep' at the DOS prompt. Through a series of menus, the user is prompted to specify his or her particular hardware set-up: the options cover display, a pointing device (usually a mouse, though it could be a Summa tablet) and printer. More than one printer may be installed — for example, a laser printer could be used to proof the page — with the final document being produced in Postscript format for typesetting.

For this review Ventura was installed on an Olivetti M24 with Xitan's LaserMaster printer, a mono screen and a Torrington mouse. Installation took 15-20 minutes, much of this time being taken up 'unpacking' the bit-mapped printer fonts. These fonts reside on the installation disk in Ventura's own format and are translated into the appropriate format for the printer in use. This process also creates the representational screen fonts for the type of display being used.

Documents

There are two basic documents used by Ventura: a style document; and



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the content, which is referred to as a chapter. The number of pages in a chapter depends on your machine's memory: 40k of text for a 512k machine; 168k with 640k of memory. A number of chapters can be linked to form a publication many hundreds of pages long. Each chapter's file does not contain all the actual text, pictures, and so on, in the complete publication, but it does tell Ventura which individual documents are to be included in the publication, and it assumes that all of these are accessible. Annoyingly, if a drawing or text file is missing from the hard disk or is not in the floppy disk drive, the program doesn't prompt you to insert the relevant disk — it just ignores it and carries on regardless. Appalling.

Under this system, changes you make to text files while in Ventura are stored in the original documents. This helps save disk space (and you're going to need all the disk space you can get with this program) as information is not duplicated.

To create a new document, you would normally begin by loading in a previously created style sheet. This document contains extensive information for Ventura to use, such as in which font and size the main text (body copy) is to be set, the number and size of the columns used on a page and the size of the gutter between them, and a great deal more. In effect it's similar to keeping a blank document with all the pages already set up, with no text or pictures; but it's a far more elegant solution. Any item on a style sheet can be changed at any time; Ventura will then ask whether you wish to incorporate those changes into the style sheet for later use.

There are many sample documents (of which more below) included with Ventura, and most users would probably begin by adapting one of these for their own use. It is noticeable that throughout Ventura, both in the program and the manual, a fairly extensive knowledge of typography is taken for granted and specialist terms are presented with little or no explanation. The manual does contain a glossary, but this is a lightweight affair and many of the terms used are not defined.

Although an experienced designer will be able to take most terms in his stride (though some, like 'deckhead', I had never heard of, nor could find any reference to), the average user of this package is unlikely to fit into that category. Most new users will have to begin to use the package by learning the terms and anachronistic measures that have been developed over the centuries by the printing industry, though these may appear as paradigms of logic and clarity compared to MS-DOS — and at least are in plain English.

It should also be borne in mind that the graphic and printing industries of the US and the UK sometimes use different terms for the same thing ('surprint' really means 'overprint'). To make life even more fun, they can also use the same term for different things: a 'point' in the UK and the US is 1/72 of an inch — it isn't in the rest of Europe.

The review copy was an American version of the software — and it remains to been seen how much translation, if any, it will undergo for the UK market.

In use

The way Ventura Publisher works in practice varies from machine to machine, depending on the kind of display you are using. Ventura naturally looks its best on a high-resolution screen and will work with the 1280 × 800 pixel Wyse 700 unit. But the most vital variable is the kind of printer you are using, which greatly affects the performance of the program. For this review Ventura was used with Xitan's LaserMaster (£4100 + VAT) which is based on Ricoh's print engine and emulates a HP LaserJet, although the LaserMaster's greater memory allows it to print an entire A4 page of graphics. Unusually the LaserMaster has no fonts — these are downloaded at the beginning of the print session and changed dynamically as required. All fonts are bit-mapped, which means that a separate font is required for every size and style, and the maximum size is 36-point (the maximum size that can be used with Ventura is 24-point). Larger typefaces have to be incorporated as pictures created in programs such as PC Paintbrush, but this causes an inevitable reduction in quality.

This obviously imposes great limitations (the entire Hewlett-Packard font set takes 1.6Mbytes of disk space!), and a page make-up program that is limited to 24-point can hardly be called professional. This restriction makes it difficult to make one page look very different from another, and is merely encouragement for dull design.

Using Ventura with the LaserMaster gave the use of only four fonts, and not all of them were available in all styles and sizes.

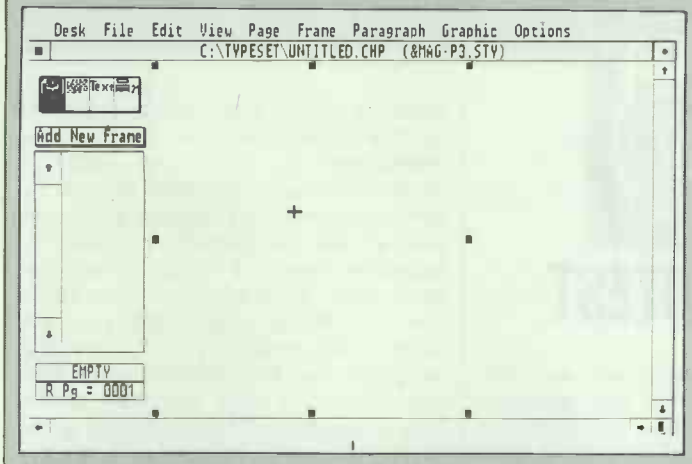
Ventura becomes a far better program with a much greater range of options when teamed with a laser printer such as Apple's which, along with other Postscript devices, takes the opposite approach to the LaserMaster.

The outlines of a font are held in ROM in the machine. In the case of the LaserWriter Plus this means 11 complete typefaces — more can be downloaded. Rather than have a different set for each point size, each particular font size is scaled from that outline. There is no real limit to the size (maximum or minimum) of a letter, and it can be stretched, rotated, italicised, outlined, inverted, condensed, expanded, shadowed, and so on.

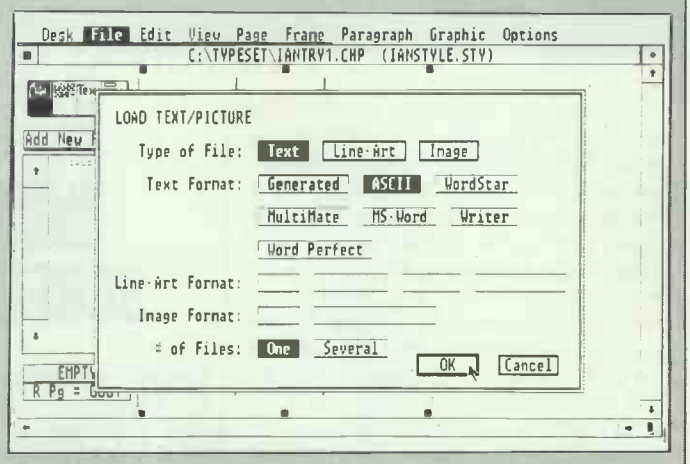
Using Postscript also allows portability between machines, compilers and printers: for example, a document prepared in Ventura could be proofed on the LaserWriter and then output to a Postscript typesetter, such as the Linotronic 1000 working at 1200 dots per inch. And the availability of typesetters is very important, for although laserwriters at 300 dots per inch offer far better quality than daisywheel or dot-matrix printers, they are not typeset quality and not good enough for the highest-quality work. Ventura can also be configured to work with Epson MX and FX dot-matrix printers, but these cannot be recommended for the job.

Ventura can import text and pictures from a wide variety of sources, both from word processing programs and graphics programs. Currently Ventura can open files directly from WordStar, Multimate, MS Word, Writer and Word Perfect — it can also open other files generated by itself. If your word processor is not on the list, then text can be imported into Ventura as an ASCII file. Investigating an existing Ventura text document reveals that many of the style changes, and so on, are visible as embedded code, and therefore can be included into documents that are, for example, to be mail-merged — this also has the advantage that Ventura documents can be produced without needing a graphics screen.

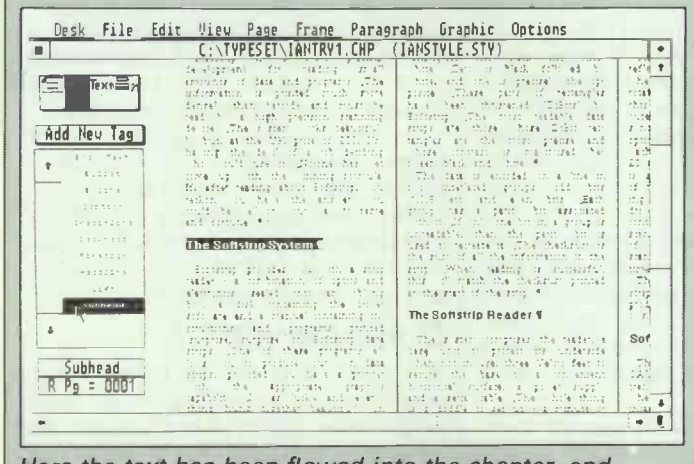
As Ventura can cope with many formats, it is also capable of converting a document from one format to another. This facility for creating Ventura templates with another program is not limited to word processors. For example, templates can be created in dBaseIII for transfer to Ventura for printing, so that graphics could be added to, say, a catalogue.



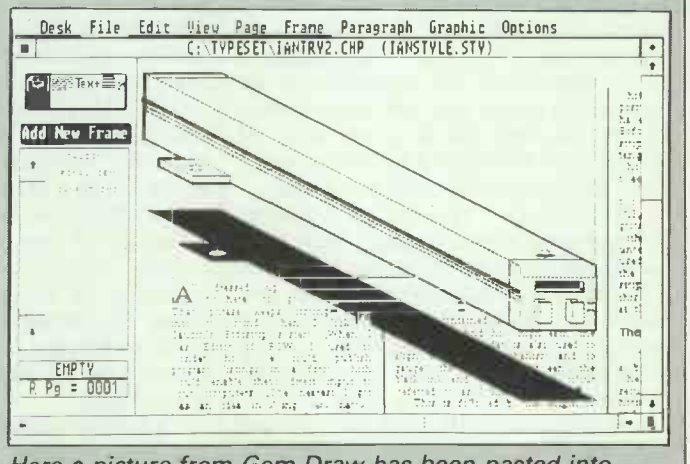
This is what greets you when the program is loaded; any resemblance between this screen and that of a Macintosh is purely intentional. The first action to take would be to load a 'style sheet' which contains a comprehensive list of information about which fonts should be used for which part of the document, what paper size you are using, what your sub-heads should look like, and so on



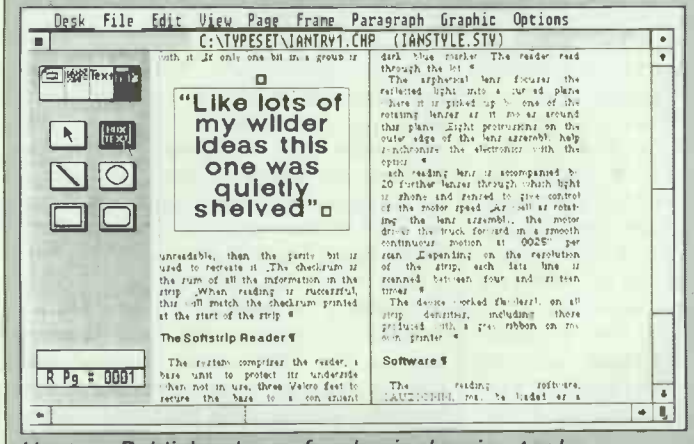
The next stage is to import the pictures and text that you will be using. Ventura automatically increases the number of pages to fit whatever document you include. Text and pictures can be imported from a variety of sources, and the names of the documents will be displayed in the large box to the left of the page. It's important that all of the documents you include are on your hard disk



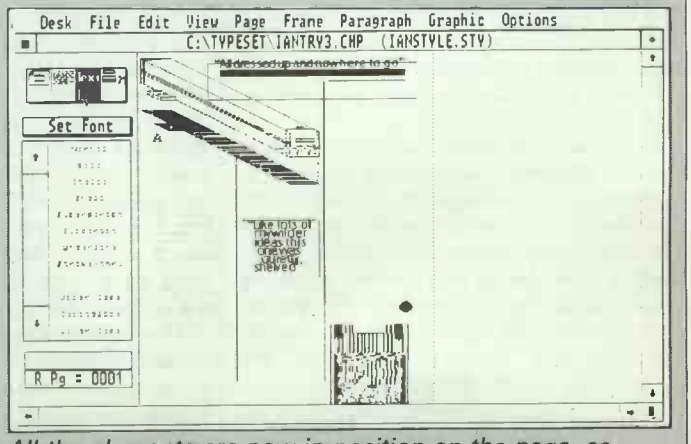
Here the text has been flowed into the chapter, and details and elements of the word-processing document are being selected and instantly converted into their relevant style by selecting the appropriate name from the box on the left-hand side — in this case a sub-head. It's possible to embed the code to do this directly in the word-processing document so that this process occurs automatically



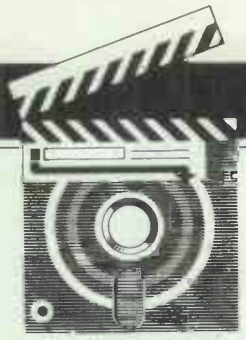
Here a picture from Gem Draw has been pasted into the chapter, and text is being made to flow round it by drawing a series of 'frames' beneath the drawing. Any changes will ripple through an entire chapter very quickly and changes that are made to the text will also be made in the original word-processing document — pictures can only be resized, they cannot be redrawn



Ventura Publisher has a few basic drawing tools which can be used for creating grids, rules and simple shapes. Here 'box text' has been selected, around which can be seen the outline of the frame within which it sits. These graphics can be easily selected and repositioned, and the pattern with which they are filled (if any) chosen from a wide selection



All the elements are now in position on the page, as can be seen in this reduced view. Any of these elements can be 'picked up' and repositioned. Here the text is represented by lines, though this option can be disabled and the text drawn in full but it will be illegible at this scale. The text is generally drawn very quickly, but pictures can slow proceedings down considerably



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Ventura can import graphics from AutoCad, PC Paintbrush, GEM Draw, GEM Paint, GEM Graph, Mentor Graphics' PC CAD and Lotus 1-2-3. The graphics used in the example on page 181 were made using GEM Draw, GEM Paint and PC Paintbrush. In comparison with the wide selection of increasingly sophisticated graphics programs for the Macintosh, these three programs for the IBM and clones can really only be described as pathetic. Their resemblance to the Macintosh programs on which they are based is purely superficial. This lack of any good graphics program, apart from the extremely complex and user-hostile AutoCad, is a severe shortcoming of Ventura, and so is its lack of a seamless interface with most other programs.

Operation of Ventura Publisher is through icons and pull-down menus, most of which are generally well thought out. The four main aspects of its operation are represented by four icons in the top left-hand corner of the screen. Clicking on one of these icons leads to a different set of tools for undertaking different tasks.

The first icon represents 'frames'. Every element on the page, be it text, headlines or pictures, is contained in a frame. It's possible to have just one frame — the underlying page — or a number of frames containing many elements, possibly even overlapping. A frame can be thought of as a miniature page in itself, and can be set up in a style completely different to the rest of the chapter. Each of these frames, with the exception of the underlying page, can be moved and repositioned anywhere in the chapter. If a frame is placed over a block of text, that text can be made to flow around it — all very nice.

While in the frame mode, the box below the icon contains the names of all the documents associated with the current chapter, and including one of these is as simple as clicking on it.

The second icon represents 'paragraph tagging', where the style of a particular paragraph can be assigned. In this mode the box beneath the icons contains 'tags', which can be given names such as body text, byline, and so on, which are part of the style sheet. To create a new 'tag' the user specifies the attributes such as point size, font, spacing and alignment, which can be given a relevant name. Any paragraph, word or words that have been selected with the mouse can now be instantly changed by clicking in the list on the left (that is, assigning a tag to them). Thus, if a paragraph (which, in the case of a heading, may only be one word long) is selected (groups of paragraphs are selected by keeping the Shift key pressed) and 'sub-head' chosen (or whatever label you have applied to that particular style), it will instantly appear in larger bold type, with extra space above and below, outdented with a large first letter — or whatever style you have assigned.

This macro facility is one of Ventura's best features. It's fast, simple and elegant, and allows an existing word-processing document to be adapted to a particular style very quickly. In this respect Ventura is a real improvement over Pagemaker on the Macintosh, and presents an object lesson in carefully considered program design. Many tags can be assigned to a style sheet, and a scroll bar appears at the side of the box when all of the tags cannot be displayed at once. Ventura can also generate an automatic table of contents by searching for paragraph tags, and it can also search for index entries to produce automatic index generation.

The third icon (if the word 'text' can be considered an icon) selects the mode for editing individual characters or words. Thus, in this mode, new text can be added or existing text altered, and the font and style of selected text can be altered very quickly by clicking on the appropriate style in the box to the left of the screen. Clicking the 'set font' box brings up a dialog box showing all the available options, and text can also be cut and pasted in this mode. The methods of selecting text lack many of the Macintosh's short-cuts (such as double-clicking on a word to select the whole of that word). On the screen, small symbols represent the end of a paragraph and double word spaces, such as at the beginning of a new sentence — they do not appear on the final hard copy.

The remaining icon, the graphic-drawing function, enables you to draw lines, rectangles and circles. These tools are very basic and not really comprehensive enough to undertake drawings of any consequence which need to be imported from a graphics program, but they are adequate for most page design.

User image

Most of the work undertaken using Ventura, apart from initially setting up the style sheet and making any exceptions to that style, will be undertaken using the four modes described above. This relative simplicity also allows for flexibility of use: for example, when a style sheet has been fully developed, *anyone* could use it to design pages. Many people could, and probably will, use the program like this without venturing any further. If they did, they would find a number of facilities that allow small changes to be made: for example, an individual character can be lifted a fraction of a millimetre at a time, and individual letter pairs can be moved closer together (kerning).

It is small touches such as these that add greatly to Ventura's claim to be a 'professional' page make-up program, but they also have a negative side — they make the program appear much more complex and, to a new user, much more intimidating, as dialog boxes offer a wealth of choices and decisions to be made.

On the negative side Ventura has some odd quirks — for example, it suffers the usual American chauvinism of having inches as the default measurement — and don't be fooled into thinking that if you've changed one, you've changed them all.

Documentation

The manual, of which I only saw a beta copy, is a weighty tome. It was informative about the program and generally readable as manuals go, but it can only be described, even by the most generous reviewer, as dull. Desktop publishing is about producing attractive, professional-looking results quickly and easily — and good design is not a subject dealt with in this manual.

Conclusion

Despite the general excellence of the program, Ventura is not a program that will sell machines to new users, because ultimately it cannot fully overcome the complexities of the system on which it runs. However, for any company which already owns an IBM or compatible, Ventura Publisher is well worth investigating.

But don't be misled by desktop publishing — there's far more to producing a masterpiece than simply having the right tools. A great deal has to be learnt, and much of that learning has nothing to do with computers. Before you get too confident, remember that virtually all the materials used by Leonardo da Vinci can be bought from your local art shop!

Ventura Publisher costs £795 (excl VAT) and is supplied by Xitan on (0703) 871211. END

Ventura Publisher - Desktop Publishing For Your IBM PC

Ventura Software brings a new generation of desktop publishing to the IBM PC.

You can now create stylish newsletters, flyers, technical documents, catalogues, proposals and magazines - all with a professional touch.

Ventura contains dozens of professionally designed "style-sheets". You can modify those supplied or simply design your own.

To choose your design, you select a "style-sheet", load text from your word processor and watch it flow instantly into your format.

Maybe you want three columns instead of two. The format for a whole chapter up to 100 pages can be changed automatically. It will switch to three column format with proportional spacing, justification, hyphenation, multiple typestyles and sizes. Chapters can be chained together to form documents as large as your hard disk can hold.

Full integration of text and graphics means you can change a picture, enlarge it, move it around and crop it. Your document is automatically reformatted to reflect the change. Last minute edits, additions, deletions can be made in seconds with the built-in word processor.

Ventura is a true WYSIWYG system which means that as you edit and modify, your screen shows you what the print-out will look like. Exactly.

The real power of Ventura lies in its ability to integrate with existing PC based software. You can bring graphics in from GEM, Lotus 123, Autocad, PC-Paintbrush and so on. You can also use text from word processing packages such as Multimate, Wordstar, Microsoft Word, Wordperfect, and any other ASCII file.

Ventura supports the HP Laserjet, Laserjet+, Apple Laserwriter, Laserwriter Plus, Allied Linotronic Typesetter (or any other postscript typesetter).

Ventura Publisher

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The key to successful computing

Defeating the object

Object-orientated programming is where objects communicate by sending and receiving messages. Carl Phillips gives a detailed explanation of the method, with particular reference to PARC's Smalltalk.

Writing a large computer program is hard work; writing a large computer program that works is even harder. As programs get larger they get more and more complex, and part of the reason for this is that different parts of a program come to depend on the other parts. It's a little like building a house out of playing cards: things start out OK, but pretty soon adding new cards or making changes becomes a difficult exercise.

Most programmers are familiar with the ideas of 'structured programming' embodied in languages such as Pascal or C. Structured programming techniques are an attempt to control the complexity inherent in large programs by building barriers between different parts of a program. These barriers are designed to hide the details of how part of a program works, from the other parts. Unfortunately, barriers built using structured programming have a problem — they tend to leak, revealing more than they should about the inner workings. As a result, structured programming techniques are only a partial success.

Object-orientated programming is a set of ideas and techniques for building large computer programs that *work*. By using object-orientated programming techniques, water-tight barriers are built automatically between all parts of a program.

The benefits are substantial: programs that would be hopelessly complex using conventional techniques can be straightforwardly programmed; software development time is reduced; changes are much easier to make; and the resulting software is much more flexible. Since object-orientated programming absolutely minimises the number of assumptions different parts of a program make about each other, re-using part of a program written for one application in another application is easy.

The ideas behind object-orientated programming first appeared during the 1960s. The programming language Simula was designed as an extension to Algol 60 by Kristen Nygaard and Ole-Johan Dahl at the Norwegian Computing Centre, to allow easy modelling and simulation of real-world phenomena. The ideas were developed and extended by Alan Kay and his co-workers in the Learning Research Group at the famous Xerox Palo Alto Research Centre (PARC) during the 1970s. The PARC researchers developed the seminal Smalltalk programming environment which is still the standard by which all other object-orientated languages are judged.

This article uses Smalltalk terminology to introduce the ideas behind object-orientated programming. Differences do exist in the terms used by other object-orientated languages, but the fundamental ideas of object, message, method, class and inheritance remain the same.

Object-orientated programming terminology

Object: the basic building blocks of object-orientated programming. An object consists of a set of variables and procedures (called methods) that cannot be accessed directly from outside the object. Objects can be thought of as small, specialist computers with some memory — the variables — plus a set of operations — the methods — that can access the memory.

For example, objects which represent integer quantities would have a variable storing their current value plus methods for basic arithmetic — add, subtract, multiply and divide (among others). Objects representing rectangles could have two variables, storing-point objects, plus methods for drawing the rectangle, calculating its area, or moving it.

The number of variables, plus the set of methods an object can respond to, depends on the class of the object. To get an object to do something, you have to send the object a message.

Message: a request that an object perform some operation by calling its methods. The object is free to choose how to respond to the message. Sending the message 'draw' to an object of class Rectangle could, for example, display it on the screen.

Method: a procedure that is private to an object. Methods provide the means by which an object carries out its actions in response to a message.

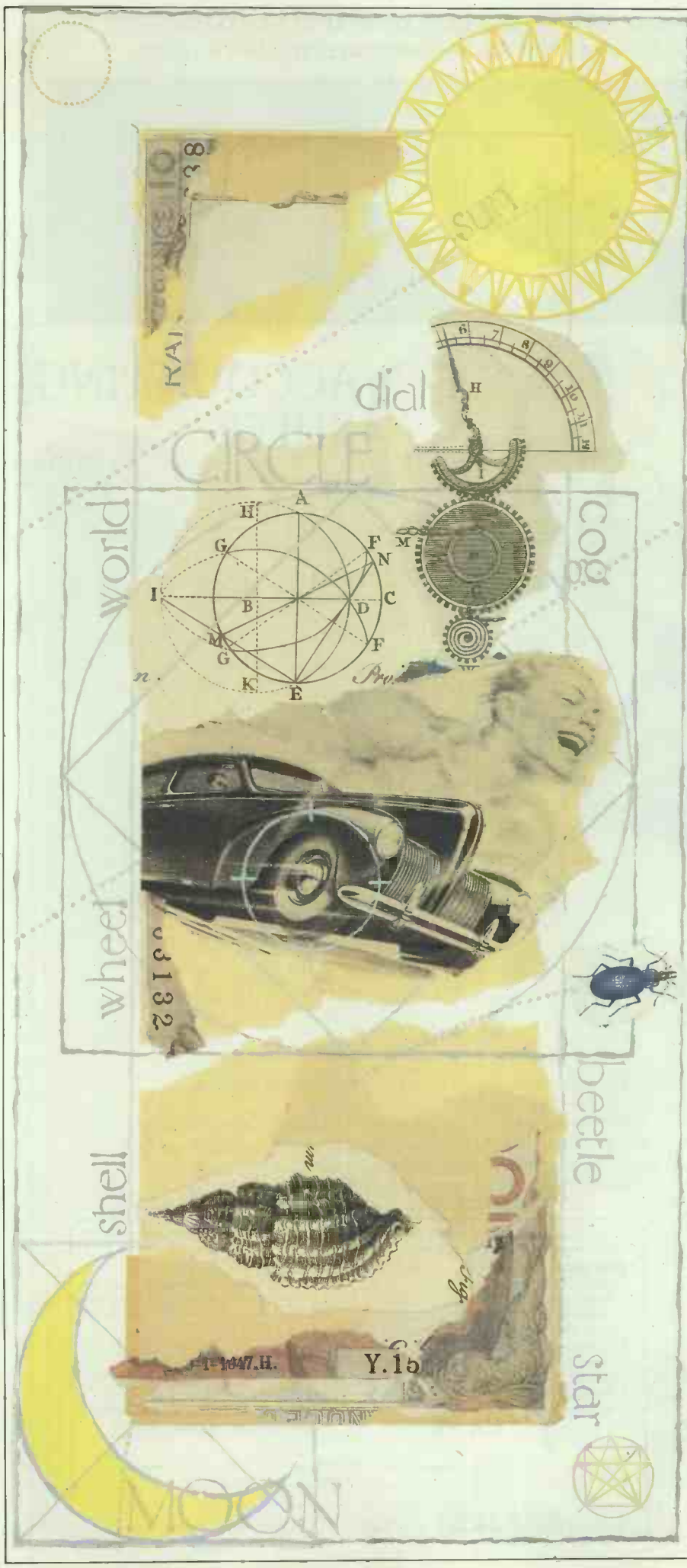
Class: a structuring mechanism for objects. All objects are members (called instances) of some class. The class of an object determines what it represents. Objects of Class Integer represent integers, objects of class Rectangle represent rectangles. The class specifies the number of variables and the set of methods an object will have. Class Rectangle might specify that objects which represent rectangles (that is, objects of class Rectangle) have two variables holding points named topLeft and bottomRight, and methods named height, width, area, draw and move.

Inheritance: a structuring mechanism for classes. Classes are organised in a tree structure with class Object at the top. Subclasses inherit the variables and methods of the parent superclass. Class Rectangle might inherit methods and variables from class Shape which, in turn, inherits methods from class Object.

Objects & messages

The basic building blocks of object-orientated software systems are called, not surprisingly, objects. Objects are chunks of memory which can contain data and/or references to other objects. In this respect objects are similar to a collection of variables in Basic, or the structures or records used in C and Pascal to represent a

Illustration by David Loftus



related group of variables. There are, however, some crucial differences.

The most important difference requires a change of viewpoint on the part of the programmer. In Basic, C or Pascal, procedures (subroutines in Basic) and operators perform computation upon passive data stored in variables. In object-orientated programming, objects are active entities. Objects consist of the data stored in their variables, plus the set of procedures or subroutines (called *methods*) which can act upon that data. If this idea seems strange, don't worry — you're not alone. It seems strange to most programmers. The reasons why it is a good idea are what make object-orientated programming special. The change is subtle but the consequences are profound.

The data and methods stored in an object are *private to that object* — they cannot be accessed directly from outside the object. This is the water-tight barrier provided by object-orientated programming and which is technically known as *encapsulation*.

To make something happen in an object-orientated language, you have to send a *message* to an object requesting it to carry out one of its internal methods (procedures). Sending a message to an object causes one of the internal methods to be called, some computation to take place and, usually, a result to be returned.

There is no way to access the internal variables (called 'instance variables') of an object directly: the only way to make something happen is by sending a message to an object. Objects are free to respond as they choose to the message.

Different kinds of object will respond differently to the same message. For example, if you send the message '+ 3' to an object that represents the integer 3, the result will be 6. Send '+ 3' to a string object 'Apple' and the result will be a string 'Apple3'. The key difference is that it's the object which is in control, not the '+' procedure. It's the object which decides what the appropriate response to a message will be.

Program flow using message-sending is like directing actors on a stage (some of the object-orientated extensions to Lisp are called 'actor languages' for just this reason). On the stage actors are told when to perform a task, but the interpretation and implementation of that task is largely up to them.

To be able to make use of an object, you need only know how it behaves and the set of messages it responds to — you don't need to know how this behaviour is implemented inside the object: 'What should happen' is separated from the 'How it happens'. This separation of concerns is crucial for the design of

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modular and re-usable software.

In Smalltalk, everything is represented as an object. This includes all the basic types you would find in any conventional programming language — integers, floating-point numbers, characters, strings, arrays, and so on. Abstract data types which would be defined using structures or records, such as linked lists, hash tables and binary trees, are also represented as objects. Even the high-level components of the system such as menus, windows, compilers, debuggers and applications programs are represented as objects.

Classes & inheritance

In theory, every object in an object-orientated system could specify the number of instance variables it has and store the set of methods to which it responds. In practice, it's useful to share the structure and methods between similar objects, so saving memory and re-using code.

Objects that share the same layout of data and methods are grouped together into *classes*, and each object contains a reference to the class it belongs to. An object's class specifies the internal structure of the data stored in an object, plus the set of methods available for responding to messages. An object is said to be an *instance* of a class; classes are grouped together and organised into a hierarchy or tree structure. Classes have a parent or *superclass* and can also have subclasses; subclasses *inherit* their behaviour — their instance variables and set of methods — from their superclass. Inheritance is a powerful technique for re-using code and embedding knowledge in a program.

At the top of the tree structure the only class without a superclass, usually called class Object, defines the basic structure of all objects and the set of methods that, by default, all objects, whatever they represent, can respond to.

When an object receives a message, it looks at the set of methods stored in its class. If it doesn't know how to respond to the message using these methods, it looks in its superclass. If no method is found there it looks at its superclass's superclass, and so on, right up the tree, ultimately to class Object. If no appropriate response is found there, an error is generated.

Subclasses can add to the instance variables and set of methods an object responds to; they let you refine or vary the behaviour of the superclass. For example, a subclass of class Shape, named Rectangle, can refine the behaviour (instance variables and methods) of class Shape, making Rectangle objects more suitable for storing rectangles (only two points need to be stored rather than a list of points for an arbitrary shape, thereby saving memory). If class Shape has a method named inShape that tests whether a point is inside an arbitrary shape or not, it can be redefined in Rectangle to perform a much simpler, and therefore a much faster, test. Class Circle, another subclass of Shape, could store only its centre point and its radius. Again, the inShape method could be redefined to provide a faster test.

Counting the words in a text file in Smalltalk/V

Object-orientated programming really comes into its own in the development of large programs, but a short example will serve to illustrate some of the techniques. The problem is to read a text file and produce a sorted list of the words in that text file, plus a count of the number of occurrences of each word. WordCount depends heavily on re-using classes already built into Smalltalk/V.

The words are initially read into a dictionary object (a Smalltalk dictionary is an object that would be represented as a hash table in C or Pascal). Dictionaries consist of a set of associations: an association is just that — a key plus the value associated with it. The key and values can be any arbitrary objects, but in this case the key will be a word and the value will be the count of the number of occurrences.

Class SortedCollection is used in the method report and holds arbitrary objects sorted according to some criteria. (You can, if required, specify what criteria, but for WordCount the default alphabetic ordering of strings is adequate).

```
Object subclass: #WordCount
  instanceVariableNames:
    'words'
  classVariableNames: ''
  poolDictionaries: ''

addWord: aWord
    "add word to dictionary (just increment count if already present)"
    |count|
    count:= words at: aWord ifAbsent: [count:=0].
    words at: aWord put: count+1

from: inputStream to: outputStream
    "Read from inputStream to outputStream, counting and sorting words'
    words := Dictionary new.
    self readDocument: inputStream.
    self report: outputStream

readDocument: aStream
        "Count the words in the named stream"
    | inputWord |
   [(inputWord := aStream nextWord) == nil]
        whileFalse: [self addWord: inputWord asLowerCase].
   aStream close

report: aStream
        "sort and then print word frequency list"
    |sortedWords|
    sortedWords := SortedCollection new.
    words associationsDo:
       [:anAssoc| sortedWords add: anAssoc].
    aStream cr.
    sortedWords do:
       [:anAssoc| aStream nextPutAll: anAssoc key.
                  aStream space.
                  aStream nextPutAll: anAssoc value printString.
                  aStream cr].
    aStream close
```

At the top of the listing is the class specification for class WordCount. This says that WordCount is a subclass of Object, and differs from class Object in that instances of WordCount have an additional instance variable named Words.

Class WordCount does not have any class variables (variables that are shared by all instances of a class), nor does it access any pool Dictionaries (global variables that instances of several classes may have access to). WordCount objects have four additional methods, apart from those in Object, called addWord:, from: to:, readDocument: and report:.

To create and execute WordCount from within Smalltalk you would enter the expressions:

```
|in out|
in:= Disk file: 'mydoc.txt'.
out:=Disk file: 'counts.txt'.
WordCount new from: in to: out
```

Select them with a mouse and choose the 'do it' menu option.

Smalltalk message expressions are separated by the full stop (.) character. Comments are embedded in double quotes. Temporary variables are declared between two ¦ symbols.

Creating and executing WordCount from within Smalltalk: order of execution

1) Declare two temporary variables to hold objects named 'in' and 'out'.
2) Send the Disk class the message 'file:' with the argument 'mydoc.text'. This will return a Smalltalk stream — an object that will let you access a file on disk named 'mydoc.text'. Assign the stream object to 'in'. Send the Disk class the message 'file:' with the argument 'counts.txt'. This will return a stream object that lets you access a file named 'counts.txt'. Assign the stream object to 'out'.
3) Send class WordCount the message 'new'; this will create a new WordCount object. Immediately send the new WordCount object the message 'from: in to: out'. The 'from: inputStream to: outputStream' method above will be executed with 'in' and 'out' passed as arguments.
4) Send Class Dictionary the message 'new', creating a new, empty dictionary object, and assign it to the instance variable 'words'.
5) Send the message readDocument: with the argument inputStream to self. 'Self' is a pseudo-variable that allows an executing method to send a message to another method in the same object. The readDocument: method is executed.
6) A temporary variable named inputWord is declared. Send the message nextWord to the stream object. The next word in the file will be returned and assigned to inputWord.
7) Send inputWord the message asLowerCase; this will return an object which is inputWord with upper-case characters translated to lower-case. If the returned word was not the object 'nil' (which signals end of file), send the message addWord: to self with the translated inputWord. The addWord: method is executed.
8) Declare a temporary variable named 'count'. Ask the words dictionary object to return the count associated with the key aWord. If aWord is not present in words, set count to 0.
9) Put aWord and count+1 into the dictionary and return to executing the method readDocument:.
10) Go round a loop in addWord: (steps 6 to 9) until the end-of-file indicator 'nil' is returned.
11) Send the message close to the inputStream as it's no longer needed, and return to the from:to: method.
12) Send the message report: with the argument outStream to self.
13) Declare a temporary variable named sortedWords. Assign a new SortedCollection to sortedWords by sending class SortedCollection the message new.
14) Go round a loop, adding each word and count in the dictionary words to the sorted collection sortedWords.
15) Send a carriage return to the output stream. For each word and count in sortedWords print the word, a space, the count as an ASCII string, and a carriage return to the outputStream.
16) Finally, close the outputStream and return to the method from: to:. There are no more expressions to do in from:to: so return to the caller.

Example: Object-orientated design of a page make-up program

Desktop publishing and page make-up programs are currently one of the most fashionable applications for personal computers. A portion of a simple page make-up program written using an object-orientated language might be designed in the following way:

Page make-up programs have to deal with a wide variety of different objects, and text — in the form of paragraphs of body text, plus various floating text items such as headings, footers and footnotes. It would also be nice to be able to use various kinds of illustration — for example, pure bit-map pictures, graphs and pie charts, and screenshots from other programs.

'. . . water-tight barriers are built automatically between all parts of a program.'

Pages can be regarded as containers for these objects. Objects are stored on the page according to a set of constraints; typically they must not overlap so that text must flow around illustrations, for example. A page would need to be a subclass of a collection class — perhaps LinkedList. The messages a page would respond to would allow adding new objects to the page with, or without, overlap. A draw message to a page would instruct each object on the list to draw itself in its remembered position. Other messages would allow you to ask the object its height and width, and whether it could be split across a page boundary (text usually can — illustrations can't).

Class DisplayObject could be an *abstract superclass* for both text and illustrations. Abstract superclasses are not intended to have instances: instead, they merely act as a shared repository of knowledge for their subclasses. In this case DisplayObject would implement messages allowing the position of an object on the page to be stored, and messages that respond to enquiries as to whether or not an object can be split across page boundaries. Subclasses of DisplayObject could be Class TextObject and Class Illustration.

Class TextObject might have subclasses Paragraph (for body text), Header, Footer and Footnote. A subclass of Paragraph, DisplayParagraph, could be a special form of paragraph for flowing text around illustrations. Paragraphs would refer to a variety of different objects: string objects that hold characters, style objects that remember the fonts and any print enhancements such as bold, underlining or italics.

Class Illustration would be an abstract superclass for the classes that represent illustrations — perhaps Bitmap, Graph (with a subclass Piechart) and Screenshot.

Note how flexible this is: you don't need to know the type of any of these objects, just that they respond to particular messages which page objects send them. If you wanted to add new types of illustration or text objects, you could do so without having to use working code: simply develop new subclasses of illustration and TextObject that reflect the new types of object.

Designing the set of messages to which objects respond, for a particular class, is similar to deciding which procedures or functions are needed in a structured programming language such as Pascal or C, but the responsibilities of handling data type are shifted from the programmer to the machine. The programmer is designing a 'language of interaction' for the objects and, as with any language, if it's powerful and expressive then the results will be much better.

Smalltalk is a uniformly object-orientated language — *everything* is represented as an object. With the upsurge of interest in Smalltalk and object-orientated programming in general, a large number of hybrid

languages — which take conventional languages such as C or Pascal and add extensions suitable for object-orientated programming — have also been designed, and more are on the way.

In hybrid languages the low-level components remain the conventional data types, procedures and operators built into the language. Objects are used to represent higher-level components. In hybrid object-orientated languages, the total encapsulation of an object is often relaxed: the internal instance variables of an object can be accessed by external procedures or functions. However, as with global variables and procedures in structured programming, this is a major potential source of bugs and problems.

These hybrid languages have the advantages of familiarity — programmers are free to choose whether or not to learn about and make use of the object-orientated features. However, they lack the rigorous consistency and conceptual clarity that makes Smalltalk such a powerful programming language. In addition, Smalltalk is a high-quality, interactive programming environment, and the hybrid languages do not attempt to replicate this environment.

Conclusion

The best way to learn about any new programming language or technique is to try it on some worthwhile problems. A wide variety of different object-orientated programming languages are available for personal computer systems (see the box alongside). They divide into roughly two camps: uniform object-orientated languages (Smalltalk-80, Smalltalk/V and Actor) and hybrid languages that incorporate some degree of support for object-orientated programming.

Most people find that the easiest way to learn about object-orientated programming is to borrow a technique from learning a foreign language — total immersion. For this reason, many people initially learn about object-orientated techniques by programming in Smalltalk — everything is an object and there is no way to slip back into known habits. In addition, Smalltalk is a powerful programming environment in its own right and can serve as a useful environment for prototyping or developing applications software.

Object-orientated programming techniques represent a real change in the way people view and write computer software. Although the central idea — active objects communicating using messages — seems strange at first, it rapidly becomes second nature. This concept may well be a powerful abstraction, but it does simplify many kinds of complex programming problems. END

Object-orientated languages available for personal computers

Smalltalk-80:Smalltalk-80 Version 2, the latest version of the original Xerox implementation of the Smalltalk language and programming environment, is available for the IBM PC/AT from Softsmarts Inc. Apple sells an unsupported version of Smalltalk-80 Version 1 for the Apple Macintosh, for a nominal sum.

Smalltalk/V: This is a low-cost, high-performance Smalltalk developed by Digitalk Inc to run on the IBM PC family. It was reviewed in the November 1986 issue of *PCW*.

Actor: Actor is an ambitious attempt to combine Microsoft Windows and a Smalltalk-like interactive programming environment, with a new object-orientated programming language. The Actor language has a Pascal or C-like syntax and special features for improving the performance of object-orientated programs. Actor was designed by CB Duff who also developed Neon, a simple object-orientated Forth for the Macintosh. Actor is available from the Whitewater Group and runs on the IBM PC.

EXTENSIONS TO C

Objective C: Objective C is an extension to C from Productivity Products International, which adds a small amount of additional Smalltalk-80-like syntax to C to support object-orientated programming and message sending. It is a pre-processor that translates the object-orientated extensions into conventional C code, which is then fed to a standard C compiler. Objective C comes complete with a class library in source form which is a useful aid to learning the basics. It is available for the IBM PC with Microsoft C Version 3.0.

C++: C++ is an extension to the C language designed by Bjarne Stroustrup of AT&T Bell Laboratories — the home of the C language itself. It incorporates a number of extensions to C, including support for classes and object-orientated programming. Like Objective C it is implemented as a pre-processor. Two implementations are available for the IBM PC family from Guidelines Software and Lifeboat Associates, for Microsoft and Lattice C.

EXTENSIONS TO PASCAL

Object Pascal: Object Pascal is an extension to Pascal, and was designed by Apple in conjunction with Niklaus Wirth for the Apple Macintosh. Object Pascal is a simple object-orientated language and lacks some of the more involved ideas present in Smalltalk. An Object Pascal compiler is available as part of the Macintosh Programmer's Workshop.

Apple Computer's MacApp is one of the best examples to date of the power of object-orientated programming. MacApp is a generic Macintosh application, written in Object Pascal, that serves as a framework for programmers developing their own applications to run on the Macintosh. MacApp implements the standard features common to all Macintosh applications (one or more resizable windows with scroll bars and grow boxes, the pull-down menu bar, application launching, printing, and so on).

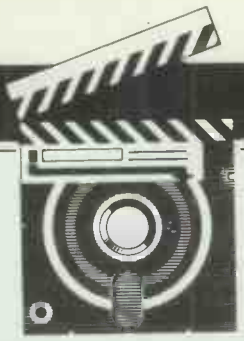
The programmer specifies how the application being developed differs from the generic MacApp application (by using subclassing and redefining methods). According to reports from software developers, MacApp makes developing Macintosh software much faster.

EXTENSIONS TO LISP

Lisp is a malleable language, and it's possible to program object-orientated extensions yourself in any reasonable Lisp implementation. Two versions of Lisp available for micros that include explicit language support for object-orientated programming are:

XLISP: This is a public-domain Lisp implementation by David Betz that is specially designed to support experiments in object-orientated programming. It is available free from a number of bulletin boards and user groups, and runs on the IBM PC, MS-DOS machines and the Macintosh.

Scheme: Scheme is a Lisp dialect which has been developed for teaching purposes at MIT. PC Scheme is sold by Texas Instruments for its own PC and other IBM-compatibles. MacScheme is sold by Semantic Microsystems for the Apple Macintosh.

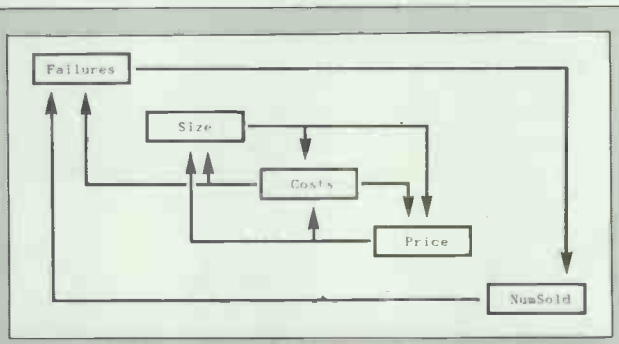


SCREENTEST

Second Sight

The problem with spreadsheets is that they rely on accurate data input for accurate results. Second Sight from British company Strategies can be used as a stand-alone application or in conjunction with a spreadsheet. It makes sound predictions by analysing underlying statistical trends, and so alleviates the 'guesswork' element of financial forecasting. Mike Liardet predicts its chances of success.

How Second Sight works



The 'model' shows relationships between the 'series'

Second Sight operates on a number of 'series'. A series is just a sequence of numbers, representing the values of some 'variable' at different moments in time. For example, in the business context, a typical series might be a sequence of numbers representing a product's price, as it changed over the last few months or years. Other typical series might be the number of units sold, and advertising expenditure. The 'names' for these series (price, sales and advertising) are known as the variables.

Second Sight applies a battery of sophisticated statistical analysis techniques, including Box-Jenkins and multi-variate regression analysis, in order to build a 'model' out of all the series, which it can then use for making predictions. These statistical techniques are highly-regarded by statisticians, especially for the sort of short to medium-term predictions to which Second Sight will be commonly applied.

The basic function of the statistical analysis involves not only looking for trends within a series, but also explicitly looking for interactions between them (see the diagram), and dealing with both seasonal effects and time-delays. Statistically, it is relatively straightforward to continue the series 1, 3, 5 . . ., or whatever. But Second Sight can make far more complex observations — for example, it may 'notice' that an advertising campaign does not affect sales until three months later or that firework sales take off every November.

The resulting 'model' that Second Sight builds, on the basis of the statistical analysis, expresses the relationships between the variables, and it's from this that Second Sight can make its predictions.

The actual structure of the model can be very complex, and cannot be seen in detail by the user — but its effects can be observed in the forecasts, and a summary of the relationships can be seen in a diagram. The model might contain relationships such as sales are inversely proportional to price; advertising Y improves sales by X, n months into the year; and so on. Once these relationships are known, the system can predict into the future with straightforward calculations, by using the relationships in the model as a kind of formulae.

Hands up anyone who has recently used a spreadsheet system for modelling future business plans. And how did you decide on those vital figures for product sales, advertising expenditure or whatever? Did you take last year's figures and add 10 per cent? Or did you, perhaps, just juggle the figures until the profits looked about right?

Of course, the difficulty with financial planning is that a spreadsheet is excellent at calculating and recalculating, but it does not necessarily help the user find sensible figures for it to calculate on. For example, once given a figure for the number of product units to be sold, any spreadsheet worth its salt can calculate anticipated sales revenue and profits right down to a thousandth of a penny. But how reliable is the *original* figure for anticipated product sales?

What the bewildered financial planner really needs is the software equivalent of a crystal ball to interface to his spreadsheet system, and (don't laugh!) a number of software companies have been working on just this problem. Actually these companies normally refer to their products as 'statistical analysis packages', which is a more appropriate description for them. In an attempt to maintain the crystal-ball image, Strategies, a UK-based marketing and consultancy organisation, has called its statistical product Second Sight.

A typical use of Second Sight involves feeding it with the vital historical information on a business (several weeks, months or years of sales

figures, promotional expenditure, and so on) so that it can then make predictions based on the underlying statistical trends. Along the way it can also uncover the various inter-dependencies between all the figures (for example, it might notice that sales are dependent on the selling price) and provide some neat presentations of all this information. But to summarise its function as succinctly as possible: if you tell it what you sold last year, it will estimate what you will sell this year.

In this review, I shall provide a thorough examination of Second Sight, primarily from the viewpoint of an average numerate, but non-statistically-minded, spreadsheet user. Second Sight *can* be used as a stand-alone package, but I shall particularly emphasise its usage in conjunction with spreadsheeting, which would seem to be its main application area.

For those 'in the know', Second Sight uses a combination of the Box-Jenkins univariate ARIMA time-forecasting, with additional multi-variate analysis. For everyone else, this means that Second Sight's statistical methods are highly sophisticated and complex in the extreme and that, fortunately, it is not really necessary to know a great deal about them in order to use the product. A major feature of Second Sight is that it shields the user from all the internal complexity — but, as a gentle introduction for the benefit of the curious, a simplified summary of its internal operation is given in the box at the beginning of this article.

Design

Second Sight is supplied as a single manual and a PC disk. The manual is divided into tutorial and reference material, and the disk contains a number of example model files, in addition to the Second Sight program itself. The disk is not copy-protected, and once a working copy has been made, the system can be run immediately from DOS.

The review copy of Second Sight was one of a range of Second Sight products, all of which are available for the IBM PC, XT, AT and compatibles. (See the 'Price' section below.) The review copy was the £385 version, which can handle up to 20 multi-variate series simultaneously. (Being 'multi-variate' means that it can handle interactions and dependencies between the various series.) This version requires a PC with at least 512k of RAM.

The rationale behind the various Second Sight versions is that the higher the price, the bigger the problem that can be solved, and the bigger the hardware needed to use the product properly. Actually, the entire product range will run on the smallest and slowest of PCs, but no-one would have the patience to run the more sophisticated systems on a slow machine. Thus, the smaller versions are pitched at the Amstrad/cheap clone end of the market, the middling ones at XT users and the top of the range at the AT 'power' users.

Before getting started with Second Sight it is 'highly recommended' (in the manual) that the computer be fitted with a numeric co-processor chip. With a co-processor the statistical analysis part of the system will operate up to thirty times faster than its normal speed. Fortunately, installing a co-processor does not involve any major upheavals in the hardware (although it does involve a few upheavals in your wallet), so it is well worth doing.

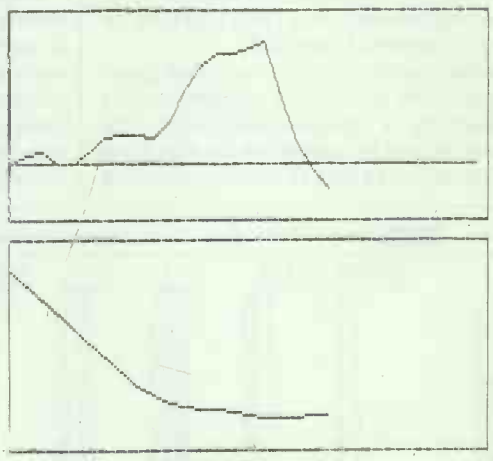
If your machine is not already fitted with a numeric co-processor, then Strategies can supply one along with Second Sight, for between £90 (the Intel 8087 running at 5MHz) and £300 (the Intel 80287 running at 10MHz). The numeric co-processor is just a single chip that needs to be carefully pushed into a vacant socket alongside the main processor — most PCs have this vacant socket. In my experience, it takes much longer to unscrew the computer cover than it does to insert the chip, but one of the benefits is that some other applications, particularly heavy numerical ones such as spreadsheeting, may enjoy greatly improved performance as a result.

Set-up

Once the co-processor is installed, and working copies of the disk have been made, Second Sight can be started up from the DOS command prompt by typing "2S". After the copyright screen the user is presented with a fairly sparse display — a menu bar across the top, some row numbers down the left-hand side, a prompt at the bottom, and the rest of the display is blank.

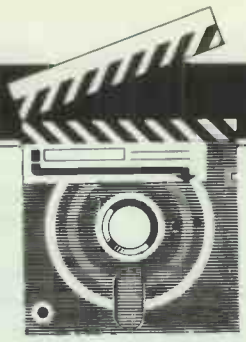
Entry Forecast Model Graph Disk Print Options Configure Quit

	Failures Percent	Size cufeet	Costs Pounds	Price Pounds	NumSold Units
1970	2.6	5.35	18692	18.69	974
1971	3.4	4.92	20325	20.53	956
1972	3.7	4.49	22272	22.72	943
1973	2.6	4.06	24631	25.37	945
1974	2.6	3.63	27548	28.65	936
1975	3.6	3.20	31250	32.81	916
1976	4.9	2.76	36232	38.41	894
1977	5.2	2.31	43290	46.32	883
1978	5.2	1.92	52083	56.25	874
1979	4.9	1.68	59524	64.88	868
1980	6.3	1.40	71429	78.57	846
1981	9.4	1.33	75188	83.46	807
1982	11.5	1.26	79365	88.89	778
1983	12.6	1.19	84034	94.96	759
1984	12.5	1.12	89286	101.79	752
1985	13.0	1.06	94340	108.49	740
1986	13.5	1.00	100000	116.00	727
1987					



Menu choice ? Options - define conf. intervals, time intervals etc.

This review works with a simple demonstration problem which exposes many of the issues with Second Sight. The problem is one of predicting the sales of a particular product. The product has been around since 1970, and there are annual figures available for its price, number of units sold, promotional costs, size and percentage of units returned for repair. All the historical data is given here. If you examine the data and the accompanying unlabelled graph, you can see that the product has been a total disaster, with total sales revenue generally outstripped by promotion costs, and very poor reliability in recent years. Moreover, there are not really enough figures available to make 'sensible predictions' — but it is only a demonstration!



SCREENTEST

To enter some data into the main display area the 'Enter' option in the menu must be selected. Immediately following Enter, an empty box, labelled 'Series-A', is displayed in the form of a column on the left-hand side of the screen. The cursor is stationed at the top of this column, ready for some numeric values to be keyed in down the column in a fairly obvious fashion. This is how a 'series' is entered into Second Sight.

Second Sight can operate on a number of series. Taking all the series together they amount to a table of numbers. Quite sensibly, bearing in mind that many of its users will be familiar with spreadsheets, Second Sight arranges interaction with this table in a spreadsheet fashion. Each column in Second Sight's 'spreadsheet' holds a single series, and the rows represent the different time periods being modelled. This is actually a reversal of the usual spreadsheet practice with columns being used for time periods, rather than rows. For Second Sight's purposes, this alternative arrangement makes more effective use of the PC's limited screen dimensions, since most applications will have relatively few series (that is, columns), but will stretch over a relatively large number of time periods (that is, rows).

In use

At the start of data entry, the user is limited to just one column but can, at any time, make a special keystroke to introduce a second column, and then a third, fourth, and so on. Depending on the version of Second Sight in use, the number of columns permitted is limited to between one (yes, just one for the £50 version) and 100.

When several columns have been created, the interaction becomes very similar to a spreadsheet, with the screen acting as a window on six of the columns/series and 18 of the rows/time periods. The arrow keys can be used to move the cursor up, down, left or right in the usual way. The 'home' and other 'Edit' keys also operate in a fashion with which spreadsheet users will be familiar. Any attempt to move the cursor into a row or column off-screen results in a rapid scrolling action to accommodate the destination point. In true spreadsheet fashion, values can be altered by moving the cursor to the right place and retyping them. Thus, anyone who has previously worked with a spreadsheet should find the system particularly easy to learn.

Although there are similarities, it is important to emphasise that there are a number of differences between Second Sight and a *pure* spreadsheet. In particular, it has a more specialised area of application and cannot be used in place of a spreadsheet. Most obviously, it is not possible to enter any formulae into Second Sight, so this rules it out for performing any of the generalised calculation applications performed by spreadsheets. In fact, only numbers can be entered in the main body of the spreadsheet, and no text is allowed either. It is, however, possible to arrange textual labelling for the rows and columns.

Second Sight has fairly rigid requirements for the organisation of the data in each series. Although all the series can be of different lengths, they must all start at the same time, and it is not possible to leave gaps in them. This can be irritating if one or two figures have gone missing — not an altogether unlikely event. If any figures are absent, then the best that can be done is to 'invent' values by, for example, using linear interpolation. (If the series goes 4, 6, ?, ?, 12, then the invented figures would be 8 and 10). This, of course, must be done manually — with its massive statistical skills it is a pity that Second Sight has not been designed to perform this time-consuming chore automatically.

It is useful to be able to label the various series with more meaningful text than 'Series-A', 'Series-B', and so on, and to be able to identify the time periods by real dates rather than just sequence numbers. Second Sight enables arbitrary labels and unit names to be specified for each series. The units (for example, 'Pounds', 'Percentages') for each series are just maintained for display purposes, and Second Sight does not use them in its computations. The time periods can involve both 'seasons' (for example, months) and 'periods' (for example, years). Second Sight's computations do take account of seasonal effects, so it should be quite possible to use it in ice cream and christmas cracker companies, for example. Once the series names and time periods have been specified, the display should look like that shown in the figure on page 191, and the data is ready to be 'modelled'.

Before getting any predictions out of Second Sight, it is first necessary to exit 'Entry' and then select the 'Model' option. This causes Second Sight to build a 'model' of the data so that it can make its forecasts. Three types of modelling are provided: simple, intermediate and complex. The simple modelling is achieved the fastest, but it *is* less sophisticated than the other options and its predictions may be questionable. The complex modelling is, of course, the slowest, but it is more reliable.

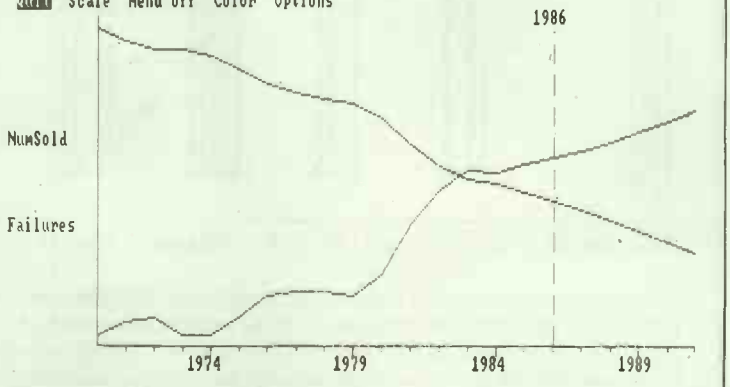
The time taken to complete the modelling depends on a number of factors

Entry Forecast Model Graph Disk Print Options Configure Quit

	Failures Percent	Size cufeet	Costs Pounds	Price Pounds	NumSold Units
1973	2.6	4.06	24631	25.37	945
1974	2.6	3.63	27548	28.65	936
1975	3.6	3.20	31250	32.81	916
1976	4.9	2.76	36232	38.41	894
1977	5.2	2.31	43290	46.32	883
1978	5.2	1.92	52083	56.25	874
1979	4.9	1.68	59524	64.88	868
1980	6.3	1.40	71429	78.57	846
1981	9.4	1.33	75188	83.46	807
1982	11.5	1.26	79365	88.89	778
1983	12.6	1.19	84034	94.96	759
1984	12.5	1.12	89286	101.79	752
1985	13.0	1.06	94340	108.49	740
1986	13.5	1.00	100000	116.00	727
1987	13.8	0.98	105432	123.01	715
1988	14.5	0.98	110566	129.73	700
1989	15.1	1.02	115615	136.25	685
1990	15.7	1.07	120639	142.66	670

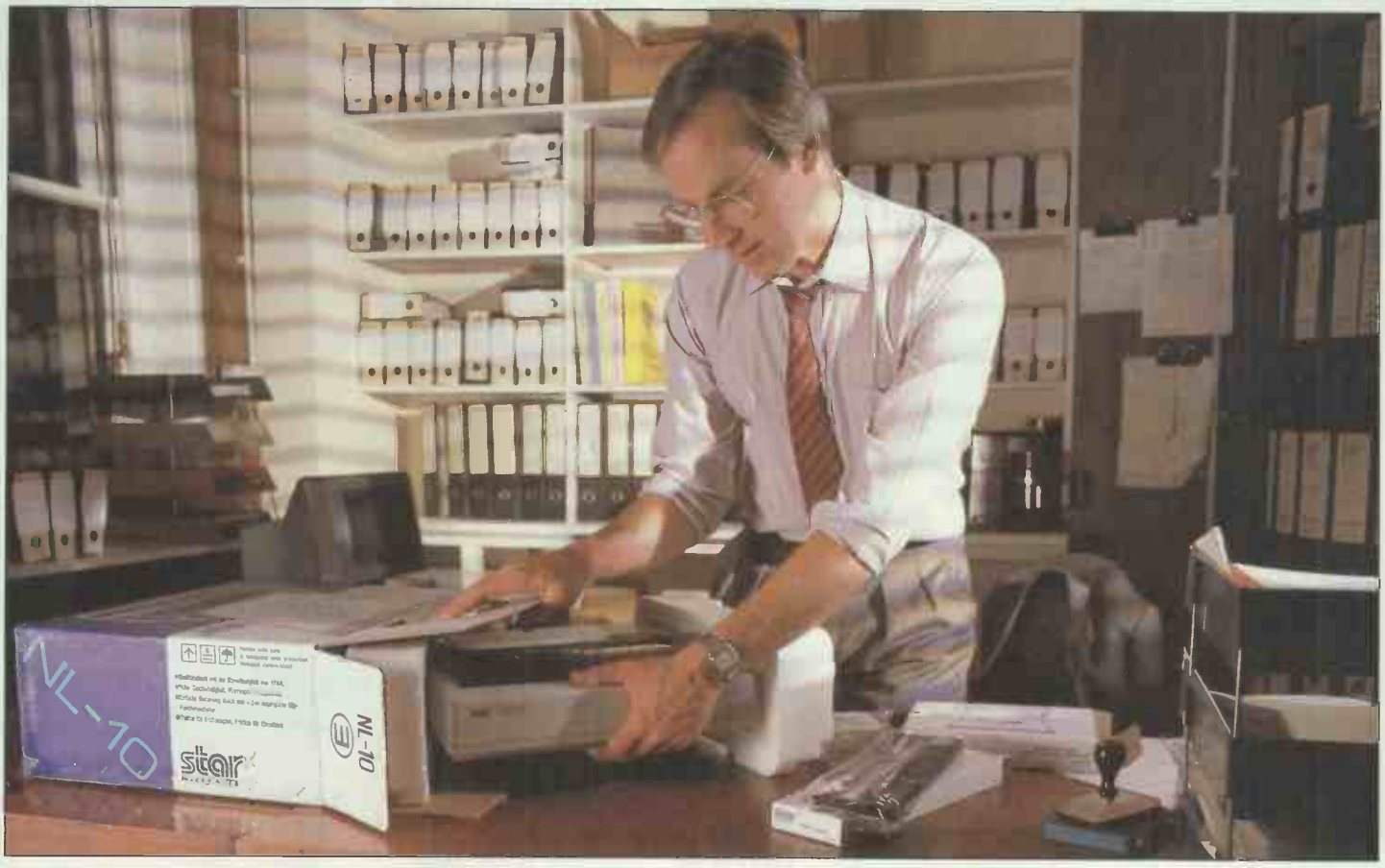
Menu choice ? Forecast
More data would allow a more sophisticated forecast

Quit Scale Menu off Color Options



Menu choice ? Quit - return to main menu

Using 'Forecast' we can look four years ahead at our product, and see its abysmal performance in graph form



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JUKI 6200 30CPS	425
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NEC PINWRITER P7	465
NEC 3550 35CPS	545
OLIVETTI DM290 160CPS/NLQ	375
OLIVETTI DY450 45CPS	755
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— the amount of data, the computer's processor speed, the complexity of the model required, the presence/absence of a numeric co-processor, and the particular 'shape' of the data presented. For the 'beginner's' problems modelling is unlikely to take more than a minute, provided a co-processor is present. Also, once completed, the model can be preserved along with the data, and it should not normally be necessary to repeat the modelling; that is, unless the historical data is changed for any reason.

While performing the modelling, Second Sight gives a commentary on its progress, as each series is modelled. Once the modelling is finished, Second Sight is then ready to make predictions.

Selecting 'Forecast' from the main menu drops the cursor back into the main display — as if in Entry mode. The user can then roam freely around the work area, but every time the cursor is moved into a new row at the end of the data, Second Sight fills it with its 'predicted' values. It is possible to move several years or even centuries into the future in this fashion, but obviously some common sense should prevail before acting on any of its long-term predictions. The figure on page 192 shows some predictions four years ahead. Although this prediction is too far off to be meaningful, it is more interesting than looking at a single year.

Planning a prediction

It is actually quite easy to simply throw data into Second Sight, and to get it 'predicting'. Although this can be quite amusing, for serious use it is worthwhile to do some planning and research before setting the system to work.

The first essential is that Second Sight needs good, accurate, historical information to work on. Suppose it is going to be used to predict the sales of a single product. Clearly a comprehensive sales record for that product will be needed — this will constitute one 'series' to be entered into Second Sight.

Given a product's sales record, it is then necessary to consider what factors affected sales in the past, presuming that these same factors will continue to affect it in the future. Possible factors might be: promotional expenditure, product price, competitors' pricing, sales staff training, and even general economic factors such as the inflation rate and the level of unemployment.

Obviously it is never going to be possible to take all factors into account, and some factors are a lot more difficult to quantify. For example, expenditure on advertising should be easy to handle, but fashion influences would not be. (But even in this case some ingenuity with reference to some previous fashion products' performances may be possible.) Each factor that *is* quantifiable, and for which figures exist, will constitute another series for Second Sight to handle.

Second Sight can be made to operate in *any* time units, but years, quarters, months or weeks would normally be logical choices. Whatever time units are used, there must be available a full quota of historical data for each series for all the time periods. If working in yearly time units, there must be at least 13 years of historical data. For shorter time periods, the data must go back at least three years — in general, there would need to be more than 13 values in each series — for example, there would need to be 36 values in each series for monthly time periods. All these limits are just the minimum acceptable, and in practice it would be preferable to assemble more figures — the manual recommends 30 to 50 figures per series for optimum performance.

It is not possible to mix series with different time periods, or for series to start at different times, so there may need to be some care and research undertaken just to assemble the necessary data for Second Sight.

Having got all the relevant data assembled, it can be quite readily entered into Second Sight, processed into a 'model' and then used to make a forecast. Forecasts can go as far into the future as needed and, unless instructed otherwise, Second Sight will predict for all the series. Normally you do not actually want this to happen. Thus, there is a facility to specify planned values for some of the series, such as the selling price and promotional expenditure, and then do 'what-if' type clauses with the model, in the time-honoured spreadsheet fashion.

The main menu in Second Sight, displayed as a bar at the top of the screen, has nine options, although so far I have only covered three of them: 'Enter', 'Forecast' and 'Model'. Five of the six other options conceal a variety of sophisticated extra facilities. (The sixth option is 'Quit'.) Menu selections can be made in a fashion which has now become standard with most high-quality software — by moving the highlighting for the current option with the arrow keys, or by pressing the initial letter of the option required. For most options there is a pull-down menu of sub-options, and sometimes further sub-menus, and so on.

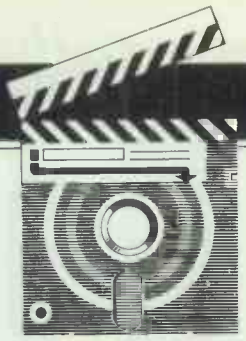
One of the main menu options in Second Sight is 'Graph'. Many spreadsheet users will already be familiar with graphing facilities, so this is a welcome feature. Graphs are useful, not just because they produce impressive pictures, but because they enable the user to appreciate Second Sight's predictive capabilities visually. The Second Sight graphs are XY plots of both the *entered* and the *predicted* data. The point at which the prediction starts is clearly marked and it is possible to see the smooth continuation of a curve as it heads off into the future.

Second Sight does not offer the usual bar-graphs and pie-charts, which in any case would be less useful in this context, but it *does* provide a great deal of flexibility for the XY plots: for example, it is possible to graph in colour, annotate the axes, override its own choice of scale and plot several series simultaneously.

Second Sight can access data in files in a number of ways. Firstly, it has its own internal file structures which contain not only the raw historical data, but also the model developed from it. As the modelling process can be fairly slow, it is clearly useful to be able to save the model on disk to avoid any need to recalculate it.

In Second Sight it is possible to manipulate individual series within files. This can be especially useful where a number of models are being developed, all of which share a common pool of information. This could happen, for example, if a range of products were being modelled independently, but they all shared common information about the company.

The vast majority of Second Sight users will want to use it in conjunction with a spreadsheet. Some of the historical data may already be in a spreadsheet work-file and the results of using the system will undoubtedly be needed as input to a spreadsheet. Accordingly, Second Sight provides the facility to both import and export spreadsheet data, via the Lotus 1-2-3 PRN format files. 1-2-3's PRN files are a straightforward disk file version of a



SCREENTEST

1-2-3 paper printout, so Second Sight should also be able to work with any other spreadsheets that have this type of facility. In particular, this same file layout also works (both ways) with dBase. The dBase link will probably be less useful in practice, but it is there for anyone who needs it.

The 'Options' option on the main menu conceals a miscellany of facilities, half of which are concerned with formatting the data and labelling the series, and so on; while the other half offers some really interesting possibilities. These extra facilities include 'Seek' and 'Diagram'.

The Seek sub-option is a goal-seeking function which enables future plans to be embedded in the forecast. For example, you may plan (hope!) to keep promotional costs down to a certain level over a future period. With Seek you can specify this information, and the system will re-forecast, taking your plans into account. The forecast shown in the figure below is based on the same model and historical data as that on page 191, but Seek has specified that failure returns must be brought down to an average of only four per cent over the next four years.

After it has completed its modelling, Second Sight can provide a diagram of the relationships between the various series (see the diagram in the box 'How Second Sight works').

User image

Second Sight is a truly exciting product which should fulfil a heartfelt need from many financial planners. At the time of writing a 'pre-release' version is available. This is being fairly extensively advertised, with the promise of an 'upgrade' when the full release arrives.

The review copy of the software was, of course, the pre-release version, and having spent more than a few hours using it, I can report that it has a few teething problems which should discourage anyone from making serious use of it. In the event that the full release is delayed (although it is scheduled to appear shortly), I would strongly urge any anxious financial planner to curb his impatience and wait.

'. . . a formal method of extrapolating from the past into the future . . .'

Probably the most serious bug is, during modelling, a tendency to crash back to DOS with an obscure diagnostic message. This can be particularly frustrating as it can occur after a lengthy wait for the modelling process to be completed.

None of the other problems caused a crash, and were more of a nuisance value than anything else. For example, you cannot exit from Enter mode when the cursor is positioned over a series title; moving the cursor left or right in Forecast mode sometimes results in an upward jump as well; giving two series the same name causes problems when the data is saved; when setting up time periods the prompts for 'seasons' and 'periods' are transposed — to name just a few irritations.

All the above problems are fairly typical of a software product in the very final stages of development. When they have been sorted out, then Second Sight should prove to be a winner.

Price

Versions of Second Sight range from £50 for the one univariate series; £95 for the 20 univariate series; £385 for the 20 multi-variate series; £465 for the 40 multi-variate series; to £555 for the 100 multi-variate series.

Conclusion

Second Sight should appeal to anyone engaged in financial planning. It is an excellent supplement to a spreadsheet system, as it helps with the sort of activities that spreadsheets are bad at. Not only that, it can interface to Lotus 1-2-3, and do some fairly sophisticated graph-plotting in its own right.

The product is *not* a panacea, and cannot always unerringly predict what will happen (would we be able to buy it if it could?). The reliability of its predictions depends upon the sophistication of its statistical manipulations, the relevance and completeness of the historical data, and the assumed continuity of all the multitude of factors which have *not* been entered as series into the system. For example, it would be thoroughly unreasonable to give it only three years of data, omitting critical factors, and then expect some sensible prediction for the next 10 years.

Of course, Second Sight cannot account for major future events, such as the launch of a rival product, an industrial dispute, or a general election, for example. What Second Sight does offer is a *formal* method of extrapolating from the past into the future, with far greater accuracy than the informal 'last year's figures plus 10 per cent' approach. The user can then use his own judgement about possible future events to modify its predictions, if he so wishes. Thus, although it would be unreasonable to claim that Second Sight will always be right, there is every probability that intelligent use of the product will achieve satisfactory results.

Strategies is on (082347) 5100. END

Entry **Forecast** Model Graph Disk Print Options Configure Quit

	Failures Percent	Size cufeet	Costs Pounds	Price Pounds	NumSold Units
1973	2.6	4.06	24631	25.37	945
1974	2.6	3.63	27548	28.65	936
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1976	4.9	2.76	36232	38.41	894
1977	5.2	2.31	43290	46.32	883
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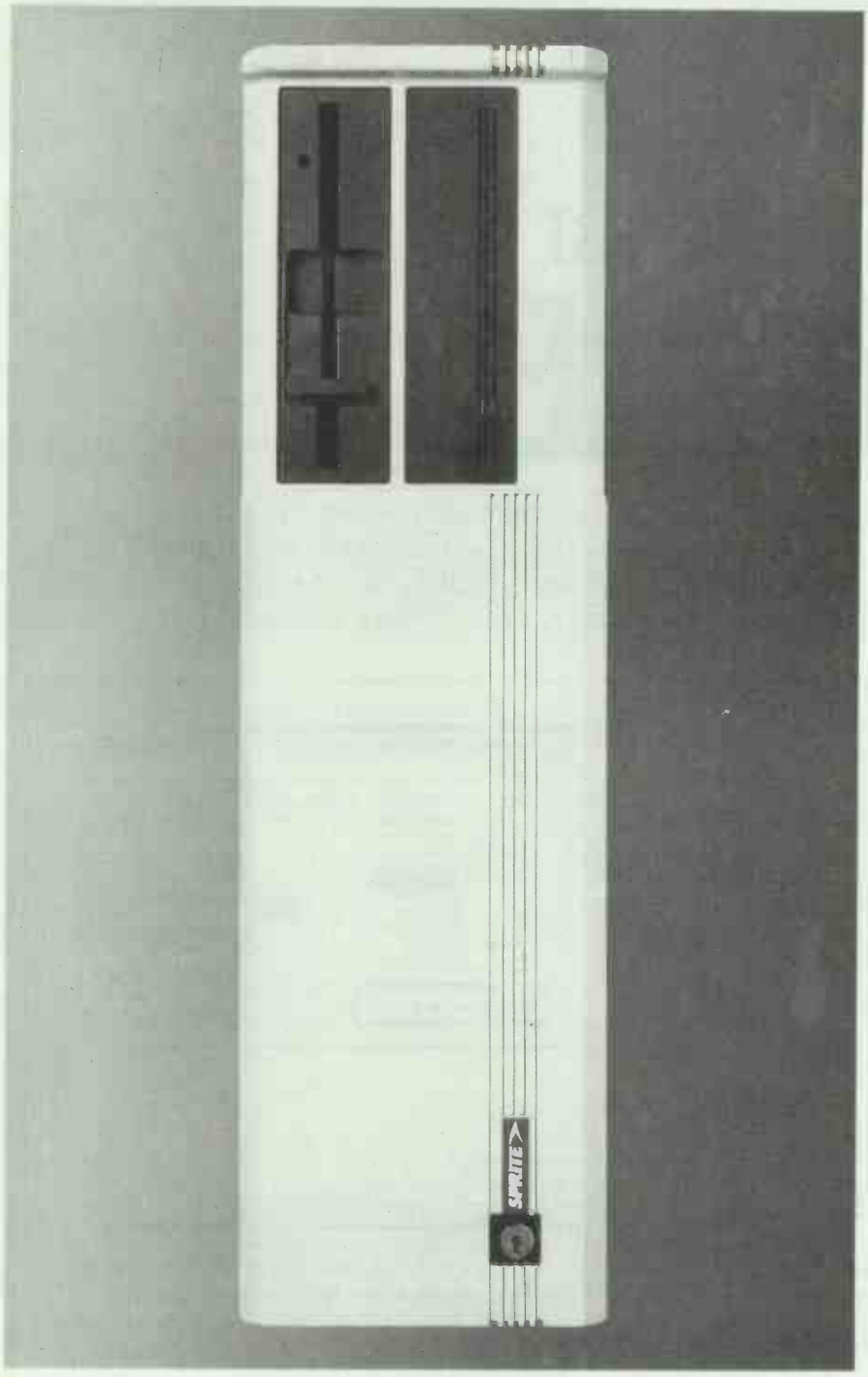
1988	4.7	0.98	110566	129.73	797
1989	2.2	1.02	115615	136.25	813
1990	0.3	1.07	120639	142.66	823

Menu choice ? Forecast
More data would allow a more sophisticated forecast

Goal-seeking using the 'Seek' option enables future plans to be embedded in the forecast. In the model here we have specified that the failure returns of our product must be brought down to around four per cent over the next four years



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COMPUTING AHEAD OF ITS TIME

SCREENTEST

MORE

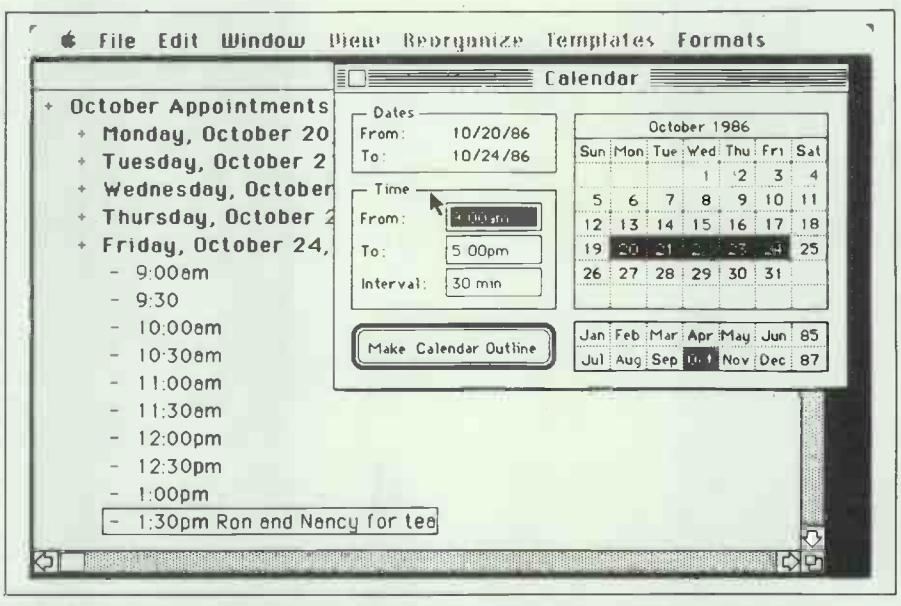
There are really only a few products that significantly affect the way we work. Living VideoText's ThinkTank was one such product, and it has defined its own niche as an 'ideas processor'. MORE, for the Apple Macintosh, takes this concept one step further. Mick O'Neill checks it out.

As an innovative young company grows successful and large, the amount of time and energy it spends listening to and responding to critics often seems to grow proportionally small. Success in itself sometimes breeds conservatism as the company copes with expansion by hiring professional 'Don't rock the boat' style managers. In the computer software industry, this short-sighted strategy has caused the demise of several promising firms.

The alternative approach is exemplified by Living Videotext Inc which seems to view its product line as something almost *organic*. The company looks at criticism as a form of feedback and where possible modifies its software accordingly. With the release of MORE for the Apple Macintosh, Living Videotext has comprehensively responded to every major shortcoming of the 'ThinkTank' series and has taken the product into previously unchartered directions.

ThinkTank, described as an 'ideas processor', cut its own innovative niche in the software world in the manner of MacPaint with graphics, PageMaker with desktop publishing or Business FileVision with pictorial-orientated data processing. ThinkTank took the tedious and underused process of outlining, and turned it into a simple, convenient and powerful tool for anyone who could benefit from organisation. MORE is a superset of ThinkTank.

For a proper analysis, the program has to be viewed as an 'ideas processor', a desktop publishing aid and a productivity tool. Although these three categories appear to be somewhat ambiguous and overlapping, they do add some perspective to MORE's many features.



MORE can help you utilise your time efficiently. For example, any part of the 'Calendar' can be highlighted to generate an appointment outline

The ideas processor

An 'ideas processor' is a program that allows the user to create an outline with headlines and sub-headings several layers deep, attach documents or graphs to any layer, and reorder the structure at will. ThinkTank, the first ideas processor on a microcomputer, is a powerful tool used by managers throughout the information industry.

Virtually everything you can do with ThinkTank, you can do with MORE. The company even includes an option to alter the default settings in MORE to exactly emulate ThinkTank commands and cursor movements. Documents created in ThinkTank can be imported effortlessly by MORE, and holding down a key combination will allow a ThinkTank document to be opened by MORE directly from the 'Finder'.

A major improvement introduced by MORE relates to repetitious outlining. For example, every software review I write includes a 'Details' section with the name of the product, the company name, the street address, city, the cost of the product, and so on. Because ThinkTank is unable to handle multiple documents, I have to open an old review, copy the sub-section outline, close it, open a new document, paste in the structure, and then delete any extraneous information. With MORE, there are several ways to handle this problem.

Because MORE can handle up to six open documents simultaneously (though only one is *selected* at any time), it's easy to open a few 're-

source' outlines that contain parts to be incorporated into your new document. The program includes an easy-to-view 'tiling' system whereby open documents are arranged in convenient patterns and, thus, choosing an outline and cutting and pasting is almost instantaneous.

MORE, however, contains a powerful feature that makes simple cutting and pasting even seem tedious. It's possible to install repeatedly used outlines in the 'Templates' menu. These can then be called up and inserted in the current outline. After spending several hours fine-tuning a monthly report structure, the capability of accessing it from a pull-down menu is simply delightful.

Other new outlining features include the ability to 'hoist' part of an outline to focus on one section; 'cloning', to cross-reference ideas, marking and gathering headlines for special treatment; emphasising headlines with font or format instructions; colour printing with the ImageWriter II; employment of a search and replace function with extensive wild cards; and a full range of print options for producing professional-quality reports,

Desktop publishing

MORE has the ability to translate any outline and/or sub-outlines into sophisticated tree charts of the line/block variety, or presentation-style 'bullet charts' for transparencies and onscreen slide shows. These options include comprehensive and almost intuitive formatting, and break new ground in the desktop publishing area. If you are not completely pleased with the results from MORE, the program includes the option to export your charts to MacDraw for further modification.

One of the major criticisms of ThinkTank is the difficulty in moving formatted data from a ThinkTank outline into a word processor. It is a simple matter to cut and paste between programs, but the resulting text includes extraneous characters devoid of all formatting.

MORE eliminates this problem completely. You can now transfer the data in MacWrite or Word format and have the option to include bullets, numbers, Roman numerals, and so on. For serious writers, this feature has greatly added to the utility of the outlining process.

Productivity features

Selecting 'Calendar' from the Edit menu presents the user with an onscreen calendar displaying the current month and year. The months and years can be toggled forward or backward, and any day or group of days can be highlighted to create appointment outlines on a daily basis. The user indicates the regular appointment intervals (half-hour, hour, and so on) and headlines are created for each.

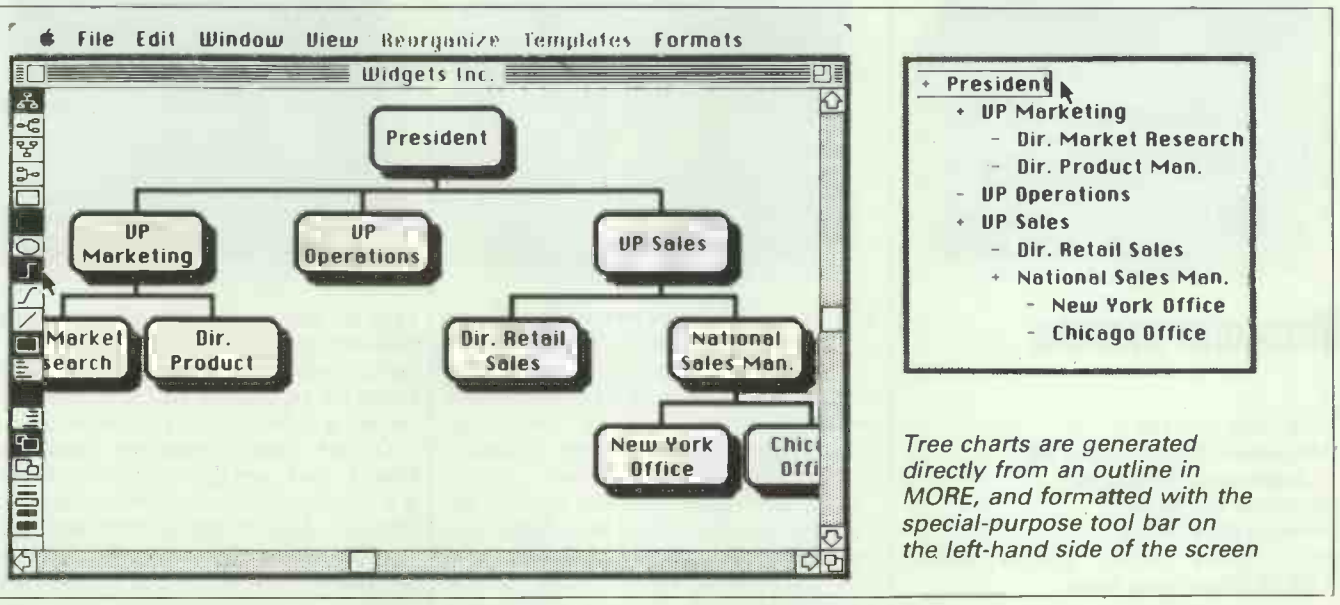
Time and date-stamping an outline could be important for timing phone calls, creating project charts with deadlines, or generally keeping track of outline alterations. This is one of those functions that might appear superfluous at first sight, but in practice proves quite useful.

The automatic phone dialling is for person to person rather than computer to computer and, so, I suspect, is of limited value except in those instances when a full address file is being queried and a number of calls are being made. However, not having made the communications plunge with the Mac as of yet, I'm probably not a good judge of this.

Documentation and support

Like most good Macintosh software, MORE can be used instinctively. Still, Living Videotext has included a first rate 200-page manual full of useful examples and pertinent screen-dumps, which is organised in a manner that itself suggests the power of ideas processing. The package includes a systems disk and a program disk with all of the necessary printer drivers (Imagewriter and Laser), the latest versions of the Finder and system, the program and several sample outlines.

And, you can breath a sigh of relief, MORE is unprotected and, therefore, can be easily installed on, and backed up from, a hard disk. After considerable use, I discovered no bugs, and I've decided that the best support any company can give me is to release a bug-free, unprotected program.



Tree charts are generated directly from an outline in MORE, and formatted with the special-purpose tool bar on the left-hand side of the screen

Price and supplier

More costs $295 (UK price £295), with a $50 rebate to registered owners of ThinkTank 128 or 512. It is available from Living VideoText Inc, 2432 Charleston Road, Mountain View, California 94043. Tel: (415) 964 6300 or toll-free (800) 443 4310.

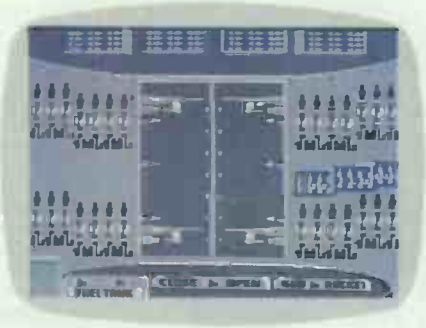
Conclusion

The inevitable question is, of course: 'Is this piece of software worth $295 (or $245 to ThinkTank owners)?'

I'm always amazed to read reviewers' attitudes concerning 'value'. I frankly admit that I can't answer this question for you. I've described what the program does; if it seems to meet your needs but you have doubts about the price, I suggest that you go to a dealer and take a first-hand look at it. No matter what your requirements, I suspect that you'll find MORE a remarkable package. Personally, I wouldn't settle for anything less!

MORE is available in the UK from MacSerious Software, 17 Park Circus Place, Glasgow G3 6AH, Scotland. Tel: (041) 332 5622. END

Stephen Applebaum shoots 'em up over the bomb-ravaged landscape of wartime Germany, deactivates — and detonates — bombs in buildings, and then relaxes with a little ten-pin bowling — and he's only reviewing this month's games!



Mosquito mission

Title: Ace of Aces
Computer: Commodore 64; Spectrum; Amstrad
Supplier: US Gold
Format: Disk; tape
Price: £9.99 (tape); £14.99 (disk); £8.99 (Spectrum tape)

In 1943, Luftwaffe chief Hermann Goering made the mistake of telling the German people: 'No British aircraft will ever bomb Berlin.' Today, history tells us that not only did British planes bomb the German capital, but that they did so as Goering made his arrogant pronouncement.

The humiliation suffered by Goering and his misguided votaries, as the dust from bombarded Saxon homes mockingly filled the air over Berlin, must have been tremendous; almost as great, even, as the elation of those who perpetrated that fantastic deed of boldness.

Ace of Aces, from US Gold, tries to capture some of the spirit of bombing raids like the one on Berlin, by putting you, the player, in the seat of a Mosquito fighter bomber.

As with nearly all the games of its genre, Ace of Aces represents the war according to Ealing Studios and Hollywood, and not that endured by countless millions of people. In other words, it glorifies that inglorious and sordid period of human history that should be remembered for the suffering it caused rather than for those who emerged as heroes; most of whom would never have been heard of had there not been a war.

Subject matter aside, Ace of Aces is an exciting mixture of strategy and mindless shoot 'em up which includes some of the best graphics seen on the Commodore 64.

The game opens to the stirring refrains of *Land of Hope and Glory*, the powerful anthem that provokes people into waving Union Jacks on the Last Night of the Proms. Somewhat tasteless, though, is the synthesised machine gun fire that rat-tat-tats over the music. As soon as that's finished, the game's first menu appears.

There are four missions in Ace of Aces which can be compounded into one epic enterprise or tackled separately. The missions are: to bomb a POW train, heading from Munich to Berlin; to destroy V1 launch sites near Paris; to sink German U-Boats; and to shoot down a squadron of JU-88 bombers.

On selecting a mission, bomber command furnishes you with an intelligence report containing information on the locations of the various targets and the directions you must take to reach them, plus the weather conditions over the German mainland.

After receiving the report and noting its orders, you move on to the weapons store. Bombs, rockets and shells are available here, but not all are necessary for every mission: what you choose depends on the target and its distance from your take-off point. The reason for this is two-fold: redundant weaponry adds weight, which in turn increases the rate at which fuel is used; and the heavier the load being carried over a long distance, the greater the likelihood of an engine catching fire. You must be judicious in your selection.

Orders read, weapons taken on board and pre-flight checks made, it's finally time to scramble, and for one of Ace of Aces' choicest moments. Notwithstanding its lack of animation, the scramble sequence is brilliant in its simplicity. A siren wails stridently, urging pilots to board their aircraft. Then there's the sound of running, followed by the whirr of propeller blades. During each phase a small picture appears, drawn as a photograph in an album, to show what's going on. Chaste as this sequence is, the mixture of realistic sound and static pictures works well, producing a moment that is quite enthralling.

That, then, is the take-off sequence — simple and unchallenging. When you're in the air, the display changes to a view of the Mosquito's flight controls which include a compass, a speedometer, an artificial horizon, an altimeter and a radar-like instrument. In front of the main panel is a joystick which simulates the movements you make as you fly the plane.

Pressing the 2, 3, 4 and 5 keys on the Commodore's keyboard changes the display to other parts of the aircraft, while 1 returns it to the original forward view. Keys 2 and 3 produce views of the left and right sides of the cockpit, and the rest of the Mosquito's instruments, respectively. Key 5 displays the bomb bay and the weapons that were selected earlier.

Photography by Chris Bell

As you soar up through the clouds, tiny black dots appear in the distance. These soon emerge as JU-88 fighters which, as they close, home in on you with their machine gun sights. Then, when the time is right, they let rip, showering you in lead. Going quickly to the bomb bay screen, you select either rockets or cannon, then return to the cockpit from where you reciprocate the JU-88's shells with a hail of your own. A flash of red indicates a direct hit. Much the same happens with V1s except that they can't fire back, being no more than flying bombs.

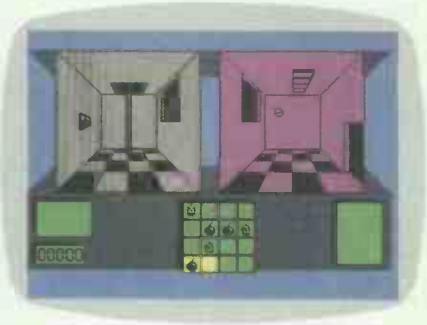
Using your bombs is rather different. When you near the POW train or a U-Boat, you open the bomb bay doors to reveal a view onto the ground below. Both the train and the submarines make difficult targets, though the former is the easier to hit since it is longer.

Sadly, I don't know what happens when you complete a mission because I didn't manage to avoid running out of fuel or crashing to the ground. In these cases you're presented with proof of the number of enemy vehicles destroyed, alongside which is the damage inflicted on your own aircraft.

Even without being able to complete a single operation, I still found playing Ace of Aces a wholly enjoyable experience. Flying games aren't normally something I go for but this one strikes just the right balance between a flight simulator and a no-nonsense shoot-out, giving inept pilots a chance, if not to win, then at least an opportunity to practise their pilot's skills and enjoy themselves.

The force of gravity

Title: Deactivators
Computer: Commodore 64/128
Supplier: Ariolasoft
Format: Disk; cassette
Price: £14.95 (disk); £9.95 (cassette)



Someone, somewhere, doesn't like the work being carried out at the Gravitational Research Institute (GRI) — time bombs have been found dispersed throughout the rooms of its five buildings. And, in addition, the robots which usually safeguard the security of the project have been reprogrammed, turning them against those who normally control them.

Such a state of affairs is intolerable, not to mention highly damaging to the project and the reputations of those involved in it. Deactivator droids must be mobilised immediately to locate and defuse the bombs — before it's too late.

There's just one problem . . . well, several problems, really. Due to the nature of the research being done at the Institute, some of the rooms are rather unusual in their design and could restrict the movements of each droid to only a small area within a particular building. Doors do not necessarily connect in the normal way, since in some rooms floors may be ceilings while in others ceilings may be walls.

Furthermore, each room has its own gravity generator. These are each set to one of four different strengths, depending on the orientation of the room. For safety each room has been colour-coded in accordance with its setting.

The layout problem can, to a certain degree, be overcome by the use of matter transmitters. Sadly not all of these are operational, due to a slight hiccough in staff/management relations. However, they can be reactivated by plugging a circuit board into the building's central computer. This is handy to know because it isn't only some of the matter transmitters that are out of order, but also the complete lighting system in building four and some electrically sealed windows.

As you are probably aware, the Deactivator droids are not automatic: someone — you — must control them manually.

Thankfully the security cameras in each room are still working, so you'll at least be able to keep a check on the position of the droids, as well as the now-hostile robots, which patrol the buildings.

When you look at your monitor you will see the transmitted pictures from two cameras located in adjacent rooms. Below these images is a small block diagram showing the building's layout, and the locations of the bombs and the Deactivator droids. You'll notice that the robots are missing — that's because at this stage, there's no pretty icon to represent them.

To the left of the map is a small box which shows whether any auxiliary droids happen to be on hand. For most of the game that box remains empty. And just to give you an idea of how near to detonation the bomb being carried by a particular droid is, a small picture of a bomb with its fuse fizzling appears on the left of your picture. Rather amusing, don't you think?

The aforementioned map can be replaced by a special control window, in which are four icons: a droid, a bomb, an arrow and another droid.

The first icon allows you to select a different droid to the one that you are controlling. Activating this function reproduces the map from where you can make operational any of the droids shown there.

The second icon provides the invaluable service of enabling you to control the angle at which a droid throws a bomb. Although this sounds rather dangerous, it's a manoeuvre which must be performed many times. But so what if it's dangerous? You're not the one who's going to be splattered over a room if the bomb goes off.

Bomb throwing is an art well worth cultivating since the successful clearance of a building depends, to a large extent, on cooperation between your three droids. Bombs, or even circuit boards, quite often have to be thrown through a window from one droid to another, as the route to the outside world might be inaccessible from the room that the droid originally carrying the object is in.

The arrow icon denotes a function that allows you to scan all the rooms in a building. This is your only method for seeing where the robots are, so it's well worth using. Due to yet another technical hitch, the scan mode is non-operational in building five; or, at least, it is until you replace a faulty circuit board that's lying in one of the rooms.

Finally, the second droid icon returns you to movement control of the currently activated droid.

Before I leave you to it, I think you should know a bit about the robots. Since their re-programming these once amiable thralls of the GRI have become psychotics, and can now kill with the merest touch of their metal claws — any Deactivator that comes into contact with one will have little chance of escape. Their one Achilles' heel is their inability to withstand more than a few falls in a short space of time. Remember this — it could mean the difference between success and failure.

Screenshots by Dimension Graphics

Your task is not an easy one. As you progress from one building to another, the number of bombs can only increase because each successive building is larger than the one before. For example, building one is a simple 4 x 4 matrix but some of the others are as big as 12 x 4.

Deactivators isn't simple — it wasn't designed to be. Although you will probably be able to remove most of the bombs from a building, it's always the last one or two that cause all the problems.

Good luck.

Rainy day games

Title: Indoor Games
Computer: Commodore 64/128
Supplier: Mindscape
Format: Disk
Price: N/A

Ten-pin bowling, darts and air hockey are hardly pastimes that spring to mind as sources of material for a successful computer simulation. Not that there's anything wrong with them. It's just that a game based on, say, darts, would not provide the other-world quality which makes you feel you're taking part in something outside of your normal, everyday sphere of experience; which, after all, is what computer games do achieve if they're designed properly.

Mindscape, however, has a knack of taking rather uninspiring subjects and turning them into exciting and challenging computer games.

Indoor Games, for instance, a title which should be available in the UK in the New Year, simulates all those 'sports' (for want of a better word) mentioned earlier. And in two of the cases, actually improves upon the real thing. (At least to my mind it does, but that could be because I'm not very good at bowling or darts.)

As is generally the case with Mindscape products, Indoor Games is of the highest quality in terms of graphics and gameplay. That said, I think the ten-pin bowling could have been made just a bit easier.

Ten-pin bowling, for those who don't know, is a game that requires a considerable degree of skill. This is surprising, considering that the idea is simply to propel a large ball down a wooden strip, or 'alley', in an attempt to topple 10 skittles, the so-called 'pins', at the other end.

Easy as that may sound, just getting the ball to stay in the alley can seem like an insurmountable task. Unskilled bowlers quite often find that however much effort they put into throwing the ball on a line with the centre pin, it still curves ungraciously, only to end up in one of the ruts running along either edge of the alley.

Failed bowlers will find little solace in Mindscape's version, because exactly the same thing happens there!

Indoor Games' ten-pin bowling consists of two screens. The first is a side view, showing the bowler going

through his paces; the other looks down the alley as the ball rolls into, or even off to one side of, the pins.

Bowling is quite simple — or, at least, the operation is. Using a joystick, you position the bowler to the left, right or centre of the alley. Then, by depressing the fire button, you move an arrow to indicate where you want the ball to roll initially. Letting go of the button sends the bowler on his way. When he is just about to let go of the ball, you press the fire button once again. It's imperative that you get the timing right, otherwise the bowler falls over, hits his leg with the ball or holds back on his swing.

Now the display changes and you can see just how successful, or otherwise, your throw has been. A face, supposedly representing that of your bowler, grimaces at the top of the screen, his expression reflecting the quality of the bowl.

The method of scoring in ten-pin bowling is something of an oddity. Normally, a player will have two turns at knocking over all the pins. Success on the first attempt is called a 'strike' and scores 10 points; getting a strike first time out prevents a player from having a second throw.

If, on the next go, another strike is hit, the two scores up until that point are left separate. Only when less than the full complement of pins are knocked down, are all the scores added together to make a running total. A game ends after nine rounds of two throws, plus a further round of three throws. The winner is the player with the highest aggregate score.

Compared to Indoor Games' ten-pin bowling, its darts is a mere bagatelle. Like the ten-pin bowling, the darts is made up of two screens. The first displays a close-up view of a dart board, below which is a dart which can be slid from left to right or vice versa. On either side of the board is a blackboard where players' scores are chalked up, and below this is a power meter and something which indicates the dart's angle of trajectory.

The second screen shows a large animated figure which represents the player. When the dart is thrown, it is shown flying towards the board in glorious 3D. Its point of impact is then displayed on the close-up view, just described, and is also in 3D. When you see a dart stuck in the board, it actually looks as if it's protruding out from the screen. (In fact, Indoor Games features some of the best pseudo three-dimensional graphics I've seen on the Commodore 64/128.)

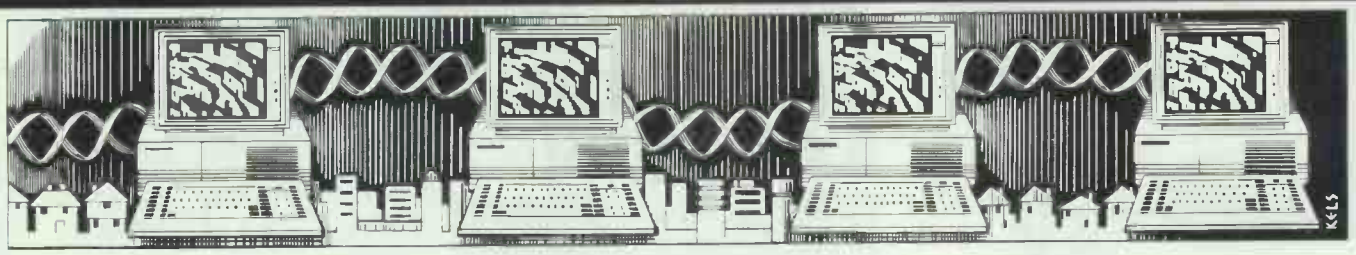
Air hockey, the third and final part of Indoor Games, is a simulation of something that was very popular in the arcades a few years ago. The original game used to be played on something like a large pool table except that instead of having beize on its surface, it had a smooth, plastic covering in which was drilled thousands of tiny holes. With the table came a thin, plastic disk and two ashtray-like objects with handles.

When money was put in the machine air would gush up through the holes, providing a cushion for the disk to ride on. The object of the game was to try and hit the disk, with your ashtray, into your opponent's goal at the other end of the table.

Mindscape's computerised air hockey recreates the original well. Even the sounds of the disk hitting the sides of the table and the air whooshing up through the holes compare favourably with the real thing.

Indoor Games contains all the trademarks of quality we've come to expect from Mindscape. It might not be wholly original, but Indoor Games will certainly put pale pretenders like Pub Games in the shade. END

Screenshots by Dimension Graphics



Hey, presto!

Whether you want information on tomorrow's weather, train timetables or the state of your stocks and shares, Prestel has something to suit — and it's now very easy to find your way round. Peter Tootill is your guide.

The long-awaited 'keyword search' facility on Prestel is due to have its public launch shortly. One of the biggest criticisms of Prestel is the difficulty of finding your way around the system; it can also be a problem to find your way back to a particular page or menu that you want to refer to. Keyword search and an associated facility called 'pagemarker' should make life a lot easier for Prestel users.

As most of you will know, Prestel information is contained in pages, each page having its own number. The quickest way to any page has been (and still is) to go directly to it by entering its number. This is fine for regular users of a particular service who get to know the page(s) they want to use. Even so, the numbers can be quite long and difficult to remember. For the casual and irregular user, finding the page containing the information you want can be a real headache. (If you have never used Prestel, I should tell you that the system is built around a series of menus, each with a number — approximately 10 — of choices. As a rule each choice leads to a submenu, and so on, until you come to the information you are looking for.)

Such a menu system is all very well until you realise that Prestel has a third of a million pages: trying to index these back to a single main index is no easy task. The problem is further compounded by the fact that there are often a number of organisations, called Information Providers (IPs), providing information on a particular topic. Each IP has its own block of pages and these blocks are not necessarily in the same part of the system, so that adjacent choices on a menu could lead to totally different page numbers. The final straw is that, for the most part, the IPs produce their own indexes, so it is very difficult to ensure consistency.

There is a subject index (starting on page 199), and a magazine containing a directory is published four times a year. In spite of all this, many people find it difficult to track down the things they are interested in. It can also be frustrating if, when looking for a particular item, you notice something you want to follow up later on an intermediate menu. Finding your way back can be very difficult. The hardened Prestel user has a pencil and paper at hand to jot down interesting page numbers so that he can refer to them in his own time.

Keywords

All this will now change. Keyword searching will allow you to type *subject# and you will find yourself at a menu page for the subject you have chosen — as long as it is one of the subjects contained in the subject index. I had a sneak preview of the system back in October and was very impressed.

The keyword search facility is a vast improvement, but it isn't perfect. You are limited to words in the subject index, so you can't find all the pages containing the word 'Amstrad', for example. Nor will it accept part of a word; you have to type it in full (and spell it correctly) for the procedure to work. Nevertheless, this facility is a great leap forward. It is much easier to remember *YORK# than *22063539#; or to find the British Rail pages by entering *TRAINS# or *BR# rather than having to search from the main menu.

Neither are you limited to one-word subjects. For example, if you were looking for somewhere to stay in France, you could specify:

*ACCOMMODATION FRANCE#

or

*SELF-CATERING ACCOMMODATION#.

You can also repeat the subject by entering */, which allows you to add words to your previous choice. In this way you could set the keyword to *SPAIN# and then search for *SPAIN AIR TRAVEL#, *SPAIN ACCOMMODATION# and *SPAIN CAR HIRE# without having to type Spain several times. There is a special keyword, *LAST#, which redisplays the last search string and allows you to edit it, and a *HELP# feature to explain how the system works.

Page marking

Pagemarker is another part of the new package on Prestel. This allows you to allocate a label to a particular page and then go back to that page by entering the label you used. For example, if you reach a menu page

Prestel statistics

Details	1986	1984	Change
Terminals attached to Prestel	67,000	43,000	+56%
Proportion in business	36,900 (63%)	27,000 (63%)	+36%
Proportion in homes	30,100 (45%)	24,000 (37%)	+40%
Frames available for access	291,600	321,000	−9%
Frame accesses per week	8.2 million	4.2 million	+95%
Messages sent per week	122,300	47,750	+156%

that you think you will want to return to, you type *SAVE FRED# (where 'FRED' can be any word of your choice). When you want to go back to that page, just enter *FETCH FRED# and you go straight there. You can mark up to five pages in this way, but the marks are lost when you log off the system. The command words can be abbreviated to their first letter.

BT hopes that these developments will make Prestel easier to use, leading to increased usage, which will in turn encourage more IPs to provide more and better information. This should make the system more interesting, so that more people will want to use it.

Services

One of the earliest successes on Prestel was with the travel industry. This is an obvious application of an online system — travel agents frequently need to contact holiday companies to check the current position regarding availability. They used to do it by phone; now they use Prestel. As with many of Prestel's specialised sections, there are areas for the general public and others only open to travel agents. The public areas cover, apart from general travel information provided by tour operators, such things as flight information, visa requirements and late availability holidays.

The area that has had the biggest impact on Prestel in terms of providing new subscribers is Micronet 800. This was launched in November 1983 and now has around 20,000 subscribers. Micronet 800 has recently combined with other microcomputer sections, such as Viewfax 258 and ClubSpot 810, into an area called Prestel Microcomputing. This contains news items, reviews, art galleries, pages you can edit yourself, information about computer clubs, a bulletin board, online games, and also gives callers the opportunity to put questions to celebrities.

The financial and insurance sector gets good coverage on Prestel. There is Prestel Citiservice, aimed at the finance industry, which contains information such as updates on stock market listings and commodity prices, and exchange and interest rates. You can even order shares online. Banking has also appeared on the system with the Bank of Scotland's Home and Office Banking service and the Nottingham Building Society. Using these you can pay bills, check your statement, write to your bank manager, check standing order details and more. British Telecom Insurance Services (BTIS) is designed to help insurance brokers by providing access to a wide range of financial information sources.

Other areas on Prestel cater for farmers, with weather information, news of crop problems, pest warnings and market prices. Educational establishments have their own section and, now, so do lawyers: a recent addition, BT Property and Law Services, is an amalgamation of the Lawtel service on Prestel and the Network for Law on Telecom Gold.

Most of these specialist sections are only available on payment of an additional subscription, which is why you may come across the 'Private page' message when you try to look at certain areas. (Details of the charges and contents of these sections can be obtained from Prestel.)

Another service, which is free, is the messaging section. This area has shown a dramatic growth since it was made available nationally in 1985. Any subscriber can send a short message to any other subscriber, free of charge. Telexes can also be sent and received, although there is a small charge for this service (around 50p). Nearly 17,500 messages are sent every day on Prestel!

Wide choice

There is something to suit everyone on Prestel. Apart from the specialist sections mentioned above, a lot of general information is also available. It's all there: train times, weather forecasts, traffic problems, sports news, film reviews, Government information (want to know the name of your MP? It's there), teleshopping services, small ads, gardening and much more besides. In the small start-up directory sent to all new subscribers there are around 1500 entries covering subjects from Activity holidays to Zimbabwe.

If you want to have a look round the system and already have access to a Prestel terminal or a micro that can behave like one, you can use the demonstration account number of 44444444 and password 4444. If you don't know the number to dial, directory enquiries should be able to help. If you don't have Prestel graphics, but have a modem and ordinary terminal software, then you can call (01) 680 8245 (300-baud only). Alternatively, if you have an account, you can use PSS — A23411002002018 is the address for Prestel without graphics (A23421920102517 for normal Prestel).

Prestel costs £6.50 per quarter for domestic users (£18 for business users). Subscribers to Micronet pay an extra £10 per quarter. Time charges are 6p per minute weekdays (8am–6pm) and Saturday mornings (8am–1pm), free at other times. You can contact Prestel on (01) 822 1122.

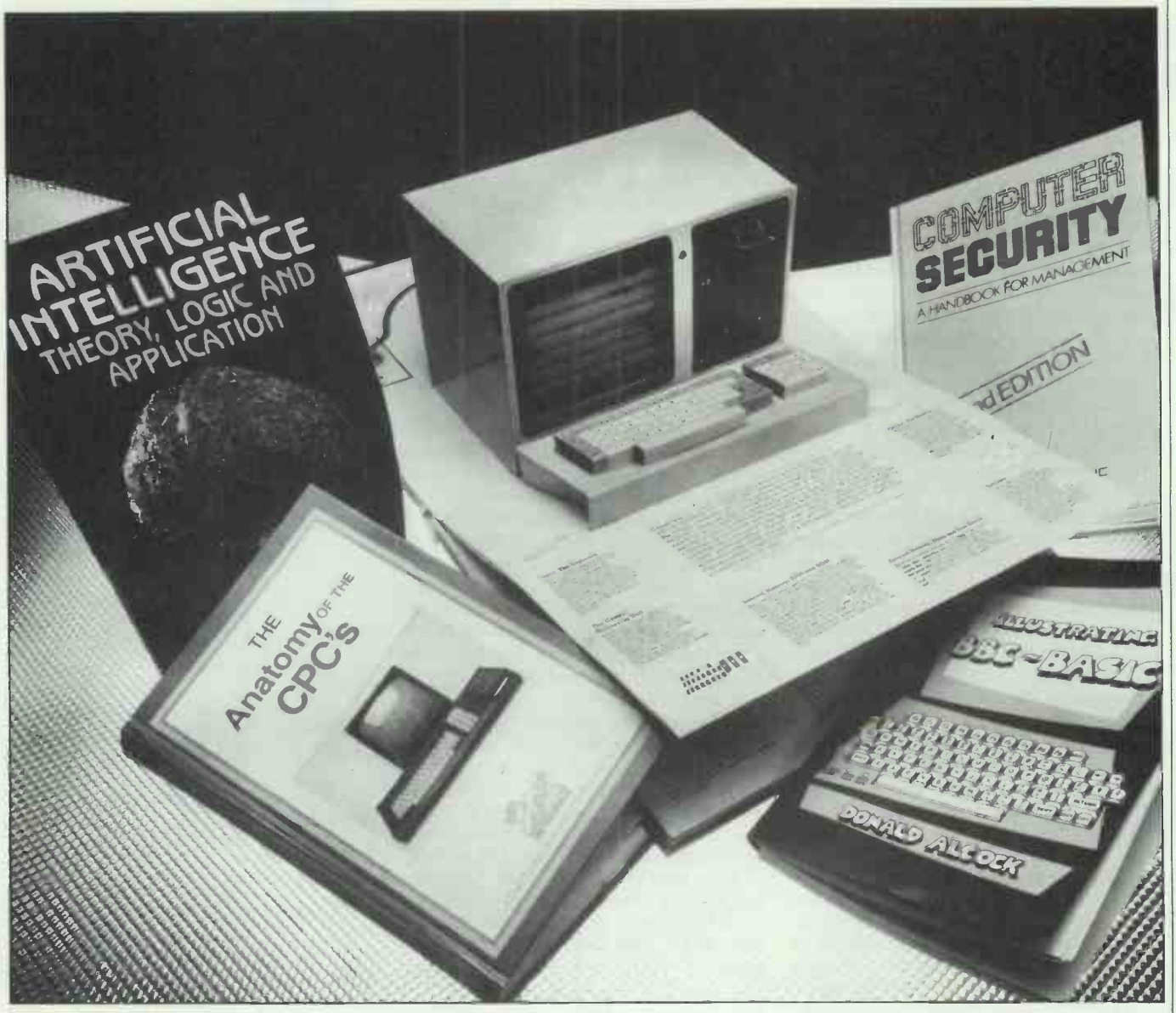
The revised list of UK bulletin boards (BBSs) has a new spot in 'End Zone'.

Useful Prestel commands and pages

***subject#**	Search for 'subject'.
***/**	Redisplay last keyword and add to it, if desired
***LAST#**	Redisplay last search string (can then be edited)
***HELP#**	Help with keyword searching
***SAVE FRED#**	Mark current page using label 'FRED'
***FETCH FRED#**	Retrieve marked page
***DELETE FRED#**	Delete page mark
***DELETE ALL#**	Delete all page marks
***0#**	Your personal main index (for example, Microcomputing, for Micronet subscribers)
***1#**	Prestel main index
***#**	Repeat last page (can be used up to three times — charged again if applicable)
**	Cancel (if you make a mistake)
***00**	Repeat current page (for example, in case of line noise — no charge)
***09**	Repeat current page, but with any updates (charged again if applicable)
***02**	Disconnect from gateway services
***90#**	Disconnect from Prestel
***123#**	Focus — Prestel's online news magazine
***170#**	What's new on Prestel
***199#**	Alphabetical subject index
***3#**	Local information
***333#**	Customer Guideline — information about Prestel
***33100#**	How to use Prestel
***33311#**	Prestel access telephone numbers
***5#**	Business information
***55#**	Teleshopping
***7#**	Mailbox — for sending messages
***77#**	Standard mailbox form
***8#**	Telex link
***9#**	Customer facilities
***90#**	Leave Prestel
***92#**	Check your bill (current computer only)
***930#**	Check for new messages to you
***931#**	See stored messages
Microcomputer related areas:	
***456#**	Prestel Microcomputing
***258#**	Viewfax 258
***800#**	Micronet 800
***810#**	ClubSpot 810

BIBLIOFILE

After all the Christmas festivities, why not feast your eyes on this month's reading matter which examines, among other things, your computer's 'lack of intelligence'. David Taylor talks you through.



Photography by Chris Bell

Bright sparks

Title: Artificial Intelligence Theory, Logic and Application
Author: James F Brule
Publisher: Tab Books (James Wiley & Sons Ltd)
Price: £11.45 (paperback)

The hot pursuit of Artificial Intelligence (AI) is getting hotter by the day. As more and more data-processing muscle is scrummed into less and less chip, and as the chips pack shoulder to shoulder into boards of unprecedented density, it starts to seem as if machines smarter than men will be with us any minute. *They won't.*

Crystal-ball gazers are beside themselves, but it's too easy to get carried away at the ooh-er thought of 'thinking' machines. I prefer the pinch of salt approach as yet. Maybe we do have expert systems already. We're assured that fifth generation superchip computers are just around the parallel-processing corner. Fine — but none of that is by any means a match for old-fashioned brains.

Nor do many people think it's ever likely to be until we've said goodbye to the electronic computer and hello in its place to the brave new dawn of photonics. The fact of the matter may well be that what can be done with electrons is beginning to approach a limit — and it's a limit that falls far short of making machines to outsmart men.

Maybe the manipulation of photons and computers which are based on light, not electricity, will one day change all that. If SDI ever works, laser technology could go all kinds of ways!

Perhaps, but meanwhile there's no stopping the optimists. Here Mr Brule (who, by the way, is an information management specialist for an American mental health institution) begins by giving us a potted history of the famous old Turing Machine, proposed in the 1950s by mathematician Alan Turing as a test to find, say, by the year 2000, a computer which could win a parlour game. He reminds us about Eliza, a 1960s prototype of expert systems which could make people believe it was knowledgeable in the field of psychiatry. Then he scoots to current expert systems which can *mimic* human advice (like MYCIN, the doctor on a disk) or the new 'decision support' applications, and is off into colourful phrases like 'probing the outer limits of business productivity.'

Up to a point, this book is fascinating stuff, just as expert systems are terrific fun to construct. You can try your hand at Knowledge Representation Schemes and play with Lisp and Prolog. You can tussle with 'fuzzy logic' or have a crack at algorithms to develop a simple AI program.

It's all good fun, but don't be fooled into believing that you and your expertly programmed micro are any cleverer than the information which some even cleverer person has fed in.

Really Brave New Artificial Worlds take a little time.

Do you take sugar?

Title: The Anatomy of the CPCs
Editor: Jim Walker
Publisher: Data Becker/ First Publishing
Price: £14.95

Human beings don't come very much smarter than the redoubtable Mr Sugar, the publicity-shy entrepreneur whose Alan M Sugar Trading Company, Amstrad for short, gives IBM sleepless nights.

He's only been going a couple of years, but already Amstrad has come up with a string of winners from the first CPCs to the cheap and cheerful PCW8256 word processors to the latest bargain basement IBM PC clone from Rumbelows and other fine business computer specialists!

This is a rum 'Data Becker' book by Bruckman-Englisch Gerits-Steigers which tells diehard enthusiast owners of a CPC464, CPC664 floppy-disk version or (introduced three months later) the CPC6128 all that they could conceivably want to know.

Data Becker men take it as read that you're not going to fool around zapping aliens or compiling your laundry lists, but are going to want to get your sleeves rolled up and have a good rummage with Locomotive Basic. More than likely you will want to know the pin assignments of the venerable Z80, or perhaps you'll warm to sentences like *'The Gate Array is of particular interest'* or *'The block header is easy to identify acoustically.'*

I dare say there are people who will sit up half the night with ears cocked for the distinctive whoop of a block header bursting into song, just as there are those who will busily thumb through the disassembler and jump between the interpreter, operating system and character generator, as listed here.

But I have to confess that I'm not one of them.

Mind how you gosub

Title: Computer Security: A Handbook for Management
Author: Leonard H Fine
Publisher: Heinemann
Price: £15

Published in association with the Irish Management Institute (wipe that smile off your face, please), Leonard H Fine's handbook for managers on how to keep snoopers out of their business systems is here in its second updated edition. In other words, it now has a bit about the Data Protection Act.

The no-nonsense approach to all manner of catastrophe and upset is still there, mind: from theft, fraud, sabotage or disruption, strikes, terrorism or bent personnel — you name it. Take floods, for instance. *'In many parts of the world,'* says Mr Fine, *'flood damage and risk is commonplace. The risk to computers is substantial ... obviously the best approach is not to site the computer in areas where flood risk is a reality.'*

Well, he's right, isn't he?

Then again: *'Installations in Europe and America have been physically attacked'* and *'The cleanliness of computer installations is important'* and *'Some organisations have introduced the practice of six-monthly or annual medical examinations for computer staff in high stress jobs. If adverse elements are detected, an individual's job may be temporarily restructured.'* So you can't be too careful.

It's cogent advice, it is, and it adds up to what the author calls his 'Total Security Concept' — a mix of policy, procedures and planning best managed by a special committee.

Useful, then, if too often awash with management jargon and led astray into wool-gathering around the blindingly obvious, not to mention euphemisms like *'an individual's job may be temporarily restructured.'*

Art and soul

Title: Illustrating BBC Basic
Author: Donald Alcock
Publisher: Cambridge University Press
Price: £6.95 (paperback)

Hats off to the lads of the Surrey Fire Brigade! Had they not turned up in the nick of time at Donald Alcock's smouldering home last summer, the hand-written draft of his book would have gone up in smoke.

So, in what I'd imagine is a publishing first, Donald's delightfully quirky BBC Basic handbook is dedicated to the brigade. It's *quirky* because the entire text is hand-written so that the author can illustrate as he goes along, embolden text, stick bits in little thought-bubbles, or point arrows all over the place — a combination which would drive any typesetter barmy, but which works very well on the busily exciting page.

It's a BBC Basic programming manual which starts from scratch, then considers every BBC Basic facility in turn, with examples. It's often jolly — as when sorting names into alphabetical order by bubble sort, monkey puzzle (or binary tree) and Quicksort recursion.

Certainly not the first programming primer for the BBC, but very well-done and highly recommended.

Hey-ho and up she rises!

Title: Inside the Personal Computer (A Pop-Up Guide)
Author: Sharon Gallagher
Publisher: Viking
Price: £7.95

This book hits you in the face with ingenuity. Open it and up pops a cardboard system unit, with cardboard keyboard, jokey screen and itsy-bitsy disk drive.

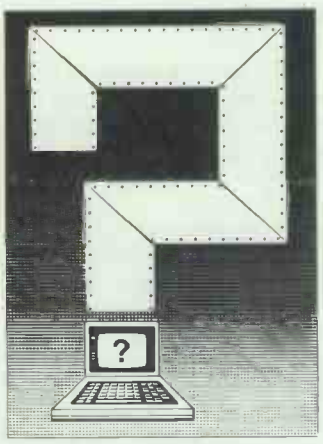
There are half a dozen more such spreads — each as if made from remaindered cereal boxes. There are slots to peer through and tabs to pull, all a lot more fun for kids than looking at the surrounding snippets of text.

The Mr Plod style of writing is the let-down. It tries hard to be simple and intelligible to young, enquiring minds but it ends up just being wooden: for example, *'Computers don't have the five senses through which people learn about the world.'*

Gosh. If your kids haven't spotted that for themselves, perhaps you should forget about pop-up books and have their eyes tested. END

COMPUTER ANSWERS

Simon Goodwin takes his toolkit to your problems. The address to write to is: Computer Answers, PCW, 32-34 Broadwick Street, London W1A 2HG.



Computer Answers is PCW's help column. We offer advice about all kinds of specific hardware and software problems through the pages of the magazine. We also welcome further information in response to published queries.

Final version

As a BBC Micro programmer I need to know the difference between versions of the Acorn BBC Micro operating system — for example, versions 0.1, 1.0 and 1.2. What is the difference between Basic 1 and Basic 2? How can I be sure that my programs will run on any version?
Kevin Murphy, Purley, Surrey

The BBC Micro was developed at great speed, and the first machines had an operating system which did not really live up to the computer's specification. The RS232 input routines were missing, tape-handling was unreliable and there was no support for disks or extra 'sideways' ROMs. Nonetheless, Acorn continued to issue version 0.1 of the operating system until late 1982, when it produced version 1.0, available as a plug-in upgrade for a few pounds. Version 1.0 fixed most of the early bugs and supported the disk system, although a rare version 0.9 was better in some respects.

Version 1.0 was a stop-gap product. The current standard is version 1.2, which is fitted in new and middle-aged machines. OS 1.2 supports the 'tube' — Acorn's interface for extra processors — fully, and improves disk handling. The operating systems are upwards-compatible, as long as you use the 'official entry points' to gain access to the ROM. Version 1.2 implements these entry points most fully, but for maximum compatibility you should obtain a copy of version 0.1 and use it to test your programs.

The first BBC Micro Basic was relatively free of bugs, and appeared in the first 100,000 machines. Acorn then produced Basic 2, which it still sells as an upgrade. This has improved file-handling and a useful new command — OSCLI — to pass parameters to the operating system.

In general, Basic 1 programs will run happily under Basic 2, but unfortunately Acorn has changed some of the 'tokens' used to encode the language, so weird results can arise if programs are SAVEd on one version and LOADed on another. You can avoid this by handling programs in a rather more verbose 'ASCII' form, using *SPOOL and *EXEC.

Acorn has produced two more versions of BBC Basic. Basic 3 was a trivial upgrade supplied with computers intended for the US market; it was also supplied with some 'second processor' expansion systems. These days Basic 4 is best — it has nice, new commands like ON . . . PROC for computed calls, improved editing and list formatting, and TIME$ to read the real-time clock. Basic 4 is the fastest yet from Acorn, especially for complicated number-crunching. It makes use of special instructions allowed by the CMOS processor in the 'Turbo' and 'Master series' computers, so it won't work on earlier machines.

Music for all ears!

I am looking for a program that will let me input music, either as coded notes or from a keyboard; transpose between keys; and print out the results in the form of conventional music staves. I realise that this may be a narrow field of interest, but any help at all would be appreciated.
Gordon Snow, New Marston, Oxford

There are several systems that will do what you ask. The best choice depends upon your musical background, your application and the capacity of your wallet!

The industry tends to treat this area as two linked markets. Publishers make separate 'performer' and 'composer' packages which can generally be paired as you wish.

Performer systems load and record musical notes from a musical keyboard or any instrument with a MIDI (Musical Instrument Digital Interface) port. Most modern synthesisers support MIDI; you can buy interfaces for older synths, guitars and even mouth-organs! A MIDI interface is built into the Atari ST and is available as an add-on for most other computers.

Once you've loaded the music — as you play or step by step — you need to be able to edit it, and this is where the 'composer' part of the system comes in. It works like a word processor, letting you edit music, move or transpose lines, copy sections and generally fiddle around. The results can be played back through the computer's sound chip or via the MIDI port to a synthesiser. Printouts are obtained, depending upon the package, from a plotter, laser printer or dot-matrix printer, in descending order of quality.

The top-flight packages run on Apple's stylish but costly Macintosh system. Performer and composer packages cost £725 in total, plus £185 for an adaptor to turn the Mac's telephone port into a MIDI interface. You'll also need a Mac Plus and an Apple printer. For further information contact the Mac Musos at Rod Argent's Keyboards, 20 Denmark Street, London WC2, tel: (01) 379 6690.

Syndromic Music, of 24 Avenue Mews, London N10, caters for Commodore 64, IBM PC and Atari ST users. The 64 was a popular tool among professional musicians last year; now, the pros use more expensive micros with extra memory and better graphics, but it is quite possible to get good results from a 64 plus £150 worth of add-ons.

If you can afford a bigger computer Syndromic, I would recommend the 'Easy Track' and 'Easy Score' packages for the ST. These programs cost £60 and £90 respectively, and produce a neat printout on an Epson or Star printer.

The best notation I have seen comes from a package that runs on the IBM PC or compatibles. Oxford University Press distributes a PC package that converts codes into written music, precisely drawn with a pen on a plotter. It is exciting to see this system in action, although musicians may not find it particularly user-friendly. Contact Syndromic Music on (01) 444 9126 for further details.

If you've already got a home computer, the company to talk to is Electromusic Research on (0702) 335747. EMR produces cheap MIDI interfaces and dot-matrix printout software for the Spectrum, Commodore 64, Acorn and Amstrad micros.

Archive editing

I have a Sinclair QL, and would like to know whether it is possible to enter data into Basic by editing a default value. The Archive database has this facility, but I don't want to learn a new application. The QL's INPUT statement requires you to re-type the entire entry — you can't 'pick up' and modify the old values.
D Valente, Clarkston, Glasgow

The facility you describe is not built into the QL's Superbasic, but extensions for the interpreter are widely available. Turbo Toolkit, from Digital Precision on (01) 527 5493 provides a stack of useful commands, including EDIT%, EDIT$ and EDITF.

These functions display any string on the screen and allow it to be edited like a Basic line. You set the maximum field length at will; the result is automatically checked to prevent 'error in expression' reports, and returned as an integer, string or number. Turbo Toolkit costs £24.95; the EDIT functions are only a small part of the package, which contains another 60 commands and over a hundred example programs. You can write to Digital Precision at 222 The Avenue, London E4 9SE.

Breakthrough Software on (0763) 45482 advertises similar functions called GETN and GETF, but these are only available as 'extras' when you purchase other items; as yet I haven't had the opportunity to test them.

Key numbers

Part of the keyboard on the Amstrad PCW8256 can be converted to a numeric pad by pressing ALT with RELAY. Unfortunately, this prevents the rest of the keyboard being fully used under CP/M — for example, the letter 'M' cannot be typed. Is it possible to switch the numeric keyboard on and off with a programmable command?
Alan Ratcliffe, Stocksfield, Northumberland

Amstrad doesn't know of any way to turn the pad on from a program, although a keen hacker ought to be able to work out a POKE to do it. The PCW8256 does all its keyboard scanning and decoding in software, so the system presumably keeps a record of the meaning of each key.

Apparently late versions of CP/M Plus support this feature, but Amstrad — understandably — says that the missing control is 'not a bug', so you're not entitled to a free upgrade. You can get the required effect by re-programming the keys with SETKEYS, although this is not as easy as using a software switch. Alternatively, it would not be too difficult to convert key codes as they are read into your program.

Too choosy

I am about to buy a new computer. I am attracted to the IBM PC, or one of its compatibles, but one point confuses me. The IBM family comprises the PC, XT and AT. It seems that these are not 100 per cent compatible, and this also applies to the various 'IBM clones'. Am I correct and, if so, what is the difference between the three models?
Richard J Fullford, Fallingbostel, West Germany

The original 1981 IBM PC had a very limited basic configuration, with no disks, little memory and Basic in ROM. Most people bought an expanded system, so IBM scrapped the original, simple PC hardware when it launched the XT, an expanded model equipped with a hard disk. Modern IBM PCs are just XTs without the hard disk card, so the PC and XT are almost totally compatible.

The PC and the XT both use 360k floppy disks and a simple processor called an 8088. This is a version of the Intel 8086, an early 16-bit microprocessor, which is adapted to use a slow but cheap 8-bit data bus. In other words, the XT's processor can only transmit and receive data one character at a time, albeit very quickly. Many clones, such as the Amstrad PC1512, use the full 16-bit 8086, which transmits 16 bits — two characters — at a time. Apart from this difference the 8088 and the 8086 are very similar — virtually the only difference is the speed of operation.

Another way of speeding up a computer is to change the 'clock speed' — the pulse that determines when the processor must perform the next step in a computation. The PC and XT use a clock speed of 4.77MHz, whereas the Amstrad and other 'clones' run at 8MHz — eight million pulses a second. It is *not* sensible to compare the clock speed of machines unless they have the same processor and type of memory, because the amount of work done in each step varies greatly between different processors.

Once you've exhausted the potential of the 8086, you must use a more powerful processor to get extra performance. Intel's 80186, 80286 and 80386 processors are successive attempts to remove bottlenecks in the crude 8086 design. Each version is faster and — inevitably — a little less compatible than the one before. Current system software does not make full use of the 'quirks' of these beefed-up chips.

IBM's PC AT uses the 80286 processor but complicates things by packing 80 concentric tracks onto each floppy disk, rather than 40 as on the PC. You can read and format 40-track disks on either machine (the AT can skip alternate tracks). Compatibility is still rather uncertain, and things can go wrong if you try to write data with a different type of system to that which formatted the disk.

There are several other things that can affect compatibility. For instance, a genuine IBM uses certain fixed codes to control the display and the serial port, and some of these are different on the Amstrad PC. That isn't important as long as you use the hardware and software supplied, but you can run into problems if you try to plug in a new graphics board (which can't turn off Amstrad's circuitry) or your new software tries to talk to IBM components directly. Well-behaved software will communicate via a built-in program called the BIOS (Basic Input Output System), which translates requests to allow for the quirks of a particular design. Some BIOS programs work better than others . . .

The only way to ensure the compatibility of a machine is to test it with your chosen software or hardware. If you're not sure what programs you're going to use, Lotus' Symphony and Microsoft's Flight Simulator are good generic tests — they both flog the hardware to death!

Feedback

Labels and the EP44 Several readers have come to the rescue of Leslie Fahidy, who was having trouble addressing envelopes with a Brother EP44 printer. John R Bradley swears by 'Butterfly perforated gummed address labels', which are available from most stationers. Martin Lipman's missive was neatly printed with a standard carbon ribbon on glossy paper labels. He warns that the print-head can be damaged if thick envelopes are stuffed into the EP44. Alan Chivers explains that the printer is not designed to put pressure on the paper, as it works by thermal transfer. He says that 'only the cheapest envelopes seem to be thin enough to give a satisfactory result'. Alan recommends WH Smith's brown envelopes, or the white ones supplied with cheap greeting cards.

Andromeda Zita Michael Parker has sent a telex to say that he used to work for the makers of this machine as software manager. He has a copy of the unreleased program to format disks, and can be contacted on (01) 351 2468, or One to One Email MBX MIKEP. Thanks also to Vic Dorman, who wrote in offering the formatted disks he was left with when his Zita Alfa 'died, aged 15 months.'

Silent 700 A Squires has written in offering manuals for CA Salter's Silent 700 printer. Unfortunately, Mr Salter, I've mislaid your address, for which I apologise. Please write again if you still need information.

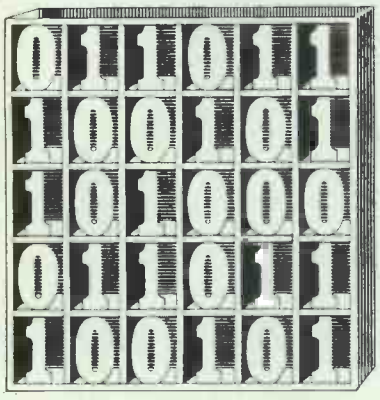
Dot-matrix stencils DG Bell has sent in a clearly printed newsletter, *The Eagle of the North,* to prove that duplicating stencils can be cut with a dot-matrix printer. David uses an NEC 8023 with unbranded stencils, although Gestetner recommends its 'Memory 4' range. The trick, apparently, is to leave an old, dry fabric ribbon in the machine while stencil-cutting.

Colour, chroma and chrominance Mr RA Ashworth has contacted me in writing and at the PCW Show, offering extra information about colour displays, discussed in September's *PCW*. Mr Ashworth works in the surface colour business and found the TV industry terms in my reply rather alien. After some research he has found that displays use *two* chrominance signals internally. These represent the difference in level between the luminance and two out of three of the primary RGB signals (it is easy to compute the third). This format makes it simple to drive a variety of display phosphors. Users can still work with red, green and blue intensities, as I stated in my answer — the conversion is handled by the display circuits.

Help needed Patrick Nevison needs information about the 24 switches inside a DLE-SB 2123D modem. Marshall P Brown has an Oberon Omnireader, but no documentation or software for his Apple 2 Plus. Sadly, Oberon has gone out of business. Please write to *PCW* if you can help.

Simon Goodwin can only reply to queries through the pages of PCW. *Please don't send him an* sae, *expecting an individual reply.* END

SUBSET



David Barrow presents more documented machine code routines and useful information for the assembly language programmer. If you have a good routine, an improvement or conversion of one already printed, or just a helpful programming hint, then send it in and share it with other programmers. Subroutines for any of the popular processors and computers are welcome but please include full documentation. All published code will be paid for. Send your contributions to SubSet, PCW, 32-34 Broadwick Street, London W1A 2HG.

6502 SHELLSORT

There is just one Datasheet this month, DIBS, a 6502 diminishing increment bubble-sort routine from Philip Honour of Bicester.

DIBS, like SHELLZ (May 1986), leaves the actual variable length strings unmoved and sorts the fixed length string descriptors, which, in this case, contain only the 2-byte addresses. This is not only quicker than moving long strings, but also allows non-adjacent records to be exchanged without any need to shuffle up intermediate records.

However, DIBS differs considerably from SHELLZ in the way that it uses the diminishing increment method first proposed by Donald Shell in 1959. In fact, DIBS does not use the method as intended by Shell and consequently suffers the penalty of greatly increased processing time. Philip says that the routine will sort 500 randomly generated strings on a BBC model B in about 21.5 seconds, and this is far slower than a good machine code sort should be. What has gone wrong?

Fig 1 shows the intermediate results and the number of comparisons and exchanges for each pass during a DIBS sort of 16 randomly arranged records. Fig 2 shows the corresponding results for a correctly implemented Shell bubble-sort. Obviously, DIBS is not doing enough work during the early part of the process when the increments are large, and too much at the end when the increment is reduced to one.

DIBS may be partially corrected by changing the two code sections after label NOEXCHNG to increment the pointers by two (to index the descriptor next in physical sequence) instead of by the value INCRMENT. The corresponding part of the program's structure is marked in the far right column of the documentation.

INCR	PASS	16 RECORDS	CMPS	SWAPS
		0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15		
15		GO BE IS AD RA DA PA EX KA FA CO HI JO LI ON NE		
7	1	EX BE IS AD RA DA PA GO KA FA CO HI JO LI ON NE	2	1
7	2	EX BE IS AD RA DA PA GO KA FA CO HI JO LI ON NE	2	0
3	1	AD BE IS EX RA DA FA GO KA JO CO HI NE LI ON PA	5	4
3	2	AD BE IS EX RA DA FA GO KA JO CO HI NE LI ON PA	5	0
1	1	AD BE EX IS DA FA GO KA JO CO HI NE LI ON PA RA	15	12
1	2	AD BE EX DA FA GO IS JO CO HI KA LI NE ON PA RA	15	7
1	3	AD BE DA EX FA GO IS CO HI JO KA LI NE ON PA RA	15	3
1	4	AD BE DA EX FA GO CO HI IS JO KA LI NE ON PA RA	15	2
1	5	AD BE DA EX FA CO GO HI IS JO KA LI NE ON PA RA	15	1
1	6	AD BE DA EX CO FA GO HI IS JO KA LI NE ON PA RA	15	1
1	7	AD BE DA CO EX FA GO HI IS JO KA LI NE ON PA RA	15	1
1	8	AD BE CO DA EX FA GO HI IS JO KA LI NE ON PA RA	15	1
1	9	AD BE CO DA EX FA GO HI IS JO KA LI NE ON PA RA	15	0
	13	TOTALS	149	33

Fig 1

INCR	PASS	16 RECORDS	CMPS	SWAPS
		0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15		
15		GO BE IS AD RA DA PA EX KA FA CO HI JO LI ON NE		
7	1	EX BE PA AD HI DA LI GO KA IS CO RA JO PA DN NE	9	4
7	2	EX BE FA AD HI DA LI GO KA IS CO RA JO PA ON NE	9	0
3	1	AD BE DA EX GO FA IS CO KA JO HI ON LI PA RA NE	13	7
3	2	AD BE DA EX CO PA IS GO KA JO HI ON LI PA RA NE	13	1
3	3	AD BE DA EX CO FA IS GO KA JO HI ON LI PA RA NE	13	0
1	1	AD BE DA CO EX FA GO IS JO HI KA LI ON PA NE RA	15	6
1	2	AD BE CO DA EX FA GO IS HI JO KA LI ON NE PA RA	15	3
1	3	AD BE CO DA EX FA GO HI IS JO KA LI NE ON PA RA	15	2
1	4	AD BE CO DA EX FA GO HI IS JO KA LI NE ON PA RA	15	0
	9	TOTALS	130	23

Fig 2

INCR	PASS	16 RECORDS	CMPS	SWAPS
		0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15		
1		GO BE IS AD RA DA PA EX KA FA CO HI JO LI ON NE*		
1	1	BE GO AD IS DA PA EX KA FA CO HI JO LI ON NE*RA	15	13
1	2	BE AD GO DA IS EX KA FA CO HI JO LI ON NE*PA RA	14	11
1	3	AD BE DA GO EX IS FA CO HI JO KA LI NE*ON PA RA	13	8
1	4	AD BE DA EX GO FA CO HI*IS JO KA LI NE ON PA RA	12	4
1	5	AD BE DA EX FA CO*GO HI IS JO KA LI NE ON PA RA	7	2
1	6	AD BE DA EX CO*FA GO HI IS JO KA LI NE ON PA RA	5	1
1	7	AD BE DA CO*EX FA GO HI IS JO KA LI NE ON PA RA	4	1
1	8	AD BE CO*DA EX FA GO HI IS JO KA LI NE ON PA RA	3	1
1	9	AD BE CO*DA EX FA GO HI IS JO KA LI NE ON PA RA	2	0
	9	TOTALS	75	41

Fig 3

The problem seems to be caused by a misunderstanding of the term *diminishing increment* which is not intended as the value by which each pointer is moved forward between comparisons, but as the *initial distance* set between the pointers before each pass. During each pass, both pointers should be incremented sequentially by one record at a time through the file.

Incidentally, the Shellsort's speed is not illustrated particularly well by a short sort — it is easily outperformed by even the humble bubble-sort. Fig 3 shows the results of sorting the sample file using a modified bubble-sort which limits the number of comparisons by setting an end marker (the asterisk on each line of Fig 3) before the last record exchanged on each pass.

DATASHEET 1

```
;
; CALL:         DIBS
;               Diminishing Increment Bubble Sort to sort an array of
;               descriptors of variable length strings into ascending
;               order of the strings' ASCII values.
;
; STRUCTURAL CONCEPTS
;DATA           STRING DESCRIPTOR ARRAY:
;                 Simple list of string start addresses.
;               STRING:
;                 Length:      1 to 256 bytes including terminator.
;                 Terminator: must be less than ASCII space (20hex).
;PROGRAM        increment = array-length - 1.
;               UNTIL increment = 1
;               {
;                 increment = increment \ 2.
```

```
;                   UNTIL swap-flag = FALSE
;                   {
;                     swap-flag = FALSE.
;                     pointer-1 = array-start.
;                     pointer-2 = array-start + increment.
;                     UNTIL pointer-2 > array-end
;                     {
;                       address-1 = [pointer-1].
;                       address-2 = [pointer-2].
;                       index = 0.
;                       WHILE [address-2 + index] = [address-1 + index]
;                         AND [address-2 + index] <> string-terminator
;                       {
;                         index = index + 1.
;                       }
;                       IF [address-2 + index] < [address-1 + index]
;                       {
;                         [pointer-1] = address-2.
;                         [pointer-2] = address-1.
;                         swap-flag = TRUE.
;                       }
;                       pointer-1 = pointer-1 + increment.
;                       pointer-2 = pointer-2 + increment.
;                     }
;                   }
;
;-------------------------------------------------------------------------
; SYSTEM REQUIREMENTS
;PROCESSOR          6502
;HARDWARE           RAM containing string descriptor array.
;                   Page zero: 8 words (16 consecutive bytes, M0-MF).
;SOFTWARE           None.
;-------------------------------------------------------------------------
; PROGRAMMING DETAILS
;INPUT              M0,1 = String descriptor array word length.
;                   M2,3 = Address of string descriptor array.
;OUTPUT             String descriptors sorted in string ascending order.
;                   Strings unaffected.
;STATE CHANGES      M0,1 = input M0,1 - 1.
;                   M2,3 unchanged.
;                   M4-MF changed.
;                   CPU registers and flags changed.
;I/O ERRORS         Descriptor array length < 2.
;                   String length > 255.
;OPTIMISATION       Increment used adjusted to descriptor size (2 bytes).
;                   Index register and carry states of previous operations
;                   used instead of specific setting.
;INTERRUPT EFFECT   May be interrupted (and re-entered from interrupting
;                   program) only if registers, flags & M0-MF saved.
;LOCATION NEEDS     Not specific.
;                   Object code is relocatable and PROMable.
;PROGRAM BYTES      159
;STACK BYTES        1
;CLOCK CYCLES       Not given.
;-------------------------------------------------------------------------
;
;...Define page zero pseudo-register use & constant.
;
ARRAYLEN =    M0              ;Number of string descriptors in array.
ARRSTART =    M2              ;Address of first string descriptor.
ARRAYEND =    M4              ;Address of last string descriptor.
INCRMENT =    M6              ;Difference between sort pointers 1 & 2.
POINTONE =    M8              ;Sort pointer 1.
POINTTWO =    MA              ;Sort pointer 2.
ARRELONE =    MC              ;Descriptor 1 store for comparison.
ARRELTWO =    ME              ;descriptor 2 store for comparison.
STRNGEND =    $0D             ;String terminator (carriage return).
;
;...Sort routine entry.
;
DIBS      LDA  #-1             ;Prepare for 16-bit decrement.     A9 FF
          DEC  ARRAYLEN        ;Decrement array length to give    C6 M0
          CMP  ARRAYLEN        ;index to last element.            C5 M0
          BNE  NOBORROW        ;Take care of any borrow           D0 02
          DEC  ARRAYLEN+1      ;from high order byte.             C6 M1
;
NOBORROW LDA  ARRAYLEN         ;Set sort pointers increment       A5 M0
          ASL  A               ;to twice array size initially     0A
          STA  INCRMENT        ;so array start + increment =      85 M6
          LDA  ARRAYLEN+1      ;address of last descriptor, and   A5 M1
          ROL  A               ;first increment halving sets      2A
          STA  INCRMENT+1      ;2nd sort pointer at halfway.      85 M7

          CLC                  ;Prepare for subtract, no borrow.  18
          LDA  INCRMENT        ;Calculate address of last         A5 M6
          ADC  ARRSTART        ;string descriptor in array        65 M2
          STA  ARRAYEND        ;by adding initial increment       85 M4
          LDA  INCRMENT+1      ;to array start address.           A5 M7
          ADC  ARRSTART+1      ;                                  65 M3
          STA  ARRAYEND+1      ;                                  85 M5

 ...Repeat with diminishing differences between sort pointers.

 ORTLOOP LSR  INCRMENT+1      ;Sort with reducing increments.    46 M7
          ROR  INCRMENT        ;Halve increments, always to       66 M6
          ROR  INCRMENT        ;even number to ensure correct     66 M6
          ASL  INCRMENT        ;addressing of 2-byte descriptors. 06 M6
;
;...Repeat until pass made with no exchanges.
;...(This is a simple bubble sort at each reduced increment.)
;
SCANLOOP LDA  ARRSTART         ;Set sort pointer 1 to start       A5 M2
          STA  POINTONE        ;of string descriptor array.       85 M8
          LDA  ARRSTART+1      ;                                  A5 M3
          STA  POINTONE+1      ;                                  85 M9
;
          CLC                  ;Clear swap-flag (carry)           18
          PHP                  ;and save on stack.                08
;
          LDA  INCRMENT        ;(With no carry in) add increment  A5 M6
          ADC  ARRSTART        ;to array start to give initial    65 M2
          STA  POINTTWO        ;address for sort pointer 2.       85 MA
          LDA  INCRMENT+1      ;                                  A5 M7
          ADC  ARRSTART+1      ;                                  65 M3
          STA  POINTTWO+1      ;                                  85 MB
;
```

```
;...Repeat until pointers past end of descriptor array.
;
PASSLOOP LDY  #1               ;Prepare to get descriptors.       A0 01
;
GETSTRDS LDA  (POINTONE),Y     ;Copy descriptors addressed by     B1 M8
          STA  ARRELONE,Y      ;sort pointers into page zero      99 MC 00
          LDA  (POINTTWO),Y    ;for string comparison using       B1 MA
          STA  ARRELTWO,Y      ;indexed addressing.               99 ME 00
          DEY                  ;Repeat for two bytes              88
          BPL  GETSTRDS        ;each descriptor.                  10 F3
;
COMPARES INY                   ;Start index 0, index next byte    C8
          LDA  (ARRELTWO),Y    ;and compare corresponding bytes   B1 ME
          CMP  (ARRELONE),Y    ;in currently addressed strings    D1 MC
          BNE  DIFFRENT        ;until different or                D0 04
          CMP  #STRNGEND       ;end of strings found.             C9 0D
          BNE  COMPARES        ;                                  D0 F5
;
DIFFRENT BCS  NOEXCHNG         ;Don't swap if 2nd >= 1st.         B0 12
          PLP                  ;Else access swap-flag and         28
          SEC                  ;set it to show swap occurred      38
          PHP                  ;then re-save on stack.            08
          LDY  #1              ;Prepare to swap DESCRIPTORS.      A0 01
;
EXCHANGE LDA  (POINTONE),Y     ;Swap 2-byte string descriptors    B1 M8
          TAX                  ;in string descriptor array        AA
          LDA  (POINTTWO),Y    ;(leaving strings alone) so        B1 MA
          STA  (POINTONE),Y    ;string indexed by descriptor      91 M8
          TXA                  ;at sort pointer 1 is less than    8A
          STA  (POINTTWO),Y    ;that indexed by descriptor at     91 MA
          DEY                  ;sort pointer 2.                   88
          BPL  EXCHANGE        ;Repeat for 2-byte descriptors.    10 F3
;
NOEXCHNG CLC                   ;Prepare to add, no carry.         18
;
;...Bump pointers by adding increment.
;...(Shell's method should bump each pointer to next descriptor.)
;
          LDA  INCRMENT        ;Bump sort pointer 1 up by         A5 M6
          ADC  POINTONE        ;current increment to index        65 M8
          STA  POINTONE        ;descriptor currently indexed      85 M8
          LDA  INCRMENT+1      ;by sort pointer 2 (and            A5 M7
          ADC  POINTONE+1      ;possibly just swapped with        65 M9
          STA  POINTONE+1      ;previously indexed descriptor).   85 M9
;
          LDA  INCRMENT        ;(With carry=0 from previous add)  A5 M6
          ADC  POINTTWO        ;bump sort pointer 2 up by         65 MA
          STA  POINTTWO        ;current increment to index        85 MA
          LDA  INCRMENT+1      ;next descriptor (for comparison   A5 M7
          ADC  POINTTWO+1      ;of strings and possible swap      65 MB
          STA  POINTTWO+1      ;of indexed descriptors).          85 MB
;
          SEC                  ;Prepare for no borrow compare.    38
          LDA  ARRAYEND        ;Compare sort pointer 2 with       A5 M4
          SBC  POINTTWO        ;end of descriptor array.          E5 MA
          LDA  ARRAYEND+1      ;Repeat comparisons this pass      A5 M5
          SBC  POINTTWO+1      ;until 2nd pointer gone past       E5 MB
          BCS  PASSLOOP        ;end of array.                     B0 AE
;
          PLP                  ;Restore swap-flag and do another  28
          BCS  SCANLOOP        ;pass if any swaps have been made. B0 95
;
          LDA  INCRMENT+1      ;Repeat with reduced increment     A5 M7
          BNE  SORTLOOP        ;if increment hi-byte > 0          D0 89
          LDA  #2              ;or if increment > 2.              A9 02
          CMP  INCRMENT        ;Finish sort when last sort made   C5 M6
          BCC  SORTLOOP        ;at single descriptor increments.  90 83
;
          RTS                  ;Exit, sort completed.             60
;
```

SHELL'S METHOD

All the basic exchange sorting methods which sort within the original file space — ripple, bubble and insertion — index and exchange only adjacent records. In the worst cases each record in an N-record file has to be exchanged N times, giving a total of (N^N-N)/2 comparisons and exchanges. The average is about half of that.

Shell's method (which can be applied to any of the exchange methods, though straight insertion is the easiest to implement) superimposes a binary indexing structure on the file. Instead of the two pointers being always set to address adjacent records, they are set to address records that are successively half a file apart on the first pass, a quarter on the second, an eighth on the third, and so on. Only on the last pass do the pointers finally address adjacent records.

With a series of diminishing increments set to 2^n-1 (that is, 31, 15, 7, 3, 1) and beginning at a value equal to or greater than half the number of records N, the number of exchanges in the worst case is only 2N.

Knuth provides a basic algorithm and a complete analysis of the Shellsort in his book *Sorting and Searching* (volume three of *The Art of Computer Programming*). He also deals with other fast sorts such as Hoare's Quicksort, which is a true binary sort; and Batcher's parallel sort, which should receive greater prominence in the age of the transputer.

Meanwhile, the best sequential routine implementing Batcher's method will be sure to find a place in SubSet.

SUBSET INDEX 1986

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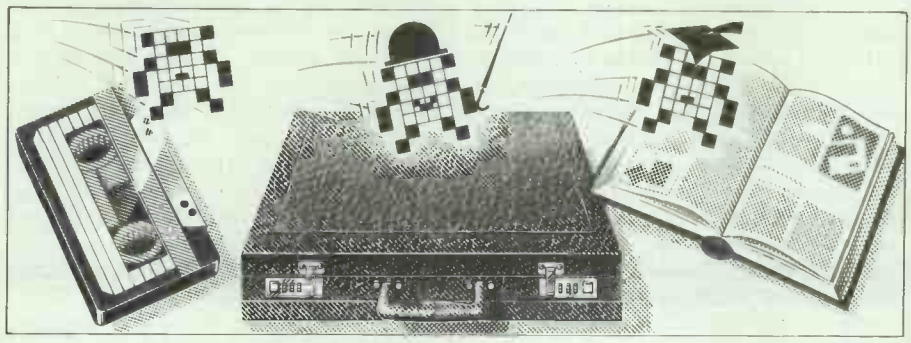
PROGRAM FILE



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Owen Linderholm selects the best of readers' programs.
For details on submitting your own, see page 216.

Once again I must apologise to all QL owners: we still haven't obtained a machine, so I am unable to publish any QL programs. I didn't receive any anonymous messages on the subject this month, as I did last month, so I'm assuming that the more militant among you have decided to wait and see what happens before taking further action. Nevertheless, letters of complaint would probably help me to get the point across!

One subject that crops up fairly regularly in readers' letters to Program File is that we ought to supply the programs on disk/tape, or get the author to do so. There are two problems with this. Firstly, *PCW* can't supply the programs on disk, since we would need a different disk for each of the machines for which a program has been published. Organising this would be difficult.

The second alternative is to allow authors to supply disk or cassette copies for a small fee to cover their costs but this, unfortunately, brings the matter into the rather obscure realms of mail order law. To allow this would amount to touting for mail order business, which is illegal.

One of Program File's regular contributors, Mark Needham, has produced a shareware disk of improved versions of all his programs that have appeared in Program File. Most of the programs have been updated, and full documentation is included on the disk.

As the programs are in the 'shareware' domain, anyone who wants a copy to evaluate may have one; but if you make regular use of the program, then you must pay for it and become a registered user, which entitles you to product support.

As the original versions of these programs appeared in *PCW's* Program File, anyone who has taken the trouble to type them in is entitled to use their own copy of the program as they wish. However, if you then get a copy of the new version and use that, you still have to register.

I highly recommend all the shareware programs to users of the IBM PC and its compatibles, and a couple of the programs are also available for the BBC Micro. More information can be obtained from Mark Needham at 35 Griffin Gardens, Harborne, Birmingham B17 0HU.

Sorry

A few errors have cropped up again. The first, in November's Program File, is a result of my careless typing. In the directory tip for the Apricot, a line was inadvertently omitted. After the first line 'Create a file DD.BAT ...' should have appeared the line 'type DDD', so please insert this instruction in order to create a batch file.

The second error is a correction to a bug which was discovered in the BBC XREF program (*PCW* August,) by EW Ayers. As it stands, the program fails with most calls that involve the line-number token &5D. The problem occurs in lines 900-920 where, if the detokenised line number contains a &00, the program goes into an infinite loop. The corrections are:

```
50 start = &1400
900 .movename LDA name:
  STA name2: LDA name + 1:
  STA name2 + 1:
  BNE moven2: RTS
910 .moven2 LDX#2
920 .moven3 LDA name,X:STA
  name2, X: INX: CMP #0:BNE
  move3:RTS
```

The final mistake occurred in last month's 'Program of the Month'. MacMand by Jack Weber contains a very small error that causes it to 'hang up' at the end of a full plot — after several hours of calculation and plotting. The final subroutine in the program should be changed to read as follows:

```
Finished:
  MENU 6,0,1
  MENU ON
  WHILE again%=0: WEND
RETURN
```

Reminder

After my recent remarks about the need for more original programs, I was heartened to receive this month's Program of the Month. Unfortunately, far too many unoriginal submissions are still coming in. I would like to see fresh, interesting programs that are fully documented from conception through the design, structure and writing of the program, to actual code and operating instructions.

The purpose of Program File is two-fold. It is not only meant to provide useful programs for readers to type in, but also to educate readers in programming techniques new and old, and to show, by example, how to write better programs.

If at all possible, documentation which accompanies programs should be double line spaced rather than single line spaced — it makes editing so much easier.

This month's programs

The Program of the Month is Darwin's Lens which was written for the Atari ST in C using the Megamax C compiler. The program is based on an article by Dr Richard Dawkins, author of *The Selfish Gene* and other works on evolution, which was published in the *New Scientist* of 25 September 1986. The article discussed a program the author had written to simulate natural selection using tree shapes as simple models, and then selecting the 'best' of a

variety of mutant offspring. Richard Dawkins chose his offspring according to his own personal taste. Darwin's Lens takes a single objective, defined beforehand, to create a simple lens for focusing light — and selects the best offspring as the one which focuses light most effectively.

This is a more accurate model of the process of natural selection, although it is still far from complete. Neither program takes account of the fact that the occurrence of mutation is extremely rare and happens only once in many generations rather than many times in one generation, which is how the program works. Also, a mutation which doesn't lead towards the selected criteria might, nevertheless, have advantages in other situations and so be successful in real life, despite having been discarded by the program.

Despite these differences, the program is extremely interesting and the principle could be easily adapted to other situations. One example that would be easy to create from this program is to set up two programs, one as described, and one modified for working in water which has a different refractive index. The two sets of results could then be compared with the lenses developing in the eyes of creatures which can see underwater, such as fish or penguins.

I hope that if anyone does modify the program and use it in other ways, they will let me know, since this type of program is both interesting and useful — just what I want to see in Program File.

Also included in this month's selection of programs is a multi-machine game that uses serial port connections to carry messages between the different computers. It was originally written for the BBC Micro, but can be adapted for other machines as long as serial communications can be implemented reasonably well. The game is rather like an extended and advanced Star Trek simulation, but the principle of communication between several computers could be applied to other programs.

For 8-bit Ataris there's a progam called GTIA+, which sets up a new graphics mode — 80 × 96 pixels in 256 colours — for general use by other progams.

For the Spectrum, there's a program to extend Basic. It doesn't need the Interface 1, but may not work on the Spectrum +2 or the 128k. The added commands include box drawing and error trapping.

PCW is interested in programs written in any of the major programming languages for all home and small business micros. When submitting programs please include a cassette or disk version of your program, brief but comprehensive documentation, and a listing on plain white paper — typed if you have no printer.

Please ensure that the software itself, the documentation and the listing are all marked with your name, address, program title, machine (along with any minimum requirements) and — if possible — a daytime phone number.

Check through the previous Program Files to see the kind of programs we prefer. As a rough guide, original ideas are always welcome, as are good implementations of utilities and applications.

Obviously the programs should be well-written, easy to understand, and preferably not too long (remember that other readers have to type them in).

All programs should be fully debugged and your own original, unpublished work.

We prefer to receive programs with a maximum 80-column width printed in emphasised typeface.

We will try to return submissions if they are accompanied by a stamped, addressed envelope of the appropriate size, but please keep a copy of everything.

Programs are paid for at the rate of £50 per page of published listing, plus a £50 bonus for the Program of the Month. Send your contributions to Owen Linderholm, Program File, PCW, 32-34 Broadwick Street, London W1A 2HG.

Atari ST C Darwin's Lens

by David Wilson

This program was written in Megamax C for the Atari 1040ST, but since it uses arrays rather than pointers it should run on the 520ST. It was written for a monochrome monitor, but should not be too hard to adapt for colour output.

The program is based on an article by Dr Richard Dawkins in the 25 September issue of the *New Scientist*, which attempts to demonstrate how the theory of natural selection might have led to the evolution of an optical lens in the skin of an organism. It simulates the theory of natural selection, acting on the arrangement of cells in the skin of a simple organism to evolve a simple lens. One major drawback of the program is that it takes 25 minutes to evolve a lens of focal length of 450 units, and 90 minutes to evolve one with a focal length of 180 units.

It is assumed that the cells allow light to pass through them with some refraction. Several columns of cells are considered, surrounding a

light-sensitive cell. The program alters the number of cells in each column until a final configuration is reached which resembles a simple lens (Fig 1).

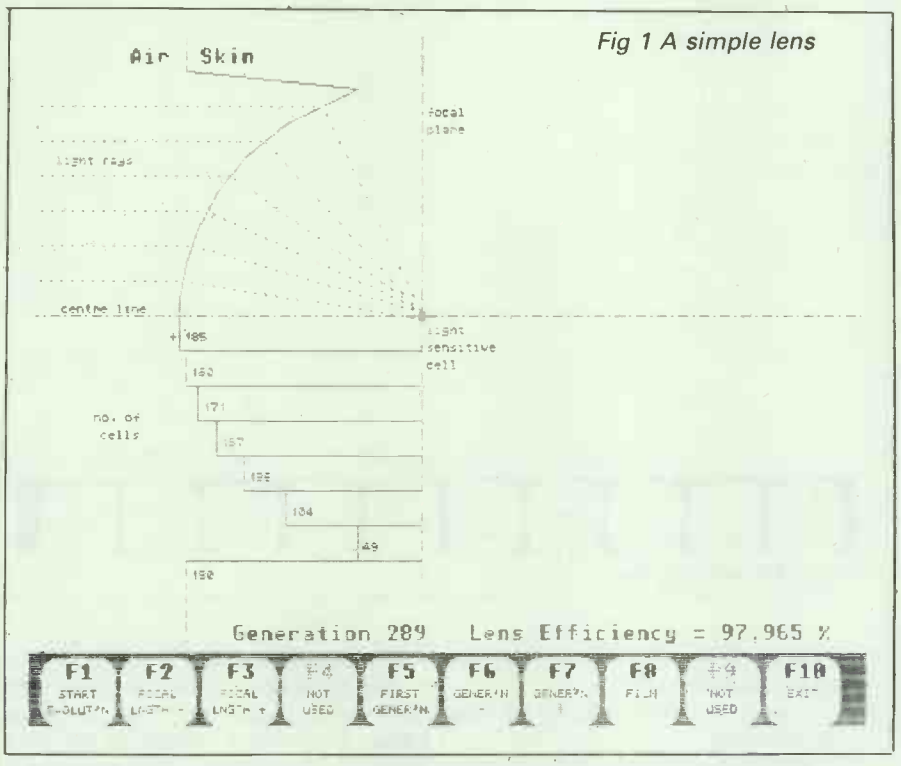

Fig 1 A simple lens

The computer is used to generate possible cell configurations and assess the 'optical efficiency' of each one. This efficiency is a crude measure of how much the rays of light passing through the 'skin' are deflected towards the sensitive cell by refraction. Values range from zero per cent where no light is deflected towards the sensitive cell, up to 100 per cent where all the light falls on the cell.

The program displays each new 'generation' of lens, and when the evolution is complete the user can step forward and backward through the process or watch an animated film of the lens shape evolving.

The initial focal length of the lens can be specified to evolve a short or long focal-length lens.

Theory of natural selection

If the selection procedure to choose which of several random changes in the configuration were itself random, then the chance of hitting on the most efficient configuration would be:

1/c * 1/c * 1/c * . . . *1/c (n times)

where c is the number of possible cells in each column and n is the number of columns of cells.

Even with a simple, crude case, as here, where there are only seven columns and a possible 450 cells in each, the chance of getting the most efficient configuration is 1 in 3.7 × 10E18. Allowing one second to evaluate each of these choices would take nearly 12 billion years, or just under the age of the universe. How, then, can things like the eyes you are using to read this have evolved?

The answer is that an organism which can 'see' to focus light more effectively is more likely to survive and reproduce, so the organisms will evolve into other organisms with a more efficient lens. Using the theory of natural selection which effectively means that the more efficient lens will survive, the computer, calculating about once every second, can evolve a very efficient optical lens in about 25 minutes.

When a simple organism reproduces, it passes a 'blueprint' of itself into its descendants by its genes. Occasionally, a mutation of the gene occurs which produces slightly different characteristics in the organism's offspring. More often than not, this mutation is an inefficient or damaging one, but sometimes it is an improvement. When it *is* an improvement, the offspring which have the improvement will be better able to identify food and predators than those organisms without the mutation. They will survive better, and so produce better adapted offspring.

This growth continues until the genes of the beneficial mutation are spread throughout the species. Then the next beneficial mutation will repeat this process, and so on, resulting in a continually improving species. In real life these processes take an extremely long time, but the program assumes the appearance and adaptation of a beneficial mutation once every generation.

Details

For the lens model, I assume that a light-sensitive cell has evolved below the skin surface of a simple organism. The program studies, in isolation, how natural selection and mutation can alter the shape of the skin surface to focus the light from outside onto this cell, thus improving its efficiency.

The following simplifying assumptions are made:

1 The cells are mostly water, and are one unit deep and 20 units wide.
2 The light rays reaching the skin are parallel to each other and the centre line

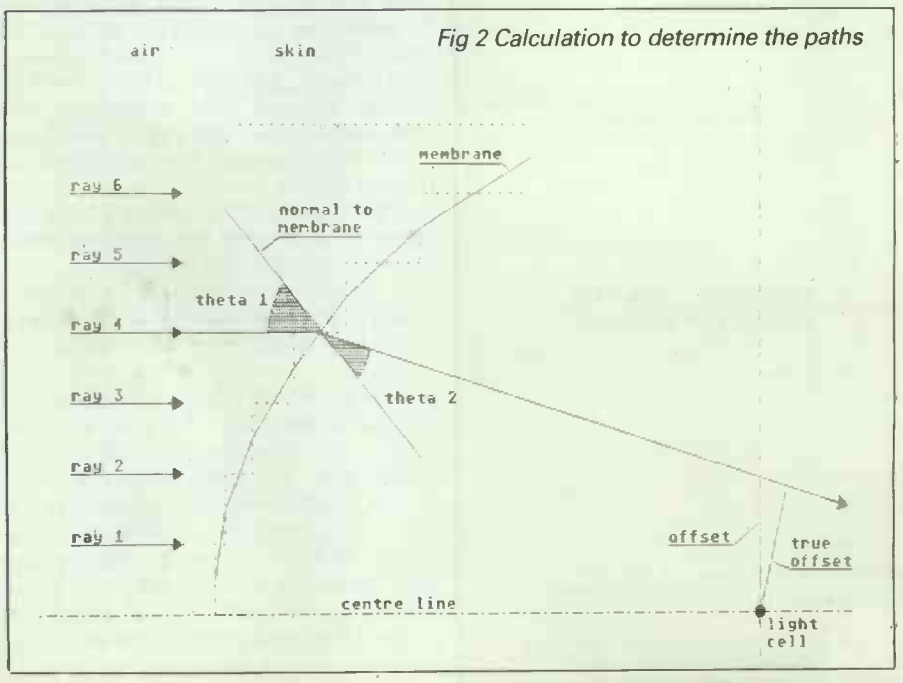

Fig 2 Calculation to determine the paths

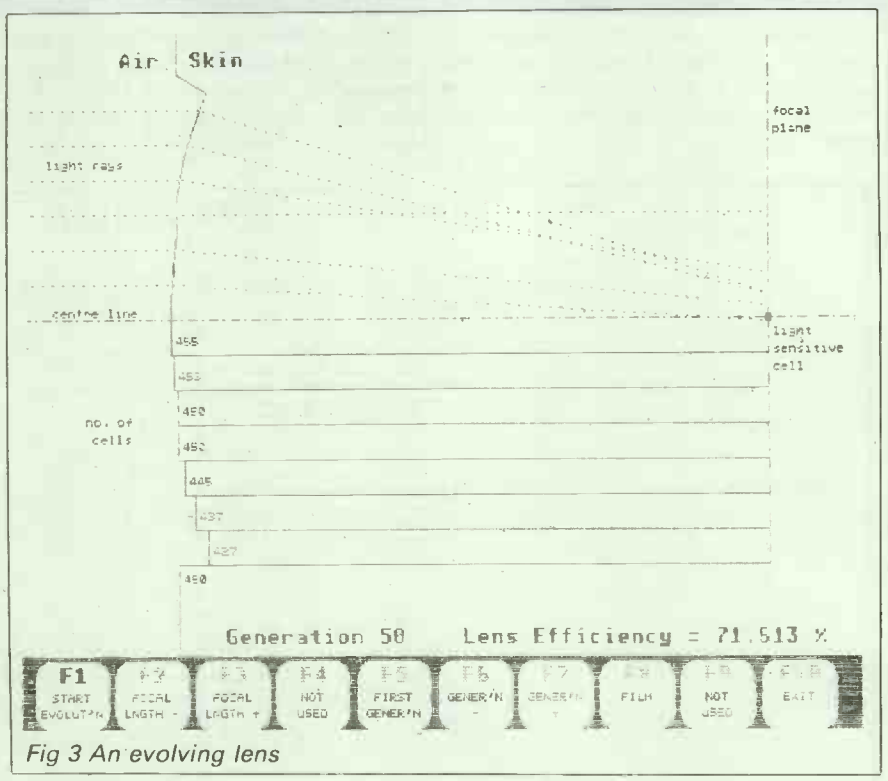

Fig 3 An evolving lens

3 By symmetry, only one half of the lens is considered.
4 The lens is only modelled in two dimensions.

The starting configuration assumes a flat area of skin above the sensitive cell which corresponds to an equal number of cells (say, 450) in each of the seven columns. The computer breeds 14 children from this parent, each of which differs from the parent by only one cell. Child one would have 451 cells in column one; child two would have 449 cells in column one, and so on.

Each child is then assessed for its ability to focus light on the sensitive cell. It is assumed that a membrane is stretched over the skin surface between the outer mid point of each cell column. Six rays of light are then shone through this membrane, and the paths after the rays have been bent by refraction are calculated as below (Fig 2).

The angle to the normal of the ray after it has passed the air-water interface can be derived from:
sin (theta1) = sin (theta2)*RI, where
theta1=angle to normal of ray in air;
theta2=angle to normal of ray in water
RI=index of refraction (air to water)

How close each of these rays passes to the sensitive cell is then summed, and the child with the minimum summed value is chosen as the parent for the next generation. Fourteen children, differing only by one cell from this parent, are then bred, and the most efficient of these becomes the next parent, and so on.

The above process is repeated until the computer finds the most efficient lens shape and the program halts. There is a check to do this, since the program will eventually oscillate between the two most efficient shapes.

Structure

The program is based around a DO ... WHILE loop in the main() function. This starts by calling the get_choice() function which can only return one of the function keys' values if they have been enabled. This loop continues until the F10 key is pressed.

The function key returned is called 'choice', and this is fed into the switch() statement which directs the program flow according to the value of choice.

F1 switches the program to the functions which perform the evolution of the lens: evolve_lens(), child_geometry and calc_efficiency(). If you want to rewrite the program in Basic, it may help to know that the variables within the function brackets are there to keep variables 'local' in C. In Basic, evolve_lens (focal_lens2) could be replaced by GOSUB EVOLVE_LENS.

Evolve_lens() starts by setting the number of cells in each of the seven columns to the focal length you have chosen. The cell count in each column at each generation is contained in the array parent [generation] [column], so to start the array, members parent [1] [1] to parent [1] [7] are all set to, say, 450. The function also

calculates the constant tot_offsets which is the sum of the distances between the six rays of light and the light-sensitive cell at generation one. This constant is used as the basis on which the efficiency of the cell is later calculated.

The rest of evolve_lens is a loop which calculates the most efficient child at each generation and uses that child as the parent of the next generation. When the program is close to the ideal lens shape, there comes a point when the addition or subtraction of a cell from the parent lens does not give a more efficient lens. This is due to the somewhat crude and discrete nature of the program since it cannot work in fractions of a cell. When this point is reached, the program returns to the main() loop.

Evolve_lens calls on child_geometry() at the start of each generation to calculate the geometry of 14 children bred from the parent. The cell count in each column for each child is stored in the array no_cells [child] [column], and each is initially set to the same cell count as the parent. Each child then has one cell added or subtracted from one of its columns to produce 14 unique children.

These children are then assessed by calc_efficiency() which calculates how close the rays of light pass to the light cell in each child. A figure is produced in child_eff[child] which is the sum of the shortest distances between each ray and the light cell, and this figure is converted into a percentage by comparing it with tot_offsets.

The child with the highest percentage is then passed back to evolve_lens, and the parent of the next generation is assigned the cell counts of this child by the statements:

```
for ( i=1 ; i<=NO_COLUMNS
i++)
  parent [generation+1] [i] = no cells
    [best_child] [i];
```

F2 and F3 alter the focal length to be used to evolve the next lens shape. The first statement in each case is a neat way to alter a variable up to or down to a limit without using IF statements.

F5 draws the first generation of the lens which has just been evolved.

F6 and F7 step a completed evolution backwards or forwards by one step, and F8 quickly steps the evolution through from start to finish to give a 'film' of the process.

Screen output is handled by draw_screen() and screen_text() which show the main graphics and associated text, while print_focal_length() displays the focal length arrow. Draw_menu_boxes is only called at the start of the program, while the text in the boxes is updated by calls to menu_text().

```
#include "math.h"                                   /* enable trig functions */

                                                /* ---- link with double.l ---- */

#define ENABLED 1                                    /* menu text flags      */
#define DISABLED 2
#define MIN_FOCAL_LENGTH 180                         /* programme limits     */
#define MAX_FOCAL_LENGTH 450                           /*   using arrays     */
#define CELLD 1                                          /* do not alter!    */
#define CELLW 20                                    /* CELLW*NO_COLUMNS1>140 */
#define NO_COLUMNS 7                                 /* positive odd         */
#define NO_CHILDREN 2*NO_COLUMNS
#define RI 1.33                                 /* refractive index air/water */
    /* air/quartz=1.46 air/glass=1.52 air/polythene=1.52 air/alcohol=1.36 */

#define MAX_GENERATION 300                           /* limit using arrays   */
#define ON 1
#define OFF 0

/*-------------------------------------------------------------------------*/

                                                     /* system parameters    */
int contrl[12],intin[128],ptsin[128],ptsout[128],intout[128];
int handle,i,phys_handle,int_in[11];
int int_out[57],ap_id,dummy;
                                                     /* global variables     */
int function[11],parent[MAX_GENERATION][NO_COLUMNS+1];
int no_cells[NO_CHILDREN+1][NO_COLUMNS+1],text_flag;

double efficiency[MAX_GENERATION],child_eff[NO_CHILDREN+1];
double offset[MAX_GENERATION][NO_COLUMNS+1];
double child_offset[NO_CHILDREN+1];

char temp[100];                                  /* scrap string variable */
char line1[11][10]={                                /* menu button text */
        "   ","START","FOCAL","FOCAL","NOT",
        "FIRST","GENER'N","GENER'N","FILM","NOT","EXIT"
        };
char line2[11][10]={
        "   ","EVOLUT'N","LNGTH -","LNGTH +","USED",
        "GENER'N","  -  ","  +  ","USED",""
        };

/*-------------------------------------------------------------------------*/
/* MAIN                                          NO RETURNS                */
/*-------------------------------------------------------------------------*/

main()

{
int generation,focal_len1,key,total_generations,choice;
```

PROGRAM FILE

```
int focal_len2,i;

        initialise();
        instructions();
        generation=1; focal_len1=focal_len2=300;
        text_flag=ON;
        for ( key=1 ; key<=10 ; key++ )                 /* set menu buttons */
                function[key]=ENABLED;
        for ( key=4 ; key<=9 ; key++ )
                function[key]=DISABLED;

        for ( i=1 ; i<=NO_COLUMNS ; i++ )               /* initialise 1st    */
                parent[1][i]=focal_len2;                /* generation arrays */
        for ( i=1 ; i<=NO_COLUMNS-1 ; i++ )
                offset[1][i]=i*CELLW;

        draw_menu_boxes();
        menu_text();
        draw_screen(generation,focal_len2,0);       /* draw 1st generation */
        print_focal_length(focal_len2);

        do {

                choice=get_choice();                    /* get button pressed */
                switch(choice) {

                case 1:                                 /* start evolution process */
                        generation=total_generations=evolve_lens(focal_len2);
                        vst_height(handle,8,&dummy,&dummy,&dummy,&dummy);
                        v_gtext(handle,250,20,"Evolution Complete");
                        focal_len1=focal_len2;
                        print_focal_length(focal_len2);
                        break;

                case 2:                                 /* decrement focal length */
                        focal_len2-=(focal_len2>=MIN_FOCAL_LENGTH+1);
                        print_focal_length(focal_len2);
                        break;

                case 3:                                 /* increment focal length */
                        focal_len2+=(focal_len2<=MAX_FOCAL_LENGTH-1);
                        print_focal_length(focal_len2);
                        break;

                case 5:                                 /* show 1st generation */
                        start_replay(focal_len1);
                        generation=1;
                        print_focal_length(focal_len2);
                        break;

                case 6:                                 /* show previous generation */
                        generation-=(generation>1);
                        draw_screen(generation,focal_len1,0);
                        print_focal_length(focal_len2);
                        break;

                case 7:                                 /* show next generation */
                        generation+=(generation<total_generations);
                        draw_screen(generation,focal_len1,0);
                        print_focal_length(focal_len2);
                        break;
                case 8:
                        text_flag=OFF;   /* flick through all generations */
                        auto_replay(total_generations,focal_len1);
                        text_flag=ON;
                        generation=total_generations;
                        draw_screen(generation,focal_len1,0);
                        print_focal_length(focal_len2);
                        break;

                case 10:
                        break;
                }
        } while(choice!=10);

        exit_programme();
}

/*-------------------------------------------------------------------------*/
/* INITIALISE                                          NO RETURNS          */
/*-------------------------------------------------------------------------*/

initialise()                                    /* set up virtual work station */

{
int i;

        ap_id=appl_init();
        handle=graf_handle(&dummy,&dummy,&dummy,&dummy);
        for ( i=1 ;i<10 ; i++ )
                int_in[i]=1;
        int_in[10]=2;
        v_opnvwk(int_in, &handle, int_out );
        graf_mouse(256,&dummy);
        v_clrwk(handle);

}

/*-------------------------------------------------------------------------*/
/* DRAW_MENU_BOXES                                     NO RETURNS          */
/*-------------------------------------------------------------------------*/

draw_menu_boxes()                               /* draw 10 function key boxes */

{
int box_no,pxy[4];

        pxy[0]=0;pxy[1]=399;pxy[2]=639;pxy[3]=358;/* clear base of screen */
        vsf_color(handle,1);
        v_bar(handle,pxy);
        vsf_color(handle,0);

        for ( box_no=1 ; box_no<=10 ; box_no++ ) {          /* draw boxes */
                pxy[0]=10+(box_no-1)*61.6;pxy[1]=399;
                pxy[2]=pxy[0]+56.6;pxy[3]=361;
                v_rfbox(handle,pxy);
                }
}
```

PROGRAM FILE

```
/*-------------------------------------------------------------------------*/
/* MENU_TEXT                                          NO RETURNS           */
/*-------------------------------------------------------------------------*/

menu_text()                              /* print text in function key boxes */

{
int i,x,dummy;

        for ( i=1 ; i<= 10 ; i++ ) {                          /* large text */

                vst_height(handle,8,&dummy,&dummy,&dummy,&dummy);
                vst_effects(handle,function[i]);  /* normal or feint text */
                sprintf(temp,"F%d",i);
                x=38+(i-1)*61.6-5*strlen(temp);
                v_gtext(handle,x,372,temp);
                vst_effects(handle,0);
                                                              /* small text */
                vst_height(handle,4,&dummy,&dummy,&dummy,&dummy);
                x=38+(i-1)*61.6-3*strlen(line1[i]);
                v_gtext(handle,x,383,line1[i]);
                x=38+(i-1)*61.6-3*strlen(line2[i]);
                v_gtext(handle,x,392,line2[i]);
                }
}

/*-------------------------------------------------------------------------*/
/* DRAW_SCREEN                                        NO RETURNS           */
/*-------------------------------------------------------------------------*/

draw_screen(generation,focal_length,best_child)

int generation,focal_length,best_child;

{
int pxy[10],i,df,tx,ty;

        clear_screen();

        for ( i=1 ; i<=NO_COLUMNS ; i++ ) {          /* draw cell columns */
                pxy[0]=pxy[2]=120+focal_length-parent[generation][i];
                pxy[1]=pxy[7]=pxy[9]=165+i*CELLW;
                pxy[4]=pxy[6]=120+focal_length;
                pxy[5]=pxy[3]=165+(i-1)*CELLW;
                pxy[8]=pxy[0];
                v_pline(handle,5,pxy);
                }

        pxy[0]=pxy[2]=120;                          /* draw lower skin outline */
        pxy[1]=357;
        pxy[5]=pxy[3]=165+CELLW*NO_COLUMNS;
        pxy[4]=120+focal_length-parent[generation][NO_COLUMNS];
        v_pline(handle,3,pxy);
        pxy[0]=pxy[2]=120+focal_length-parent[generation][1];

        pxy[1]=165;pxy[3]=165-.5*CELLW;        /* draw upper skin outline1 */
        v_pline(handle,2,pxy);
        for ( i=1 ; i<=NO_COLUMNS-1 ; i++ ) {           /* draw lens shape */
                pxy[0]=120+focal_length-parent[generation][i];
                pxy[1]=165-(i-1)*CELLW-.5*CELLW;
                pxy[2]=120+focal_length-parent[generation][i+1];
                pxy[3]=165-(i)*CELLW-.5*CELLW;
                v_pline(handle,2,pxy);
                }

        pxy[0]=pxy[2];pxy[1]=pxy[3];           /* draw upper skin outline2 */
        pxy[2]=pxy[4]=120;
        pxy[3]=165-NO_COLUMNS*CELLW;
        pxy[5]=0;
        v_pline(handle,3,pxy);

        vsl_type(handle,4);                                   /* draw axes */
        pxy[0]=5;pxy[1]=pxy[3]=165;pxy[2]=635;
        v_pline(handle,2,pxy);
        pxy[0]=pxy[2]=120+focal_length;
        pxy[1]=5;pxy[3]=175+CELLW*NO_COLUMNS;
        v_pline(handle,2,pxy);
        vsl_type(handle,3);

        for ( i=1 ; i<=NO_COLUMNS-1 ; i++ ) {           /* draw light rays */
                pxy[0]=5;
                pxy[1]=pxy[3]=165-i*CELLW;
                df=(parent[generation][i]+parent[generation][i+1])/2;
                pxy[2]=120+focal_length-df;
                pxy[4]=120+focal_length;
                pxy[5]=165-offset[generation][i];
                v_pline(handle,3,pxy);
                }

        vsl_type(handle,1);                  /* draw light sensitive cell */
        vsf_color(handle,1);
        v_circle(handle,120+focal_length,165,3);
        vsf_color(handle,0);

        if ( text_flag==ON )                          /* show screen text */
                screen_text(generation,focal_length,best_child);

}

/*-------------------------------------------------------------------------*/
/* CLEAR_SCREEN                                       NO RETURNS           */
/*-------------------------------------------------------------------------*/

clear_screen()                           /* clears upper part of screen */

{
int pxy[4];

        pxy[0]=0;pxy[1]=357;
        pxy[2]=639;pxy[3]=0;
        v_bar(handle,pxy);
}

/*-------------------------------------------------------------------------*/
/* SCREEN_TEXT                                        NO RETURNS           */
/*-------------------------------------------------------------------------*/
```

PROGRAM FILE

```
screen_text(generation,focal_length,best_child)       /* show screen text */

int generation,focal_length,best_child;

{
int tx,ty,i;

        vst_height(handle,8,&dummy,&dummy,&dummy,&dummy);   /* large text */
        sprintf(temp,"Generation %-3d   Lens Efficiency = %-5.3lf %%",
                        generation,efficiency[generation-1]);
        v_gtext(handle,155,350,temp);
        v_gtext(handle,76,20,"Air");
        v_gtext(handle,130,20,"Skin");

        vst_height(handle,4,&dummy,&dummy,&dummy,&dummy);   /* small text */

        for ( i=1 ; i<=NO_COLUMNS ; i++ ) {                 /* cell numbers */
                sprintf(temp,"%d",parent[generation][i]);
                tx=124+focal_length-parent[generation][i];
                ty=165+(i-1)*CELLW+.5*CELLW+4;
                v_gtext(handle,tx,ty,temp);
                }

        if ( best_child!=0 && generation!=1 ) {             /* show + or - */
                i=(1+best_child)/2;
                tx=113+focal_length-parent[generation][i];
                ty=165+(i-1)*CELLW+.5*CELLW+4;
                if ( best_child%2==0 )
                        v_gtext(handle,tx,ty,"+");
                else
                        v_gtext(handle,tx,ty,"-");
                }

        sprintf(temp,"%d",focal_length);
        v_gtext(handle,124,165+(NO_COLUMNS)*CELLW+10,temp);
        v_gtext(handle,124+focal_length,50,"focal");
        v_gtext(handle,124+focal_length,60,"plane");
        v_gtext(handle,124+focal_length,175,"light");
        v_gtext(handle,124+focal_length,185,"sensitive");
        v_gtext(handle,124+focal_length,195,"cell");
        ty=165-(NO_COLUMNS-3)*CELLW-7;
        v_gtext(handle,20,ty,"light rays");
        v_gtext(handle,25,163,"centre line");
        v_gtext(handle,50,165+(NO_COLUMNS/2)*CELLW,"no. of");
        v_gtext(handle,55,175+(NO_COLUMNS/2)*CELLW,"cells");
}

/*-------------------------------------------------------------------------*/
/* GET_CHOICE                          RETURN FUNCTION KEY PRESSED         */
/*-------------------------------------------------------------------------*/

get_choice()                                /* get function button pressed */

{
int key_pressed;

        do {
                key_pressed=evnt_keybd();

                if ( key_pressed/256>=59 && key_pressed/256<=68
                        && key_pressed%256==0
                        && function[key_pressed/256-58]==ENABLED )
                        return(key_pressed/256-58);

        } while();

}

/*-------------------------------------------------------------------------*/
/* EVOLVE_LENS                         RETURN TOTAL NO. GENERATIONS        */
/*-------------------------------------------------------------------------*/

evolve_lens(focal_length)

int focal_length;

{
int key,i,best_child,generation,column;
double tot_offsets;

        tot_offsets=0;

        for ( key=1 ; key<=10 ; key++ )          /* set function key text */
                function[key]=DISABLED;
        function[1]=ENABLED;
        menu_text();

        for ( i=1 ; i<=NO_COLUMNS ; i++ )    /* initialise 1st generation */
                parent[1][i]=focal_length;

        for ( i=1 ; i<=NO_COLUMNS-1 ; i++ )    /* calculate total offsets */
                tot_offsets+=offset[1][i]=i*CELLW;

        for ( generation=1 ; generation<=MAX_GENERATION ; generation++ ) {
                draw_screen(generation,focal_length,best_child);

                        /* calculate geometry of each child of parent */
                for ( column=1 ; column<=NO_COLUMNS ; column++ ) {
                        child_geometry(generation,column);
                        }

                                        /* select most efficient child */
            best_child=calc_efficiency(generation,focal_length,tot_offsets);
                /* most efficient child becomes parent of next generation */
                for ( i=1 ; i<=NO_COLUMNS ; i++ )
                        parent[generation+1][i]=no_cells[best_child][i];
                                                /* evolution complete? */
                if ( efficiency[generation]==efficiency[generation-2] ) {
                                        /* set function key text */
                        for ( key=1 ; key<=10 ; key++ )
                                function[key]=ENABLED;
                        function[4]=function[9]=DISABLED;
                        menu_text();

                        draw_screen(generation-1,focal_length,0);
                        return(generation-1);
                        }
```

PROGRAM FILE

```
                }


        }

        /*-------------------------------------------------------------------*/
        /* CHILD_GEOMETRY                              NO RETURNS            */
        /*-------------------------------------------------------------------*/

        child_geometry(generation,column)       /* calculate geometry of children */

        int generation,column;

        {
        int i;

                for ( i=1 ; i<=NO_COLUMNS ; i++ ) {
                        no_cells[column*2-1][i]=parent[generation][i];
                        no_cells[column*2][i]=parent[generation][i];
                        }

                no_cells[column*2-1][column]=parent[generation][column]-1;
                no_cells[column*2][column]=parent[generation][column]+1;

        }

        /*-------------------------------------------------------------------*/
        /* CALC_EFFICIENCY                    RETURN MOST EFFICIENT CHILD    */
        /*-------------------------------------------------------------------*/

        calc_efficiency(generation,focal_length,tot_offsets)
                                /* calculate optical efficiency of each child */
        int generation,focal_length;
        double tot_offsets;

        {
        int child,ray,best_child;
        double theta1,theta2,theta3,length,dh,dv,R;
        double ray_percent,true_offset,maxeff;

                for ( child=1 ; child<=NO_CHILDREN ; child++ ) {
                        child_eff[child]=0.0;
                for ( ray=1 ; ray<=NO_COLUMNS-1 ; ray++ ) {
                        dh=(no_cells[child][ray]-no_cells[child][ray+1])*CELLD;
                        theta1=atan(dh/CELLW);
                        theta2=asin(sin(theta1)/RI);
                        theta3=theta1-theta2;
                        length=focal_length+no_cells[child][ray+1]*CELLD+0.5*dh;
                        dv=length*tan(theta3);
                        R=ray*CELLW-dv;
                        child_offset[ray]=R;
                        if ( R<0 )
                                R=-R;
                        true_offset=R*cos(theta3);/* true offset of ray from cell */
                        child_eff[child]+=true_offset;
                        }

                child_eff[child]=100-100*(child_eff[child]/tot_offsets);

                if ( child_eff[child]>maxeff ) {            /* select best child */
                        maxeff=child_eff[child];
                        best_child=child;
                        for ( i=1 ; i<=NO_COLUMNS-1 ; i++ )
                                offset[generation+1][i]=child_offset[i];
                        }
                }

                efficiency[generation]=child_eff[best_child];
                return(best_child);
        }


        /*-------------------------------------------------------------------*/
        /* PRINT_FOCAL_LENGTH                          NO RETURNS            */
        /*-------------------------------------------------------------------*/

        print_focal_length(focal_len2)                  /* show next focal length */

        int focal_len2;

        {
        int pxy[4],x1,y1,x2,y2,tx,ty;
                                                        /* erase last line */
                vst_height(handle,4,&dummy,&dummy,&dummy,&dummy);
                x1=120;y1=340;x2=x1+MAX_FOCAL_LENGTH;y2=y1-20;
                pxy[0]=x1+1;pxy[1]=y1;
                pxy[2]=x2;pxy[3]=y2;
                vsf_color(handle,0);
                v_bar(handle,pxy);

                vsl_ends(handle,1,1);                           /* draw arrow */
                pxy[2]=x1+focal_len2;
                pxy[1]=pxy[3]=(y1+y2)/2;
                v_pline(handle,2,pxy);

                sprintf(temp,"Next focal length = %d",focal_len2);   /* show text */
                tx=x1+.5*focal_len2-3*strlen(temp);
                ty=y1-12;
                v_gtext(handle,tx,ty,temp);
                vsl_ends(handle,0,0);

        }

        /*-------------------------------------------------------------------*/
        /* START_REPLAY                                NO RETURNS            */
        /*-------------------------------------------------------------------*/

        start_replay(focal_length)                      /* display 1st generation */

        int focal_length;

        {
                draw_screen(1,focal_length,0);
                function[6]=function[7]=ENABLED;
                menu_text();

        }
```

PROGRAM FILE

```
/*-------------------------------------------------------------------------*/
/* AUTO_REPLAY                                        NO RETURNS           */
/*-------------------------------------------------------------------------*/

auto_replay(total_generations,focal_length)                /* film show */

int total_generations,focal_length;

{
int key,generation;

        for ( key=1 ; key<=10 ; key++ )          /* set function key text */
                function[key]=DISABLED;
        function[8]=ENABLED;
        menu_text();

        for ( generation=1 ; generation<=total_generations ; generation++)
                draw_screen(generation,focal_length,0);

        for ( key=1 ; key<=10 ; key++ )          /* set function key text */
                function[key]=ENABLED;
        function[4]=function[9]=DISABLED;
        menu_text();

}

/*-------------------------------------------------------------------------*/
/* EXIT_PROGRAMME                                     NO RETURNS           */
/*-------------------------------------------------------------------------*/

exit_programme()                                       /* return to desktop */

{
        v_clsvwk(handle);
        graf_mouse(257,&dummy);
        appl_exit();
}

/*-------------------------------------------------------------------------*/
/* INSTRUCTIONS                                       NO RETURNS           */
/*-------------------------------------------------------------------------*/

instructions()                              /* print page of instructions */

{
                /* type each line pair as single line to fit on screen */

        v_enter_cur(handle);
        puts("                                    DARWIN´S LENS ");
        puts("                                    ------------  ");
        puts("   This programme uses the theory of natural selection
              to evolve the shape of a");
        puts(" lens from a flat section of skin. It achieves this
              by breeding 14 children    ");
        puts(" from the starting skin configuration. Each child
              differs from its parent    ");
        puts(" configuration by the addition or removal of one cell
              from one of seven columns");
        puts(" of cells (hence 2x7=14 children).   ");
        puts(" ");
        puts("   The laws of physics are then applied to each of the
              children to discover   ");
        puts(" which one is the most efficient at bending rays of
              light towards a light      ");
        puts(" sensitive cell. This cell is at a depth of
              ´focal length´ beneath the skin    ");
        puts(" surface. As the cells are 1 unit of length deep,
              this depth is also the no. of");
        puts(" cells between the light sensitive cell and the skin
              surface.                                ");
        puts(" ");
        puts("   This best child then becomes the parent configuration
              for the next          ");
        puts(" generation of children. This is equivalent to the
              genetic code of the parent  ");
        puts(" being passed onto the next generation.            ");
        puts(" ");
        puts("   The process repeats until the computer can no
              longer breed a more efficient ");
        puts(" lens shape.");
        vs_curaddress(handle,24,28);
        puts("Press any key to continue");
        evnt_keybd();
        v_curhome(handle);
        v_eeos(handle);
        puts("                                    DARWIN´S LENS ");
        puts("                                    ------------  ");
        puts("   To start the evolution you should first adjust
              the focal length using keys  ");
        puts(" F2 and F3. Pressing  key F1 will then start the
              evolutionary process.      ");
        puts(" ");
        puts("   Time taken varies from 25 minutes for focal
              length of 450 to 90 minutes for ");
        puts(" focal length of 180. ");
        puts(" ");
        puts("   At each generation a cross-section through the
              lens is shown. The size of   ");
        puts(" each column of cells is shown below the centre line
              with a + or - to indicate ");
        puts(" which column was changed for this generation. ");
        puts(" ");
        puts("   Above the centre line the smoothed shape of the
              skin surface is shown along ");
        puts(" with the diffracted paths of the light rays as they
              pass through the lens.     ");
        puts(" ");
        puts("   Once you have evolved a lens shape you can study
              it generation by generation");
        puts(" using buttons F5, F6 and F7. Key F5 shows the first
              generation and F6 and F7  ");
        puts(" can be used to go forward or back by one generation.");
        puts(" ");
        puts("   F8 shows an animated film of the skin as it
              evolves from a flat surface to  ");
        puts(" the final complex lens shape.");
```

```
        vs_curaddress(handle,24,28);
        puts("Press any key to continue");
        evnt_keybd();
        v_exit_cur(handle);
}

/*------------------------------END-----------------------------------------*/
```

Multi-machine Basic MULTREK

by Paul Beadle

This program is a version of the old Star Trek game — with a difference. It is intended for multi-player use, each player using their own computer. The program has been used on a set-up consisting of a BBC Micro, an Einstein and an Apple II, as well as on a set-up of three BBCs.

There are two mistakes in the listing. Lines 3310 and 4020 contain REM statements which have not appeared. A REM should be inserted before the text that appears at the end of these two lines.

A facility provided on many computers is a serial interface. The idea of linking a group of computers with a serial interface is fine in theory, but in practice it tends to be complicated. This program uses some ideas generated in local area networks to provide data transfer between one micro and a number of others. Perhaps your computer club could share program entry and make the connecting cables?

The micros are wired in a 'serial ring': that is, the serial output of one computer is connected to the input of the next, the final computer in the ring being connected to the first (Fig 1). A message sent by one computer in the ring is tagged with a standard header which details its type, length, origin and the computer(s) it is to be read by. The message makes its way around the ring, each computer reading it in, taking action if necessary, and sending it on. When the message reaches the origin computer, it stops. In order to limit the amount of information travelling around the ring, each computer is limited to one message of one type at a time. There are 15 message types covering ship movement through to space station destruction. All characters sent in the messages are restricted to ASCII values 32 to 127 to avoid problems with control characters and stop bits.

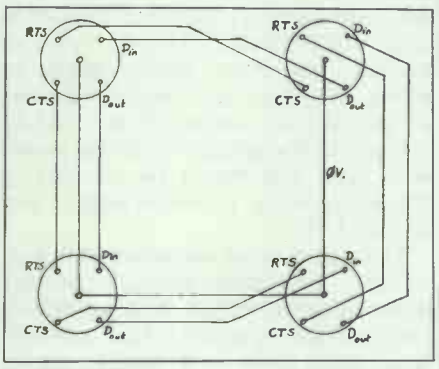

Fig 1 Serial ring arrangement

Each message is a sequence of bytes; the first four bytes are the same for all messages (see box).

Byte1: Msg type
Byte2: Total length
Byte3: Origin
Byte 4: Dest (0 for all ships)

Type	Explanation	Extra bytes
1	Ship moved	Two 2-byte numbers for location X and Y. A number can be from 0 to 9000
2	Phasor	
3	Torpedo	
4	Space mine	None
5	Text message	Sequence of characters
6	Dock request	Two 2-byte numbers, X and Y
7	Dock accept	None
8	Dock reject	None
9	Undocking	None
10	Energy transfer	Sign byte, 2-byte number
11	Ship inactive	None
12	Ship destroyed	None
13	Improbability drive	None
14	Station position	Two 2-byte numbers, X and Y
15	Station destroyed	None

It is essential that each computer has an input buffer in its serial system, and RTS-CTS protocols for input and output handshaking. Also, your micro must be able to check for the

existence of characters in the keyboard and serial input buffers. The program has been running on two and three micro rings but the maximum is four (due to screen size, but with an 80-column screen this could be improved). The listing given here is in BBC Basic, but it is very easy to convert to virtually any kind of Basic.

The problem areas are likely to be differences in serial interfaces. Machine and language-specific program lines are 160-180, 230, 320, 380-440, 610, 6020-6100, 8060, 8100-8170 and 10120-10160. There may, of course, be other details such as string manipulation, zeroth elements of arrays and integer FOR . . . NEXT variables. The program can be tested with only one micro by connecting the serial input to serial output and RTS to CTS.

The game is an extended Star Trek game — the object being to destroy other players' ships and ultimately their space stations. You possess four ships and one space station each.

A brief description of the game and commands is given in the help screens on lines 13000 to 13510. Here are a few additional details:

Moving: After setting the destination for one of your four ships with an M command, a W command will define warp speed. The warp speed will increase in steps of one to the desired speed. This means that in order to hyperspace to anywhere in the galaxy, you will have to wait until warp nine is reached before using a H command. As soon as a ship is moved, its position is known by the other players.

Improbability drive: This moves the currently selected ship to a random destination and hides its position from other players. This is fairly expensive in terms of energy, and if you try it with less than 500 units, all of your energy will be drained (so that you cannot move) and the other players will 'see' where you have gone — in other words, you will be a sitting duck. If this happens, the best thing to do is get another of your ships on the same spot, drop a space mine and pick it up with the disabled ship.

Weaponry: *Photon torpedoes*: Cost=100, destroying energy=400,

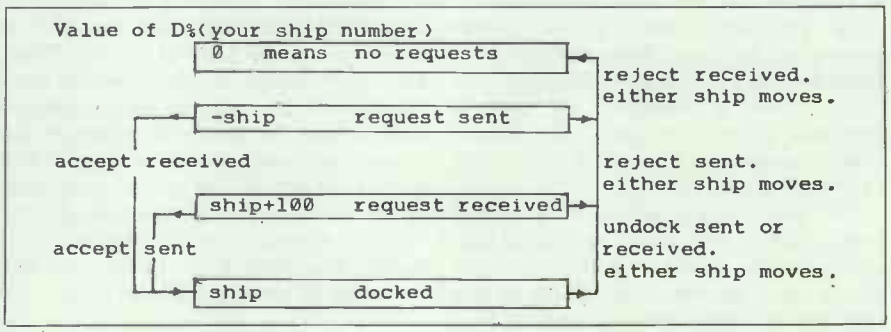

Fig 2 Docking sequence

```
SHP.CO-ORDS  DOCK.ENER.    DEST.   SPD HIT   This player
 1 1234,5678 D10 <9999> 5678,1234 W9 PH    has ships 1-4.
 2 8765,3987 R9                      TO    No energy left
 3 8765,4765      <7665>
 4*5476,4876      <  94> 2386,3764 W2 SM    Current ship=*
 5 DESTROYED     STATION:3464,3456          Ship 5 is Dead
 6 4654,4876
 7)5667,3554                                Inactive=)
 8
 9               STATION:4575,4552          Stn. for ships
10 1234,5678 D1   (PRIVATE MSG FROM SHP)    9 to 12.
11 8765,3987 R2   (NUMBER TEN.          )
12
13               STATION:2344,2345
14 3522,2644      'PUBLIC MSG RECEIVED '
15                'BY ALL SHIPS.       '
16 3856,2435
SPACE MINES         TORPEDOES
1234,7654 7676,2727             7474,3443
8282,7272 7437,4747             3464,4355
4747,4747          STATION:2354,2347        This micro's
                   ERROR MSG LINE.          station posn.

4>=-'THIS IS THE COMMAND LINE
```

Fig 3 Sample screen

effective against other space stations and ships, you may have only one torpedo from one ship flying at one time, range=200. *Phasors*: Cost=50, destroying energy=200, effective against *all* ships, range =100. *Space mines*: Cost=selected, destroying energy=selected × 4, recoverable energy=selected-25, effective against other ships.

Docking: You may dock a ship with another player's ship but only if both are stationary. This must follow a strict sequence. Fig 2 shows the commands and conditions required for docking.

Screen information: A 40-column screen has been tightly packed with all the information a player will need. The screen does not scroll but tabbing is used to direct characters to the right places. A sample screen is shown in Fig 3.

Entering commands: Most commands need to know which ship to affect. To set your current ship (marked by an '*'), enter the number of the ship and press Return. You may enter a command directly after the number and then press Return; the program will treat the command as if it were typed on a line by itself.

```
   10 REM MULTREK MULTI-USER GAME
   20 REM VERSION 2.3  (BBC)
   30 REM WRITTEN BY PAUL BEADLE. MAY'86
   40 REM
   50 REM THIS VERSION WORKS FOR UP TO
   60 REM FOUR COMPUTERS IN THE RING
   70 REM
   80 REM MANY THANKS TO STEPHEN BEADLE (APPLE IC, APPLESOFT COMPILED BASIC VERS
ION)
   90 REM AND ANDREW JOHNSON (EINSTEIN, COMPILED MBASIC VERSION)
  100 REM FOR HELP IN THE CONSTRUCTION
  110 REM OF THIS SOFTWARE.
  120 REM
  130 ST%=1:REM OFFSET FOR SHIP NUMBER. CAN BE 1,5,9 OR 13. 1 IS THE MASTER
  140 REM THERE MUST BE ONE MASTER IN THE RING (WHICH SETS UP SPACE STATIONS)
  150 REM THE NEXT 2 CMDS SET THE BBC SCREEN TO 40 COLUMN BY 25 LINES.
  160 *TV 255,1
  170 MODE 7
  180 VDU23,1,0;0;0;0;:REM TURN CURSOR OFF
  190 GOSUB 13000:REM HELP SCREEN
  200 GOTO 250:REM MAKE ROOM FOR OFTEN USED ROUTINES (SPEED)
  210 REM ROUTINE TO MOVE CURSOR TO H%(0-39),U%(0-24).   0,0 IS TOP LEFT.
  220 REM FOR 24 LINE SCREENS, PUT CURSOR ON THE BOTTOM LINE FOR H%=23 AND 24.
  230 PRINT TAB(H%,U%);
  240 RETURN
  250 REM INITIALISE SCREEN
  260 CLS
  270 U%=0:H%=0:GOSUB 210:PRINT"SHP.CO-ORDS  DOCK.ENER.   DEST.  SPD HIT";
  280 FOR I%=1 TO 16:H%=0:U%=I%:GOSUB 210:PRINTFNP(I%,2):NEXT I%:REM SHIP NUMBER
S
  290 REM INITIALISE SHIP VARS
  300 N%=3:REM NUM SHIPS MINUS ONE
  310 REM REMEMBER BBC BASIC CLEARS DIM'D ARRAYS
  320 DIM os% 256:REM FX CALL WORKSPC FOR BBC BASIC I
  330 DIM X%(N%),Y%(N%),D%(N%),W%(N%),E%(N%),SX%(10),SY%(10),SE%(10),TX%(N%),TY%
(N%),TU%(N%),TV%(N%),TM%(N%),MX%(N%),MY%(N%),WD%(N%),AX%(4),AY%(4)
  340 DIM F%(15,N%):REM MSG CIRCULATING FLAGS
  350 SM%=0:QT%=0:P$=" ":REM NO MINES, NO QUIT AND NO PREVIOUS COMMAND.
  360 CS%=0:REM CURRENT SHIP (INTERNAL NUM 0-3. ADD TO ST% FOR EXTERNAL NUM).
  370 REM SET UP I/O @ 9600 BD
  380 *FX 7,7
  390 *FX 8,7
  400 *FX2,2
  410 REM CLEAR BUFFERS
  420 *FX21,0
  430 *FX21,1
  440 *FX21,2
  450 FOR I%=0 TO N% :REM SCATTER SHIPS
  460 X%(I%)=FNR(6000)+2000
  470 MX%(I%)=X%(I%):REM MX%( AND MY%( ARE DESTINATION CO-ORDS.
  480 Y%(I%)=FNR(6000)+2000
  490 MY%(I%)=Y%(I%)
  500 E%(I%)=9999:REM MAX ENERGY.
  510 NEXT I%
  520 IF ST%=1 THEN GOSUB 12600:REM THE FIRST MICRO SENDS THE STATION POSNS
  530 AE%=20000:REM SPACE STATION DEFENCE ENERGY.
  540 H%=0:U%=17:GOSUB 210:PRINT"SPACE MINES";SPC(9);"TORPEDOES";
  550 FOR I%=ST% TO ST%+N%:H%=3:U%=I%:GOSUB 210:PRINTFNP(X%(I%-ST%),4);",";FNP(Y
%(I%-ST%),4);SPC(5);"<";FNP(E%(I%-ST%),4);">";:NEXT I%
  560 GOSUB 12300:CS="":REM CMD STRING & INDICATE CURRENT SHIP WITH A *.
  570 H%=0:U%=24:GOSUB 210:PRINTSPC(39);:REM CLR CMD LINE
  580 H%=0:U%=24:GOSUB 210:PRINT;CS%+ST%;">=-";CS;CHR$(255);:REM PUT CURRENT CMD
 AT BTM OF SCRN
  590 GOSUB 5000:REM SEND ONGOING MSGS ( MOVING SHIPS & TORPEDOES.)
  600 GOSUB 3000:REM SERIAL I/P CHK
  610 X%=ADVAL(-1):REM KEYBOARD BUFFER CHECK. X%=0 IF EMPTY, <>0 IF IT CONTAINS
A CHARACTER.
  620 IF X%=0 THEN 590
  630 B$=GET$:CS=CS+B$:REM ADD CHR TO CMD STRING.
  640 IF B$=CHR$(18) THEN CS=P$:B$=CHR$(13):H%=0:U%=24:GOSUB 210:PRINT;CS%+ST%;"
>=-";LEFT$(CS,LEN(CS)-1);:REM FORCE THE PREVIOUS CMD AGAIN WITH ^R
  650 IF B$=CHR$(13) THEN GOSUB 2000:P$=CS:GOTO 560: REM DO A COMMAND & REMEMBER
 IT
  660 IF B$=CHR$(127) THEN CS=LEFT$(CS,LEN(CS)-1-ABS(LEN(CS)<>1)):GOTO 570:REM D
ELETE A CHARACTER
  670 IF B$=CHR$(24) THEN 560:REM ^X CLEARS CMD LINE.
  680 IF LEN(CS)>34 THEN PRINTCHR$(7);:CS=LEFT$(CS,34):REM MAX NUM CHARS ON CMD
LINE IS 34.
  690 IF B$=CHR$(9) THEN GOSUB 12400:REM TIDY SCREEN IF TAB (^I) PRESSED.
  700 IF B$<" " THEN CS=LEFT$(CS,LEN(CS)-1):REM REMOVE CTRL CHRS
  710 GOTO 580:REM LOOP AROUND MAIN BIT.
 1000 REM GET NUMBER FROM C$ TO V%, CURRENT POSITION PO%
 1010 G%=0
 1020 IF PO%=LEN(CS) THEN V%=0:G%=1:RETURN:REM NO PARAM SO RETURN WITH 0 AND G%
 1030 B$=MID$(CS,PO%,1):PO%=PO%+1
 1040 IF B$<"0" OR B$>"9" THEN 1020
 1050 A$=B$
 1060 IF PO%=LEN(CS) THEN V%=VAL(A$):GOTO 1100: REM LAST PARAM IN STRING.
 1070 B$=MID$(CS,PO%,1):PO%=PO%+1
 1080 IF B$<"0" OR B$>"9" THEN V%=VAL(A$): GOTO 1100 :REM NON DIGIT DELIMITER
```

PROGRAM FILE

```
 1090 A$=A$+B$:GOTO 1060
 1100 IF V%>9000 THEN V%=9000:REM MAX NUMBER.
 1110 RETURN
 2000 REM EXECUTE CMD IN C$
 2010 IF QT% THEN RETURN:REM IGNORE CMD IF USER HAS NO SHIPS LEFT
 2020 PO%=1:REM POSN IN C$
 2030 IF C$=CHR$(13) THEN H%=20:U%=21:GOSUB 210:PRINTSPC(20);:RETURN
 2040 REM SPACESHIP CHANGE
 2050 IF ASC(C$)<48 OR ASC(C$)>57 THEN 2110:REM NOT A DIGIT
 2060 GOSUB 1000:IF V%<ST% OR V%>ST%+N% THEN H%=20:U%=21:GOSUB 210:PRINT"BAD SHI
P NUMBER.....";:RETURN
 2070 IF E%(V%-ST%)<0 THEN H%=20:U%=21:GOSUB 210:PRINT"SHIP NO LONGER ALIVE";:GO
TO 2090
 2080 C%=V%-ST%
 2090 FOR I%=PO%-1 TO LEN(C$):IF MID$(C$,I%,1)<"A" THEN NEXT I%:RETURN:REM NO MO
RE COMMANDS
 2100 PO%=I%:I%=LEN(C$):NEXT I%:C$=MID$(C$,PO%):GOTO 2020:REM MORE COMMAND
 2110 REM QUIT CMD
 2120 IF LEFT$(C$,4)="QUIT" THEN FOR I%=0 TO N%:GOSUB 9060:NEXT I%:REM THIS HAND
LES DEAD SHIPS, SETS QT%. ROUTINE BREAKS OUT & GOES TO MAIN LOOP.
 2130 REM HYPERSPACE
 2140 IF LEFT$(C$,1)="H" THEN GOTO 11600
 2150 REM SEND MESSAGE
 2160 IF LEFT$(C$,1)="'" THEN C$="C0 "+MID$(C$,2):REM "'" IS SHORTHAND FOR "C 0
MSG."
 2170 IF LEFT$(C$,1)="C" THEN GOTO 10600
 2180 REM DOCKING COMMANDS
 2190 IF LEFT$(C$,1)="D" THEN GOTO 10700
 2200 REM LAY SPACE MINE
 2210 IF LEFT$(C$,1)="S" THEN GOTO 11100
 2220 REM ENERGY TRANSFER
 2230 IF LEFT$(C$,1)="E" THEN GOTO 11300
 2240 REM UNLAY MINE
 2250 IF LEFT$(C$,1)="U" THEN GOTO 11400
 2260 REM FIRE PHASOR
 2270 IF LEFT$(C$,1)="P" THEN GOTO 11700
 2280 REM SET WARP SPEED
 2290 IF LEFT$(C$,1)="W" THEN GOTO 11800
 2300 REM SET DESTINATION
 2310 IF LEFT$(C$,1)="M" THEN GOTO 11900
 2320 REM FIRE A TORPEDO
 2330 IF LEFT$(C$,1)="T" THEN GOTO 12000
 2340 REM IMPROB DRIVE
 2350 IF LEFT$(C$,1)="I" THEN GOTO 12100
 2360 H%=20:U%=21:GOSUB 210:PRINT"UNKNOWN COMMAND ERR."
 2370 RETURN
 3000 REM INTERPRET AND TAKE ACTION ON THE INPUT STRING
 3010 GOSUB 6000:REM READ BUFFER
 3020 IF S%=0 THEN RETURN:REM NO CHARS IN BUFFER.
 3030 B1%=ASC(A$)-32:REM MSG NUMBER
 3040 B2%=ASC(MID$(A$,2))-32:REM MSG LENGTH
 3050 B3%=ASC(MID$(A$,3))-32:REM SOURCE OF MSG
 3060 B4%=ASC(MID$(A$,4))-32:REM DESTINATION OF MSG
 3070 REM NOW CHECK IF THIS MICRO SENT THE MESSAGE
 3080 IF B3%>=ST% AND B3%<=ST%+N% THEN F%(B1%,B3%-ST%)=0:RETURN:REM ENABLE NXT M
SG OF THIS TYPE AND IGNORE IT
 3090 GOSUB 8000 :REM SEND ON MSG.
 3100 ON B1% GOTO 3110,3230,3290,3440,3470,3530,3590,3660,3720,3780,3840,3870,39
30,3990,4040
 3110 REM SOMEONE HAS MOVED
 3120 NX%=FNN(5):NY%=FNN(7)
 3130 H%=2:U%=B3%:GOSUB 210:PRINT" ";FNP(NX%,4);",";FNP(NY%,4);
 3140 REM CHECK IF THE MOVED SHIP HAD ANY DOCK INFO. IF SO THEN CLEAR IT
 3150 FOR I%=0 TON%:IF D%(I%)=B3% OR D%(I%)=-B3% OR D%(I%)=100+B3% THEN D%(I%)=0
:H%=13:U%=I%+ST%:GOSUB 210:PRINTSPC(3);:U%=B3%:GOSUB 210:PRINTSPC(3);
 3160 NEXT I%
 3170 IF SM%=0 THEN RETURN:REM NO MINES SET
 3180 I%=1
 3190 IF SX%(I%)=NX% AND SY%(I%)=NY% THEN ED%=-SE%(I%)*4:SH%=B3%:GOSUB 10200:GOS
UB 11470:GOTO 3210:REM ENERGY TRANSFER,REMOVE MINE FROM ARRAYS
 3200 I%=I%+1
 3210 IF I%<=SM% THEN 3190
 3220 RETURN
 3230 REM PHASOR CHECK
 3240 NX%=FNN(5):NY%=FNN(7)
 3250 FOR I%=0 TO N%
 3260 IF E%(I%)>=0 AND NX%=X%(I%) AND NY%=Y%(I%) THEN H%=37:U%=I%+ST%:GOSUB 210:
PRINT"PH";CHR$(7);:EL%=200:GOSUB 10000:REM LOSE ENERGY
 3270 NEXT I%
 3280 RETURN
 3290 REM TORP CHECK
 3300 NX%=FNN(5):NY%=FNN(7)
 3310 H%=20:IF (B3%-1)/8<>INT((B3%-1)/8) THEN H%=30:SORT OUT SPACE ON SCREEN FOR
CO-ORDS.
 3320 U%=18+(B3%-1)/8:GOSUB 210:PRINTFNP(NX%,4);",";FNP(NY%,4);
 3330 FOR I%=0 TO N%
 3340 IF E%(I%)<0 THEN 3360:REM SHIP DEAD SO TRY NEXT ONE.
 3350 IF ABS(NX%-X%(I%))<6 AND ABS(NY%-Y%(I%))<6 THEN H%=37:U%=I%+ST%:GOSUB 210:
PRINT"TO";CHR$(7);:EL%=400:GOSUB 10000:REM LOSE ENERGY
 3360 NEXT I%
 3370 IF NX%<>AX%((ST%-1)/4+1) OR NY%<>AY%((ST%-1)/4+1) THEN RETURN:REM CHECK FO
R SPC STN DAMAGE
 3380 AE%=AE%-400:H%=20:U%=21:GOSUB 210:PRINT"STATION HIT....";FNP(AE%,5);CHR$(7
);
 3390 IF AE%>=0 THEN RETURN:REM CHECK REMAINING DEFENCE ENERGY.
 3400 H%=20:U%=21:GOSUB 210:PRINT"STATION DESTROYED...";
 3410 FOR I%=0 TO N%:IF E%(I%)>0 THEN E%(I%)=0:GOSUB 9000:REM DRAIN ENERGY IN RE
MAINING SHIPS.
 3420 NEXT I%
 3430 RETURN
 3440 REM SPACE MINE MSG
 3450 H%=20:U%=21:GOSUB 210:PRINT"SHIP ";FNP(B3%,2);" DROPPED MINE";
 3460 RETURN
 3470 REM TXT MSG
 3480 IF B4%<>0 AND (B4%>ST%+N% OR B4%<ST%) THEN RETURN:REM PRIVATE MSG FOR ANOT
HER SHIP.
 3490 D$="(":B$=")":IF B4%=0 THEN D$="'":B$="'":REM PARENTHESIS FOR PRIVATE MSG,
"'" FOR PUBLIC.
 3500 A$=MID$(A$,5):H%=17:U%=INT((B3%-1)/4)*4+2:GOSUB 210
 3510 A$=LEFT$(A$+"                                        ",40):PRINTD$;LEFT$(A
$,20);B$;:U%=U%+1:GOSUB 210:PRINTD$;RIGHT$(A$,20);B$;:REM THAT WAS 40 SPACES.
 3520 RETURN
 3530 REM DOCK REQUEST
 3540 IF B4%<ST% OR B4%>ST%+N% THEN RETURN
 3550 IF E%(B4%-ST%)<0 OR D%(B4%-ST%)<>0 OR FNN(5)<>X%(B4%-ST%) OR FNN(7)<>Y%(B4
%-ST%) THEN A$=CHR$(40)+CHR$(36)+CHR$(32+B4%)+CHR$(32+B3%):GOSUB 8000:RETURN:REM
DOCK REFUSAL IF REQUESTED SHIP IS DEAD, BUSY OR WRONGLY PLACED.
 3560 H%=13:U%=B3%:GOSUB 210:PRINT"R";B4%;
 3570 D%(B4%-ST%)=B3%+100
 3580 RETURN
 3590 REM DOCKING ACCEPT MESSAGE
 3600 IF B4%<ST% OR B4%>ST%+N% THEN RETURN
 3610 IF E%(B4%-ST%)<0 OR D%(B4%-ST%)<>-B3% THEN RETURN:REM DEAD OR NOT REQUESTE
D.
 3620 H%=13:U%=B3%:GOSUB 210:PRINT"D";B4%;
```

PROGRAM FILE

```
3630 U%=B4%:GOSUB 210:PRINT"D";B3%;
3640 D%(B4%-ST%)=B3%
3650 RETURN
3660 REM DOCK REJECT
3670 IF B4%<ST% OR B4%>ST%+N% THEN RETURN
3680 IF D%(B4%-ST%)<>-B3% THEN RETURN:REM NOT REQUESTED.
3690 D%(B4%-ST%)=0
3700 H%=13:U%=B4%:GOSUB 210:PRINTSPC(3);
3710 RETURN
3720 REM UNDOCKING MESSAGE
3730 IF B4%<ST% OR B4%>ST%+N% THEN RETURN
3740 IF D%(B4%-ST%)<>B3% THEN RETURN:REM NOT DOCKED.
3750 D%(B4%-ST%)=0
3760 H%=13:U%=B4%:GOSUB 210:PRINTSPC(3);:U%=B3%:GOSUB 210:PRINTSPC(3);
3770 RETURN
3780 REM ENERGY TRANSFER
3790 IF B4%<ST% OR B4%>ST%+N% THEN RETURN
3800 IF E%(B4%-ST%)<0 THEN RETURN
3810 EL%=-FNN(6)*(ASC(MID$(A$,5))-33):REM SIGN OF ENERGY IS IN THE 6TH BYTE.
3820 I%=B4%-ST%:GOSUB 10000
3830 RETURN
3840 REM SHIP INACTIVE MSG
3850 H%=2:U%=B3%:GOSUB 210:PRINT")";:REM INDICATE WITH PARENTHESIS AROUND SHIP NUM.
3860 RETURN
3870 REM SHIP DESTROYED MSG
3880 H%=3:U%=B3%:GOSUB 210:PRINT"DESTROYED";
3890 REM CLEAN UP DOCK STATUS
3900 FORI%=0TON%:IF D%(I%)=B3% OR D%(I%)=-B3% OR D%(I%)=100+B3% THEN D%(I%)=0:H%=13:U%=B3%:GOSUB 210:PRINTSPC(3);:U%=B4%:GOSUB 210:PRINTSPC(3);
3910 NEXT I%
3920 RETURN
3930 REM IMPROBABILITY MSG
3940 H%=3:U%=B3%:GOSUB 210:PRINTSPC(9);:REM POSITION NO LONGER KNOWN.
3950 REM CLEAR DOCK STATUS IF ANY
3960 FOR I%=0 TON%:IF D%(I%)=B3% OR D%(I%)=-B3% OR D%(I%)=100+B3% THEN D%(I%)=0:H%=13:U%=I%+ST%:GOSUB 210:PRINTSPC(3);:U%=B3%:GOSUB 210:PRINTSPC(3);
3970 NEXT I%
3980 RETURN
3990 REM POS OF STN RECEIVED
4000 I%=(B4%-1)/4+1
4010 AX%(I%)=FNN(5):AY%(I%)=FNN(7)
4020 GOSUB 12700:PRINT IT ON SCREEN.
4030 RETURN
4040 REM STATION DESTROYED MSG
4050 I%=(B4%-1)/4+1
4060 H%=17:U%=(I%-1)*4+1
4070 GOSUB 210:PRINT"STATION DESTROYED";CHR$(7);CHR$(7);
4080 RETURN
5000 REM SEND REPEATING MSGS
5010 REM SHIP MOVE MSGS
5020 FOR I%=0 TO N%
5030 IF E%(I%)<=W%(I%) OR W%(I%)=0 OR F%(1,I%)<>0 THEN GOTO 5140:REM SKIP IF NO ENERGY, SPEED OR PREVIOUS MSG HAS NOT RETURNED.
5040 H%=34:U%=I%+ST%:GOSUB 210:PRINT"W";W%(I%);
5050 IF D%(I%)<>0 THEN GOSUB 7000:REM CLEAR DOCK STATUS
5060 NX%=MX%(I%)-X%(I%):NY%=MY%(I%)-Y%(I%)
5070 X%(I%)=X%(I%)+SGN(NX%)*W%(I%):Y%(I%)=Y%(I%)+SGN(NY%)*W%(I%)
5080 IF ABS(NX%)<W%(I%) THEN X%(I%)=MX%(I%)
5090 IF ABS(NY%)<W%(I%) THEN Y%(I%)=MY%(I%)
5100 IF Y%(I%)=MY%(I%) AND X%(I%)=MX%(I%) THEN W%(I%)=0:WD%(I%)=0:H%=24:U%=I%+ST%:GOSUB 210:PRINTSPC(12);:REM DESTINATION REACHED
5110 SH%=I%+ST%:GOSUB 10240:REM SEND MOVE MSG
5120 EL%=W%(I%):GOSUB 10000:REM TAKE AWAY ENERGY
5130 IF W%(I%)<WD%(I%) THEN W%(I%)=W%(I%)+1:REM SPEED UP TO WARP DESTINATION.
5140 NEXT I%
5150 REM TORPEDO MOVE MSGS
5160 FOR I%=0 TO N%
5170 IF TM%(I%)=0 OR F%(3,I%)<>0 THEN 5260
5180 NX%=TU%(I%)-TX%(I%):NY%=TV%(I%)-TY%(I%)
5190 TX%(I%)=TX%(I%)+SGN(NX%)*15:TY%(I%)=TY%(I%)+SGN(NY%)*15
5200 IF ABS(NX%)<15 THEN TX%(I%)=TU%(I%)
5210 IF ABS(NY%)<15 THEN TY%(I%)=TV%(I%)
5220 IF TY%(I%)<>TV%(I%) OR TX%(I%)<>TU%(I%) THEN 5250
5230 TM%(I%)=0:H%=20:IF(CS%+ST%-1)/8<>INT((CS%+ST%-1)/8) THEN H%=30
5240 U%=18+(CS%+ST%-1)/8:GOSUB 210:PRINTSPC(9);
5250 SH%=I%+ST%:X%=TX%(I%):Y%=TY%(I%):GOSUB 10450:REM SEND T.MOVE MSG
5260 NEXT I%
5270 RETURN
6000 REM READ BUFFER
6010 REM SETS S% TO I AND RETURNS A$
6020 X%=ADVAL(-2):REM X%=0 IF NO CHARS IN BUFFER
6030 IF X%=0 THEN S%=0:RETURN
6040 S%=1
6050 REM SERIAL I/P ON
6060 *FX2,1
6070 Y%=GET AND 127:Z%=GET AND 127:A$=CHR$(Y%)+CHR$(Z%)
6080 REM READ IN REST OF MSG
6090 FOR Q%=1 TO Z%-34:Y%=GET AND 127:A$=A$+CHR$(Y%)
6100 NEXT Q%:*FX2,2
6110 REM SWITCH SERIAL OFF
6120 RETURN
7000 REM CLEAR DOCK STATUS
7010 IF D%(I%)>100 THEN H%=13:U%=D%(I%)-100:GOSUB 210:PRINTSPC(3);:D%(I%)=0
7020 IF D%(I%)<0 THEN H%=13:U%=I%+ST%:GOSUB 210:PRINTSPC(3);:D%(I%)=0
7030 IF D%(I%)>0 THEN H%=13:U%=I%+ST%:GOSUB 210:PRINTSPC(3);:U%=D%(I%):GOSUB 210:PRINTSPC(3);:D%(I%)=0
7040 RETURN
8000 REM SEND THE MSG IN A$
8010 IF ASC(MID$(A$,3))>=ST%+32 AND ASC(MID$(A$,3))<=ST%+N%+32 THEN F%(ASC(A$)-32,ASC(MID$(A$,3))-32-ST%)=-1:REM DISALLOW >1 MSGS OF 1 TYPE SENT BY ONE SHIP AT ONE TIME
8020 FOR Q%=1 TO LEN(A$)
8030 YY%=ASC(MID$(A$,Q%))
8040 IF YY%<32 THEN YY%=YY%+32:REM CONV CTRL CHRS TO NORM
8050 REM SEND A CHAR TO SERIAL
8060 PROCoscli(" FX138,2,"+STR$(YY%))
8070 NEXT Q%
8080 RETURN
8090 REM OSCLI FIX FOR BBC BASIC I ONLY.
8100 DEF PROCoscli(fx$)
8110 LOCAL X%,Y%
8120 X%=os% MOD 256
8130 Y%=os% DIV 256
8140 fx$=fx$+CHR$(13)
8150 $os%=fx$
8160 CALL(&FFF7)
8170 ENDPROC
9000 REM SEND SHIP INACTIVE MSG
9010 H%=18:U%=I%+ST%:GOSUB 210:PRINTSPC(4);
9020 W%(I%)=0
9030 A$=CHR$(43)+CHR$(36)+CHR$(I%+ST%+32)+CHR$(32)
9040 GOSUB 8000
9050 RETURN
9060 REM SEND SHIP DESTROYED MSG
```

PROGRAM FILE

```
 9070 H%=3:U%=I%+ST%:GOSUB 210:PRINT"DESTROYED";SPC(27);
 9080 E%(I%)=-1:W%(I%)=0
 9090 A$=CHR$(44)+CHR$(36)+CHR$(I%+ST%+32)+CHR$(32)
 9100 GOSUB 8000
 9110 REM SEARCH FOR A LIVE SHIP AND MAKE THAT THE CURRENT SHIP.
 9120 FOR Z%=0 TO N%:IF E%(Z%)<0 THEN NEXT Z%
 9130 IF Z%=N%+1 THEN H%=20:U%=21:GOSUB 210:PRINT"WITHDRAWN FROM GAME.";:QT%=1:G
OTO 600: REM SET IT TO IGNORE COMMANDS
 9140 CS%=Z%:Z%=N%:NEXT Z%:GOSUB 12300:REM PUT * WITH CURRENT SHIP
 9150 RETURN
10000 REM LOSE ENERGY EL% ON SHIP I%(INTERNAL)
10010 E%(I%)=E%(I%)-EL%:H%=18:U%=I%+ST%:GOSUB 210:PRINTFNP(E%(I%),4);
10020 IF E%(I%)=0 THEN GOSUB 9000:REM SEND SHIP INACTIVE MSG
10030 IF E%(I%)<0 THEN GOSUB 9060:REM SEND SHIP DESTROYED MSG
10040 RETURN
10100 REM OPTIONAL INITIALISE
10110 REM CALL THIS IF YOUR BASIC NEEDS IT.
10120 DEFFNN(P%)=ASC(MID$(A$,P%))-32+95*(ASC(MID$(A$,P%+1))-32):REM EXTRACT NUM
FROM MSG.
10130 DEFFNH(P%)=32+ABS(P%) DIV 95:REM CONVERT NUM TO HIGH BYTE READY FOR TRANSM
ISSION.
10140 DEFFNL(P%)=32+ABS(P%) MOD 95:REM DITTO LOW ORDER BYTE.
10150 DEFFNR(P%)=RND(P%):REM RETURN A RANDOM NUMBER FROM 0 TO P%-1
10160 DEFFNP(P%,Q%)=RIGHT$("      "+STR$(P%),Q%):REM RIGHT JUSTIFY P% IN Q% CHARS
. MAY NEED MODIFICATION IF YOUR BASIC DOESN'T DO FM'S OF STRINGS & 2 PARAMETERS.
10170 RETURN
10200 REM ENERGY TRANSFER ED% TO SH%
10210 A$=CHR$(42)+CHR$(39)+CHR$(ST%+32)+CHR$(SH%+32)+CHR$(33+SGN(ED%))+CHR$(FNL(
ED%))+CHR$(FNH(ED%))
10220 GOSUB 8000
10230 RETURN
10240 REM TX MOVE SH%,X%(,Y%(
10250 HS%=SH%-ST%:REM HS% IS INTERNAL NUM
10260 A$=CHR$(33)+CHR$(40)+CHR$(SH%+32)+CHR$(32)+CHR$(FNL(X%(HS%)))+CHR$(FNH(X%(
HS%)))+CHR$(FNL(Y%(HS%)))+CHR$(FNH(Y%(HS%)))
10270 GOSUB 8000
10300 REM PRINT SHIP POS
10310 H%=3:U%=SH%:GOSUB 210:PRINTFNP(X%(HS%),4);",";FNP(Y%(HS%),4);
10320 FOR J%=1 TO 4:REM SPACE STN CHECK.
10330 IF X%(HS%)<>AX%(J%) OR Y%(HS%)<>AY%(J%) THEN NEXT J%:RETURN
10340 IF J%=INT((ST%-1)/4+1) AND AE%>1001 THEN AE%=AE%-1000:E%(HS%)=9999:H%=18:U
%=HS%+ST%:GOSUB 210:PRINT FNP(E%(HS%),4);:NEXT J%:RETURN:REM REPLENISH ENERGY IF
 SHIP AT SPC STN.
10350 I%=HS%:GOSUB 9060:NEXT J%:RETURN:REM DESTROY SHIP IF IT WAS ON ANOTHER SPC
 STN.
10400 REM TX PHASOR SH%,X%,Y%
10410 M%=2
10420 A$=CHR$(M%+32)+CHR$(40)+CHR$(SH%+32)+CHR$(32)+CHR$(FNL(X%))+CHR$(FNH(X%))+
CHR$(FNL(Y%))+CHR$(FNH(Y%))
10430 GOSUB 8000
10440 RETURN
10450 REM TX TORPEDO SH%,X%,Y%
10460 H%=20:IF (SH%-1)/8<>INT((SH%-1)/8) THEN H%=30
10470 U%=18+(SH%-1)/8:GOSUB 210:PRINTFNP(X%,4);",";FNP(Y%,4);
10480 M%=3: GOTO 10420:REM USE 2ND HALF OF PHASOR ROUTINE.
10490 REM TX SPACE MINE WARNING SH%
10500 A$=CHR$(36)+CHR$(36)+CHR$(CS%+ST%+32)+CHR$(32)
10510 GOSUB 8000
10520 RETURN
10600 REM SEND A TEXT MESSAGE.
10610 GOSUB 1000:REM GET NUMBER
10620 IF G%=1 THEN H%=20:U%=21:GOSUB 210:PRINT"NO SHIP NUMBER GIVEN";:RETURN
10630 IF PO%+1>LEN(C$) THEN H%=20:U%=21:GOSUB 210:PRINT"NO MESSAGE TXT GIVEN";:R
ETURN
10640 A$=CHR$(37)+CHR$(36+LEN(MID$(C$,PO%,LEN(C$)-PO%)))+CHR$(CS%+ST%+32)+CHR$(V
%+32)+MID$(C$,PO%,LEN(C$)-PO%)
10650 GOSUB 8000
10660 RETURN
10700 REM DOCKING COMMANDS
10710 D$=MID$(C$,2,1)
10720 GOSUB 1000:REM GET PARAM.
10730 IF V%=0 OR (V%>=ST% AND V%<=ST%+N%) THEN H%=20:U%=21:GOSUB 210:PRINT"INVAL
ID SHIP NUMBER.":RETURN
10740 IF D$="R" THEN GOTO 10800 :REM REQUEST
10750 IF D$="A" THEN GOTO 10860 :REM ACCEPT
10760 IF D$="N" THEN GOTO 10920 :REM REFUSE
10770 IF D$="U" THEN GOTO 10980 :REM UNDOCK
10780 H%=20:U%=21:GOSUB 210:PRINT"INVALID DOCKING CMD.";
10790 RETURN
10800 IF D%(CS%)<>0 THEN H%=20:U%=21:GOSUB 210:PRINT"THIS SHIP NOT FREE..":RETUR
N
10810 H%=13:U%=CS%+ST%:GOSUB 210:PRINT"P";V%;
10820 A$=CHR$(38)+CHR$(40)+CHR$(32+ST%+CS%)+CHR$(32+V%)+CHR$(FNL(X%(CS%)))+CHR$(
FNH(X%(CS%)))+CHR$(FNL(Y%(CS%)))+CHR$(FNH(Y%(CS%)))
10830 GOSUB 8000
10840 D%(CS%)=-V%
10850 RETURN
10860 IF D%(CS%)<>V%+100 THEN H%=20:U%=21:GOSUB 210:PRINT"ACCEPT WHAT REQUEST.";
:RETURN
10870 H%=13:U%=CS%+ST%:GOSUB 210:PRINT"D";V%:U%=V%:GOSUB 210:PRINT"D";CS%+ST%;
10880 A$=CHR$(39)+CHR$(36)+CHR$(32+ST%+CS%)+CHR$(32+V%)
10890 GOSUB 8000
10900 D%(CS%)=V%
10910 RETURN
10920 IF D%(CS%)<>V%+100 THEN H%=20:U%=21:GOSUB 210:PRINT"REFUSE WHAT REQUEST?";
:RETURN
10930 H%=13:U%=V%:GOSUB 210:PRINTSPC(3);
10940 A$=CHR$(40)+CHR$(36)+CHR$(32+ST%+CS%)+CHR$(32+V%)
10950 D%(CS%)=0
10960 GOSUB 8000
10970 RETURN
10980 IF D%(CS%)<=0 OR D%(CS%)>100 THEN H%=20:U%=21:GOSUB 210:PRINT"UNDOCK WHAT
SHIP ?..";:RETURN
10990 H%=13:U%=ST%+CS%:GOSUB 210:PRINTSPC(3);:U%=V%:GOSUB 210:PRINTSPC(3);
11000 A$=CHR$(41)+CHR$(36)+CHR$(32+ST%+CS%)+CHR$(32+V%)
11010 D%(CS%)=0
11020 GOSUB 8000
11030 RETURN
11100 REM SPACE MINE
11110 GOSUB 1000:REM GET ENERGY OF MINE TO BE LAID.
11120 IF V%<26 OR V%>2000 THEN H%=20:U%=21:GOSUB 210:PRINT"MIN 25,MAX 2000UNITS"
;:RETURN
11130 IF SM%=10 THEN H%=20:U%=21:GOSUB 210:PRINT"NOT ENOUGH CANISTERS";:RETURN
11140 IF E%(CS%)<V%+1 THEN H%=20:U%=21:GOSUB 210:PRINT"NOT ENOUGH ENERGY...";:RE
TURN
11150 EL%=V%:I%=CS%:GOSUB 10000
11160 GOSUB 10500:REM SEND WARNING
11170 SM%=SM%+1:SX%(SM%)=X%(CS%):SY%(SM%)=Y%(CS%):SE%(SM%)=V%-25:GOSUB 11190
11180 RETURN
11190 REM PRINT SPACE MINE LIST
11200 FOR U%=18 TO 22:H%=0:GOSUB 210:PRINTSPC(19);:NEXT U%
11210 IF SM%=0 THEN RETURN
11220 FOR K%=1 TO SM%
11230 H%=0:IF K%/2=INT(K%/2) THEN H%=10
11240 U%=(1+K%)/2+17:GOSUB 210:PRINTFNP(SX%(K%),4);",";FNP(SY%(K%),4);
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PROGRAM FILE

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11250 NEXT K%
11260 RETURN
11300 REM ENERGY TRANSFER
11310 GOSUB 1000
11320 IF D%(CS%)<=0 OR D%(CS%)>100 THEN H%=20:U%=21:GOSUB 210:PRINT"SHIPS ARE NO
T DOCKED";:RETURN
11330 IF E%(CS%)-V%<=0 THEN H%=20:U%=21:GOSUB 210:PRINT"NOT ENOUGH ENERGY...";:R
ETURN
11340 IF V%=0 THEN RETURN
11350 ED%=V%:SH%=D%(CS%):GOSUB 10200:REM TX ENERGY
11360 EL%=V%:I%=CS%:GOSUB 10000
11370 RETURN
11400 REM UNLAY SPACE MINE
11410 IF SM%=0 THEN H%=20:U%=21:GOSUB 210:PRINT"NO MINES LAID HERE..";:RETURN
11420 I%=1
11430 IF SX%(I%)=X%(CS%) AND SY%(I%)=Y%(CS%) THEN EL%=-SE%(I%):II%=I%:I%=CS%:GOS
UB 10000:I%=II%:GOSUB 11470:GOTO11450:REM DELETE MINE FROM LIST
11440 I%=I%+1
11450 IF I%<=SM% THEN 11430
11460 RETURN
11470 REM REMOVE MINE FROM ARRAYS AND MOVE OTHERS DOWN
11480 IF SM%=I% THEN 11520:REM MINE WAS AT TOP OF LIST
11490 FOR J%=I% TO SM%-1
11500 SX%(J%)=SX%(J%+1):SY%(J%)=SY%(J%+1):SE%(J%)=SE%(J%+1)
11510 NEXT J%
11520 SM%=SM%-1
11530 GOSUB 11190:REM PRINT LIST
11540 RETURN
11600 REM HYPERSPACE COMMAND
11610 IF E%(CS%)<201 THEN H%=20:U%=21:GOSUB 210:PRINT"NOT ENOUGH ENERGY...";:RET
URN
11620 IF W%(CS%)<>9 THEN H%=20:U%=21:GOSUB 210:PRINT"WARP 9 TO HYPERSPACE";:RETU
RN
11630 X%(CS%)=MX%(CS%):Y%(CS%)=MY%(CS%)
11640 W%(CS%)=0:H%=24:U%=CS%+ST%:GOSUB 210:PRINTSPC(12);
11650 SH%=CS%+ST%:GOSUB 10240:I%=CS%:EL%=200:GOSUB 10000
11660 RETURN
11700 REM PHASOR CMD
11710 IF E%(CS%)<51 THEN H%=20:U%=21:GOSUB 210:PRINT"NOT ENOUGH ENERGY...";:RETU
RN
11720 GOSUB 1000:X%=V%:GOSUB 1000:Y%=V%
11730 IF ABS(X%-X%(CS%))>100 OR ABS(Y%-Y%(CS%))>100 THEN H%=20:U%=21:GOSUB 210:P
RINT"RANGE TOO LARGE.....";:RETURN
11740 SH%=ST%+CS%:GOSUB 10400:REM TX MSG.
11750 EL%=50:I%=CS%:GOSUB 10000:REM DEDUCT ENERGY.
11760 NX%=X%:NY%=Y%:GOTO3250:REM USE INCOMING CHECKER IN CASE YOU FIRED AT YOURS
ELF!
11800 REM SET WARP SPEED CMD
11810 IF E%(CS%)<=0 THEN H%=20:U%=21:GOSUB 210:PRINT"NOT ENOUGH ENERGY...";:RETU
RN
11820 IF X%(CS%)=MX%(CS%) AND Y%(CS%)=MY%(CS%) THEN H%=20:U%=21:GOSUB 210:PRINT"
NO DESTINATION SET..";:RETURN
11830 GOSUB 1000:REM GET VALUE
11840 IF V%>9 THEN H%=20:U%=21:GOSUB 210:PRINT"MAXIMUM SPEED WARP 9";:V%=9
11850 IF V%>0 AND W%(CS%)=0 THEN W%(CS%)=1
11860 IF V%>W%(CS%) THEN WD%(CS%)=V%:RETURN:REM THE MOVE ROUTINE WILL SPEED UP S
HIP FROM W% TO WD%
11870 IF V%=0 THEN H%=34:U%=CS%+ST%:GOSUB 210:PRINT SPC(3);:W%(CS%)=0:RETURN
11880 W%(CS%)=V%:WD%(CS%)=V%
11890 RETURN
11900 REM SET DESTINATION
11910 IF E%(CS%)<=0 THEN H%=20:U%=21:GOSUB 210:PRINT"NOT ENOUGH ENERGY...";:RETU
RN
11920 GOSUB 1000:MX%(CS%)=V%:GOSUB 1000:MY%(CS%)=V%
11930 H%=24:U%=ST%+CS%:GOSUB 210:PRINTFNP(MX%(CS%),4);",";FNP(MY%(CS%),4);
11940 IF MX%(CS%)=X%(CS%) AND MY%(CS%)=Y%(CS%) THEN W%(CS%)=0:H%=24:U%=CS%+ST%:G
OSUB 210:PRINTSPC(12);
11950 RETURN
12000 REM PHOTON TORP. CMD
12010 GOSUB 1000:X%=V%:GOSUB 1000:Y%=V%
12020 IF E%(CS%)<101 THEN H%=20:U%=21:GOSUB 210:PRINT"NOT ENOUGH ENERGY...":RET
URN
12030 IF TM%(CS%)<>0 THEN RETURN
12040 IF ABS(X%-X%(CS%))>200 OR ABS(V%-Y%(CS%))>200 THEN H%=20:U%=21:GOSUB 210:P
RINT"RANGE TOO LARGE.....";:RETURN
12050 TU%(CS%)=X%:TV%(CS%)=Y%:TX%(CS%)=X%(CS%):TY%(CS%)=Y%(CS%):TM%(CS%)=1
12060 EL%=100:I%=CS%:GOSUB 10000
12070 RETURN
12100 REM IMPROBABILITY DRIVE
12110 IF E%(CS%)<100 THEN H%=20:U%=21:GOSUB 210:PRINT"NOT ENOUGH ENERGY...";:RET
URN
12120 IF E%(CS%)<500 THEN GOTO 12190:REM NOT ENOUGH ENERGY FOR FULL IMPROB
12130 I%=CS%:EL%=500:GOSUB 10000
12140 X%(CS%)=FNR(9000):Y%(CS%)=FNR(9000)
12150 GOSUB 7000:REM CLEAR DOCK STATUS IF ANY
12160 A$=CHR$(45)+CHR$(36)+CHR$(32+CS%+ST%)+CHR$(32)
12170 GOSUB 8000
12180 SH%=CS%+ST%:HS%=CS%:GOTO 10310:REM PRINT POS ON SCRN
12190 REM PSEUDO IMPROB.
12200 EL%=E%(CS%):I%=CS%:GOSUB 10000:REM DRAIN REMAINING ENERGY
12210 X%(CS%)=FNR(9000):Y%(CS%)=FNR(9000)
12220 GOSUB 7000:REM CLEAR DOCK STATUS IF ANY.
12230 SH%=CS%+ST%:GOSUB 10240:REM SEND MOVE MSG
12240 RETURN
12300 REM INDICATE CURRENT SHIP WITH *
12310 FOR U%=ST% TO ST%+N%
12320 H%=2:GOSUB 210:PRINTSPC(1);
12330 NEXT U%
12340 U%=ST%+CS%:GOSUB 210:PRINT"*";
12350 RETURN
12400 REM CLEAR PARTS OF SCREEN (IF TAB OR ^I PRESSED).
12410 H%=20:U%=21:GOSUB 210:PRINTSPC(20);
12420 FOR I%=0 TO 3
12430 H%=37:U%=I%+ST%:GOSUB 210:PRINTSPC(2);
12440 NEXT I%
12450 FOR I%=0 TO 3
12460 IF I%*4+1=ST% THEN 12490
12470 H%=17:U%=I%*4+2:GOSUB 210:PRINTSPC(22);
12480 U%=U%+1:GOSUB 210:PRINTSPC(22);
12490 NEXT I%
12500 FOR U%=18 TO 19
12510 H%=20:GOSUB 210:PRINTSPC(19);:NEXT U%
12520 RETURN
12600 REM SEND SPACE STATION POSNS
12610 FOR I%=1 TO 4
12620 AX%(I%)=FNR(9000)
12630 AY%(I%)=FNR(9000)
12640 A$=CHR$(46)+CHR$(40)+CHR$(CS%+ST%+32)+CHR$(32+(I%-1)*4+1)+CHR$(FNL(AX%(I%
))+CHR$(FNH(AX%(I%)))+CHR$(FNL(AY%(I%)))+CHR$(FNH(AY%(I%)))
12650 GOSUB 8000
12660 GOSUB 12700:REM PRINT IT ON SCREEN
12670 NEXT I%
12680 RETURN
12700 REM PRINT SPACE STN ON SCREEN
12710 H%=17:U%=(I%-1)*4+1
```

PROGRAM FILE

```
12720 IF I%=(ST%-1)/4+1 THEN H%=20:U%=20:REM THIS MICRO'S STN
12730 GOSUB 210:PRINT"STATION:";AX%(I%);",";AY%(I%);
12740 RETURN
13000 REM HELP SCREENS
13010 CLS
13020 PRINT"MULTREK MULTI USER STAR TREK GAME"
13030 PRINT"You control ships ";ST%;" to ";ST%+3;"."
13040 PRINT"Ensure that these are unique in your"
13050 PRINT"group.  You can move your four ships in"
13060 PRINT"the galaxy which has co-ordinate"
13070 PRINT"ranges (0 to 9000,0 to 9000).  Commands"
13080 PRINT"consist of one or two letters followed"
13090 PRINT"by numbers or other information."
13100 PRINT"The next page shows the available"
13110 PRINT"commands."
13120 PRINT"The object of the game is to destroy"
13130 PRINT"the other player's space stations by"
13140 PRINT"firing photon torpedoes which weaken"
13150 PRINT"their defences.  You may use torpedoes,"
13160 PRINT"phasors or space mines to destroy"
13170 PRINT"another player's ships."
13180 PRINT"If your space station is destroyed,"
13190 PRINT"your ships will be drained of their"
13200 PRINT"energy.  You may then join with another"
13210 PRINT"player who may give your ships energy"
13220 PRINT"in return for co-operation."
13230 PRINT"Beware of players who double cross you!"
13240 PRINT:PRINT"**** PRESS SPACE TO CONTINUE ****";:A$=GET$
13250 CLS
13260 PRINT"To change the ship you are commanding,"
13270 PRINT"enter the number followed either by a"
13280 PRINT"command or <ret>."
13290 PRINT"M <x><y> Sets destination co-ords."
13300 PRINT"          Any non digit can be used as"
13310 PRINT"          the separator."
13320 PRINT"W <0-9>  Sets warp speed"
13330 PRINT"H  Hyperspace to dest., only at warp 9."
13340 PRINT"I  Improbability drive to random dest."
13350 PRINT"T <x><y> Sends photon torpedo (one per"
13360 PRINT"          ship at any time.)"
13370 PRINT"P <x><y> Fire phasor, instantaneous."
13380 PRINT"S <e>    Set mine of certain energy"
13390 PRINT"U  Unlay mines at this ship's position."
13400 PRINT"DR <n> Request a dock with ship <n>."
13410 PRINT"DA <n> Accept dock request from ship."
13420 PRINT"DN <n> Refuse dock request from ship."
13430 PRINT"DU <n> Undock from ship <n>."
13440 PRINT"E <e>  Transfer energy to docked ship."
13450 PRINT"' <txt> Send text message to all ships."
13460 PRINT"C <n>   Send text message to ship <n>."
13470 PRINT"QUIT   Withdraw from the game."
13480 PRINT"^I=Tidy scrn,^R=Repeat cmd,^X=Clear cmd"
13490 IF ST%=1 THEN PRINT"Now press space after the others have.";
13500 IF ST%<>1 THEN PRINT"Press space to start.";
13510 A$=GET$:RETURN
```

Atari GTIA+

by Paul Lay

The 8-bit Atari micros have very sophisticated graphics capabilities thanks to a couple of custom chips, ANTIC and GTIA. Much of their power is derived from the fact that a 256-colour palette is provided. However, at best only 16 of these colours can be displayed at once. Display list interrupts can be used to alter colours, but these are restrictive.

This program provides a custom display list which allows all 256 colours to be freely displayed with a resolution of 80 by 96. The principle behind this display is that every scan line alternates between 16 luminance and 16 hue modes (GTIA modes 9 and 11), so that the overall effect is of a single scan line with all 256 models.

Graphics routines

To support this custom graphics mode, a full set of graphics routines have been provided (something which the Atari ROM has always lacked). They interface to Basic via USR calls and are described below. In the program, lines 10 to 1360 set up the routines, and lines 1370 onwards provide a demonstration program, showing how the routines are used.

Graphics

<var> = USR(GRAPHICS, <option>) where <option> is one of FULLCLR, SPLITCLR, FULLNOCLR or SPLITNOCLR.

This routine opens the custom graphics mode with all the standard screen configurations provided for. Note that in order to switch between GTIA modes 9 and 11 every scan line, a display list interrupt is used which alters PRIOR ($D01B). Particularly interesting about this DLI is that the glitch problem associated with keyboard input has been resolved. This was performed by synchronising to the vertical line counter VCOUNT ($D40B).

Colour

COLOR c

Note that colour is still specified by the Basic COLOR statement. The only difference is that the colour is specified by a value in the range 0 to 255, which represents 16*hue+luminance.

PROGRAM FILE

Plot
<var> = USR (PLOT x,y)
This routine plots the pixel at position x,y in the current colour.

Drawto
<var> = USR (DRAWTO x,y)
This routine draws a line from the current graphics cursor position to position x,y in the current colour. Note that the generalised integer Bresenham's algorithm is used, working with byte arithmetic.

Mode
<var> = USR (MODE, <option>) where <option> is one of NORMAL, ANDMODE, ORMODE or XOR.
This routine allows special plotting modes to be used (normal, and, or, and exclusive or plotting modes). These modes are commonly used for special effects such as animation, colour blending and masking.

Move
<var> = USR (MOVE, x,y)
This routine moves the graphics cursor to position x,y

Locate
<var> = USR (LOCATE, x,y)
This routine returns to the calling variable the colour of the pixel specified at position x,y

Fill
<var> = USR (FILL x,y)
This routine performs an area fill in the current colour at position x,y (an area fill fills the area identified by the colour under the specified position, and is capable of filling any shape). Note that a scan line seed fill algorithm is used which specifically minimises stack use.

Circle
<var> = USR (CIRCLE, x,y,r)
This routine draws a circle in the current colour with centre x,y and radius r. Bresenham's incremental circle algorithm is used.

Disc
<var> = USR (DISC, x,y,r)
This routine draws a disc (filled circle) in the current colour with centre x,y and radius r.
Clipping off the screen is provided but suffers from the fact that the Basic USR command can only accept positive parameter values. Also, as byte arithmetic is extensively used (for efficiency), any value exceeding 255 will be truncated accordingly.

When normally using any of the GTIA modes, SETCOLOR 4, hue, lum is used to alter colours. Obviously, this is now no longer needed as all 256 colours are readily available. However, by experimenting with SETCOLOR 4, hue, lum, filter effects can be generated (effectively giving an enormous colour palette).

Finally, note that the routines reside in memory between locations $782B and $7ECO. When the routines have been set up, users with a disk drive could always enter DOS and save a binary file between these addresses, removing the need for lines 90 to 1190 by loading the binary file instead.

```
100 REM ************************
110 REM *      GTIA+ GRAPHICS    *
120 REM *        By Paul Lay     *
130 REM ************************
140 REM
150 REM --- M/C CODE DATA ---
160 DATA 533A9B0102D3D6D5D6D5D0AD2D0D4C68C901D05F68682903AABD2E788D0A78BD32788D2
9784CD67968C902DD436S6S8D1178
170 DATA 8D27786868SD1278SD28784C9679AD27789D1378AD28788D147868C902D02268688D157
88D27868688D167SSD28784C5A7A
180 DATA 68C901D0DA686829038D0B784C587BAAF0056868CAD0FB6068C902D0F268688D2778686
88D28786068C902D0E268688D1178
190 DATA 6868SD127820657B85D4A90085D56068C902D0C968688D117868688D12784CE27BA9008
DC07868C903D0B268688D24786868
200 DATA 8D25786868SD23784C0F7DA9018D00784CE778A260A90C9D42032056E4A260A9039D420
3A92B9D4403A9789D4503AD0A789D
210 DATA 4A03A9089D4B032056E4A9578D0002A9798D0102AD300285CBAD310285CCA001A9F091C
BA9F08D0ED4A9008D13788D147860
220 DATA 488A48AD6F02293F8D0C78AD0BD4C90FD0F9AE2978AD0C788D0AD409C08D0AD48D1BD0A
D0C7809408D0AD48D1BD0AD0C78CA
230 DATA D0E78D0AD48D1BD068AA684060AD11783OFAC950B0F6AD12783OF1C960B0ED85CBA9008
5CC05CB26CC06CB26CC06CB26CC06
240 DATA CB26CCA5CB85CDA5CC85CE06CB26CC06CB26CCA5CB1865CD85CBA5CC65CE85CCA5CB186
55885CBA5CC655985CCAD11784AA8
250 DATA B01FA9F08D0D78A90F8D0E78A5C829F08D0F78A5C8290F0A0A0A0A8D10784C2A7AA90F8
D0D78A9F08D0E78A5C829F04A4A4A
260 DATA 4A8D0F78A5C8290F8D1078B1CB2D0D78AD0F788D0F78B1CB2D0E780D0F7891CB9818692
8A8B1CB2D0D78AD10788D1078B1CB
270 DATA 2D0E780D107891CB60A9008D2A788D1E78AD13788D1178AD14788D1278AD157838ED137
8F00BB00D49FF186901A2FF3006A2
280 DATA 001002A2018D17788E1B78AD167838ED1478F00BB00D49FF186901A2FF3006A2001002A
2018D18788E1C78AD1878CD177890
290 DATA 0E48AD17788D18786B8D1778EE2A78AD17780A8D1978AD18780A8D1A78AD1A7838ED177
88D1D78B003CE1E78AD17788D1F78
300 DATA 209679AD1E783037D005AD1D78F030AD2A78F00EAD1178186D1B788D1178100C300AAD1
278186D1C788D1278AD1D7838ED19
310 DATA 788D1D78B003CE1E7810C630C4AD2A78F00EAD1278186D1C788D1278100C300AAD11781
86D1B788D1178AD1D78186D1A788D
320 DATA 1D789003EE1E78CE1F78109060AE0B78BD36788D2F7A8D497A60AD127885CBA90085CC0
3CB26CC03CB26CC06CB26CC06CB26
```

PROGRAM FILE

```
330 DATA CCA5CB85CDA5CC85CE06CB26CC06CB26CCA5CB1865CD85CBA5CC65CE85CCA5CB1865588
5CBA5CC655985CCAD11784AA8B019
340 DATA B1CB29F08D0D7898186928A8B1CB29F04A4A4A4A186D0D7860B1CB290F0A0A0A0A8D0D7
89318692 8A8B1CB290F186D0D7860
350 DATA 60AD11783OFAC950B0F6AD127830F1C960B0EDAD11788DC17EAD12788D117FA9018D097
920657B8D2678CE097810 0160AE09
360 DATA 78BDC17E8D1178BD117F8D1278209679AD11788D2078EE1178AD1178C950100E20A87BC
D2678D00620E8794C297CAE1178CA
370 DATA 8E2278AD20788D1178CE1178300E20A87BCD2678D00620E8794C4E7CAE1178E88E2178C
E12783049AD22788D117820657BAD
380 DATA 1178CD2178303820A87BCD2678D02ACE1178AD1178CD2178300820A87BCD2678F0EDAE0
978AC1178C8989DC17EAD12789D11
390 DATA 7FEE09784C767CCE11784C767CEE1278EE1278AD1278C960F049AD22788D117820657BA
D1178CD2178303820A87BCD2678D0
400 DATA 2ACE1178AD1178CD2178300820657BCD2678F0EDAE0978AC1178C8989DC17EAD12789D1
17FEE09784CCC7CCE11784CCC7C4C
410 DATA 0B7CA9008D01788D0378AD23788D0278A90138ED23788D0578A900E9008D06780E05782
E0678ADC078D00620387E4C417D20
420 DATA 777EAD0278CD03783011F00FAD0678300BD043AD0578D03E4CDD760A05780A9D0778A
D06782A8D0878AD02780A186D0778
430 DATA 8D07789003EE0878AD07838E9018D0778B003CE0878AD0878303BD04FAD0778F034D04
8AD05780A8D0778AD06782A8D0878
440 DATA AD0178OA8D0478AD07819ED04788D0778B003CE0878AD0878301FD054AD0778F018D04
DEE0178AD01780A386D05788D0578
450 DATA 9003EE06784C337DEE0178CE0278AD01780A386D05788D05789003EE0678AD02780A8D0
478AD057838ED04788D0578B003CE
460 DATA 0678EE0578D003EE06784C337DCE0278AD02780A8D0478AD057838ED0478AD0578B003C
E0678EE0578D003EE06784C337DAD
470 DATA 2478186D01788D1178AD2578186D02788D127820967 9AD257838ED02788D1278209679A
D247038ED01788D1178209679AD25
480 DATA 78186D02788D12782096796 0AD01780A8D1F78AD25784838ED02783D1278 D147868136
D02788D1678AD247838ED01788D11
490 DATA 78209679AD1F78F01AEE1178AD14788D1278209679AD16788D1278209679CE1F78D0E63
00000000000000000000000000000
500 REM --- READ M/C DATA ---
510 TRAP 620
520 ? :? "INSTALLING GTIA+ GRAPHICS ROUTINES"
530 DATA 0,1,2,3,4,5,6,7,8,9,0,0,0,0,0,0,0,10,11,12,13,14,15
540 DIM HEX(22),CODE$(100)
550 RESTORE 530:FOR I=0 TO 22:READ J:HEX(I)=J:NEXT I
560 CHKSM=0:ADDR=30763:RESTORE 160
570 FOR I=1 TO 34:READ CODE$
580 FOR J=0 TO 49:BYTE=16*HEX(ASC(CODE$(2*J+1))-48)+HEX(ASC(CODE$(2*J+2))-48)
590 CHKSM=CHKSM+BYTE:POKE ADDR+J,BYTE
600 NEXT J:ADDR=ADDR+50:NEXT I
610 IF CHKSM=177693 THEN 630
620 ? :? "ERROR IN DATA STATEMENTS":STOP
630 TRAP 65535
640 REM --- ROUTINE LABELS ---
650 LET GRAPHICS=30778
660 LET PLOT=30803
670 LET DRAWTO=30827
680 MODE=30863
690 MOVE=30887
700 LET LOCATE=30903
710 FILL=30928
720 CIRCLE=30946
730 DISC=30974
740 REM --- PARAMETER LABELS ---
750 REM --- GRAPHICS OPTIONS ---
760 FULLCLR=0:SPLITCLR=1
770 FULLNOCLR=2:SPLITNOCLR=3
780 REM --- MODE OPTIONS ---
790 NORMAL=0:ANDMODE=1
800 ORMODE=2:XOR=3
810 REM --- DEMO PROGRAM ---
820 DIM T$(40)
830 FOR DEMO=1 TO 7
840 ON DEMO GOSUB 860,960,1020,1080,1250,1370,1500
850 NEXT DEMO:GOTO 830
860 T$="GTIA+ GRAPHICS":GOSUB 1540
870 CALL=USR(GRAPHICS,FULLCLR)
880 FOR X=0 TO 79
890 COLOR X
900 CALL=USR(MOVE,0,0)
910 CALL=USR(DRAWTO,X,95)
920 COLOR 80+X
930 CALL=USR(MOVE,79,95)
940 CALL=USR(DRAWTO,79-X,0)
950 NEXT X:GOSUB 1600:RETURN
960 T$="CIRCLES":GOSUB 1540
970 CALL=USR(GRAPHICS,FULLCLR)
980 FOR X=0 TO 63
990 COLOR 32+X
1000 CALL=USR(CIRCLE,X,X,X)
1010 NEXT X:GOSUB 1600:RETURN
1020 T$="DISCS":GOSUB 1540
1030 CALL=USR(GRAPHICS,FULLCLR)
1040 FOR X=0 TO 5
1050 COLOR 42+14*X
1060 CALL=USR(DISC,39+4*X,47,30-5*X)
1070 NEXT X:GOSUB 1600:RETURN
1080 T$="AREA FILLS":GOSUB 1540
1090 CALL=USR(GRAPHICS,FULLCLR)
1100 COLOR 15
1110 X=5:Y=8:SIZE=69
1120 CALL=USR(MOVE,X,Y)
1130 FOR I=1 TO 7
1140 CALL=USR(DRAWTO,X,Y+SIZE)
1150 CALL=USR(DRAWTO,X+SIZE,Y+SIZE)
1160 CALL=USR(DRAWTO,X+SIZE,Y+5)
1170 CALL=USR(DRAWTO,X+5,Y+5)
1180 X=X+5:Y=Y+5:SIZE=SIZE-10:NEXT I
1190 COLOR 136
1200 CALL=USR(FILL,39,95)
1210 COLOR 0
```

PROGRAM FILE

```
1220 CALL=USR(FILL,39,0)
1230 CALL=USR(FILL,5,8)
1240 RETURN
1250 T$="SPECIAL PLOTTING MODES"
1260 GOSUB 1540
1270 CALL=USR(GRAPHICS,FULLCLR)
1280 CALL=USR(MODE,ORMODE)
1290 COLOR 54
1300 CALL=USR(DISC,30,37,20)
1310 COLOR 72
1320 CALL=USR(DISC,50,37,20)
1330 COLOR 138
1340 CALL=USR(DISC,40,57,20)
1350 CALL=USR(MODE,NORMAL)
1360 GOSUB 1600:RETURN
1370 T$="256 COLOURS":GOSUB 1540
1380 CALL=USR(GRAPHICS,FULLCLR)
1390 FOR HUE=0 TO 15
1400 FOR LUM=(HUE=0) TO 15
1410 COLOR 16*HUE+LUM
1420 CALL=USR(MOVE,5*HUE,6*LUM)
1430 CALL=USR(DRAWTO,5*HUE,6*LUM+4)
1440 CALL=USR(DRAWTO,5*HUE+3,6*LUM+4)
1450 CALL=USR(DRAWTO,5*HUE+3,6*LUM)
1460 CALL=USR(DRAWTO,5*HUE,6*LUM)
1470 CALL=USR(FILL,5*HUE+1,6*LUM+1)
1480 NEXT LUM:NEXT HUE
1490 GOSUB 1600:RETURN
1500 T$="STANDARD SCREEN CONFIGURATIONS"
1510 GOSUB 1540
1520 CALL=USR(GRAPHICS,SPLITNOCLR)
1530 LIST 500,1600:GOSUB 1600:RETURN
1540 GRAPHICS 0:POKE 752,1
1550 POKE 709,0:POKE 710,0
1560 POSITION 20-LEN(T$)/2,7:? T$
1570 FOR I=0 TO 15 STEP.0.5
1580 POKE 709,I:SOUND.0,16*I,2,I
1590 NEXT I:SOUND 0,0,0,0
1600 FOR DL=1 TO 200:NEXT DL:RETURN
```

INVITE.CPL

by Peter Lancashire

This program is an updated version of the INVITE.CPL program given in Robert Schifreen's article, 'CPL primer' (October *PCW*,) which was concerned with CPL on Prime systems and Telecom Gold in particular. See this month's 'Letters' page for a more detailed explanation.

```
/* NEW_INVITE.CPL                    Send a message to all users.
&severity &error &routine AnyError    /* trap any error
&s Me := [entryname [dir [pathname *]]] /* note user-id
&if [exists TEMP_FILE -file] &then delete TEMP_FILE

type 'Wait, looking for online users ...'
como TEMP_FILE -ntty                  /* screen off
online                                /* list of users in TEMP_FILE
type END_OF_FILE                      /* flag end of file
como -end                             /* screen still off

&s File := [open_file TEMP_FILE Status -mode R]
&do &until %User% = END_OF_FILE
  &s User := [before [trim [read_file %File% Status]] ' ']
  &if %User% ^= END_OF_FILE & ^ [null %User%] &then &do
    &data message -force              /* -force ensures message sent
Hello there! Wanna chat to %Me%?
    &end /* &data
  &end /* &if
&end /* &until

close TEMP_FILE
como -tty
type Message "%Msg%" sent to:
ty TEMP_FILE
delete TEMP_FILE
&return

&routine AnyError
como -end -tty
close TEMP_FILE
delete TEMP_FILE
&stop 1 &message Oops!
```

PROGRAM FILE

Spectrum Basic Plus

by Justin Moffitt

This program has been tested on a 48k Spectrum and Spectrum+, but not on a 128k. It should work, however. It is a toolkit which adds several extremely useful commands to Basic, without needing the Interface 1 which is normally used for such programs.

Basic Plus adds extra commands to ZX Basic that are fully syntax-checked; such commands are prefixed with the '*' symbol. The idea has been used before, but this system overlays the Spectrum OS with extra OSCLI (Operating System Command Line Interpreter) systems.

Normally '*' commands would send out 'error C Nonsense in BASIC' messages, but now they are searched for and allowed to pass if the correct command syntax is given.

Loading and saving

The main program consists of many data statements, each with a checksum. These lines are in hex, and FNh$() controls conversion into decimal. The program will save out the data and then come up with the following message:

ZX SPECTRUM EXTENDED BASIC
V1.0

If you press a key the system is initialised, and will not need initialising again until NEW is executed. Commands such as CLEAR and RUN will not upset the system.

To reload, use the loader two program to find the data. Microdrive users should note the following:

(1) The SAVE and LOAD commands must be changed for the system.

(2) Microdrive errors will upset the system, so you must initialise the system afterwards.

The bulk of the commands deal with graphics and error checking, but there are other utility commands:

*BOX <x-displacement>, <y-displacement>

This will draw a box from the present graphics cursor to the points added with the two displacements.

*BLOAD <start>, <length>

This will load a previously saved file with *BSAVE. These files are headerless, so the two values must be given with each command.

*BSAVE <start>, <length>

This will save a headerless file to tape only. There are no extras like SCREEN$ or DATA$(), but the following may be of use:

*BSAVE 16384,6912 will save a headerless SCREEN$ file

*BSAVE USR "a", 168 will save the UDG graphics area

*CAPS LOCK <new state>

This will change the cursor to C (1) or L (0). Any INPUT statements should have a *CAPS LOCK statement before them.

*DELETE <first line>, <last line>

All the lines between the two limits are deleted from a Basic program. This command may also be used during execution.

*DUMP <memory address>

Dumps memory from the address given in pages; the 'scroll?' reply is the only way to stop the command. All displays are in hex. The following is *DUMP 0:

0000 F3 AF 11 FF FF C3 s/.@@C

Each character has bit 7 set to 0 and undisplayable characters are '.'s.

*ERROR <error number>

This will produce an error, useful for the *ON ERROR GOTO command. The error can be of three main types: the ON ERROR trappable commands; the ON BREAK trappable commands; and those not trapped, for example 0. I have found that it is neater to end a program with *ERROR 0 rather than STOP (see the table below).

Error	Number	Message	Type
0	0	**OK** Completion of program was successful	A
1	1	**NEXT without FOR** There is no FOR statement for the NEXT	B
2	2	**Variable not found** There is no name match for the variable	B
3	3	**Subscript wrong** Array too small, negative number too big	B
4	4	**Out of memory** Next operation requires more memory than there is left. See USR variables	B

PROGRAM FILE

5	5	**Out of screen** There is no more room on the screen for PRINT or INPUT	B
6	6	**Number too big** Calculator cannot cope with the next number	B
7	7	**RETURN without GOSUB** There is one too many RETURN statements	B
8	8	**End of file** See Microdrive manual or Opus Discovery manual	B
9	9	**STOP statement** The next statement is STOP	A
10	A	**Invalid argument** The function argument is incorrect	B
11	B	**Integer out of range** The integer result is too big or small	B
12	C	**Nonsense in BASIC** The line is not valid. This may occur when the Basic Plus is not initialised and a '*' command is in a program	B
13	D	**BREAK — CONT repeats** Break was pressed during I/O operation	C
14	E	**Out of DATA** Too many READ statements	B
15	F	**Invalid filename** Save name is wrong, OPEN # name is not valid. See Microdrive manual or Opus Discovery manual	B
16	G	**No room for file** No more program memory left	B
17	H	**STOP in INPUT** There has been a STOP statement in INPUT	B
18	I	**FOR without NEXT** There is a FOR, but no NEXT in a loop	B
19	J	**Invalid I/O device** See Microdrive manual or Opus Discovery manual	B
20	K	**Invalid colour** Colour command parameter is wrong	B
21	L	**BREAK into program** BREAK was pressed between statements	C
22	M	**RAMTOP no good** The CLEAR command was wrong	B
23	N	**Statement lost** A statement has been deleted and a jump has been attempted to it	B
24	O	**Invalid stream** See Microdrive manual or Opus Discovery manual	B
25	P	**FN without DEF** No function for FN ()	B
26	Q	**Parameter error** Wrong number of arguments in FN ()	B
27	R	**Tape loading error** Tape file failed to LOAD	B

Error types: notes

A This error will stop execution even if *ON ERROR GOTO has been used

B When this error occurs, *ON ERROR GOTO will trap it

C *ON BREAK GOTO will trap these errors

*FONT <binary flag>

This will change the character set; the binary flag may be best sent as BIN 00xxxxx.

Bit number	Function (if bit set)
3	If set, does not set the character set to that in ROM
4	Italics
5	Emphasised
6	Underlined
7	Mirrored
8	Inverted

PROGRAM FILE

The flag is set up as follows:
*FONT BIN 12345678 (bit numbers for BIN!)

*FX <value>, <parameter>
The parameter is tested. If it is below 256 then one byte is set, otherwise two bytes are used for the command. The values are set from 23552 (the first system variable). To find the FX of PIP, for example, subtract 23552 from PIP (23609):

```
PRINT 23609-23552
57
```

So *FX 57, <value>, PIP is the keyboard bleep length, and eight bits are used.

*ON ERROR GOTO <line number>
When an error occurs (in a program), execution will continue at the line set. CONTINUE will continue with the next statement or line. For example:

```
10 *ON ERROR GOTO 1000
20 *ERROR 10
30 PRINT "Execution Ok"
40 STOP
1000 PRINT "Error in the program"
1010 CONTINUE
RUN
Error in the program
Execution Ok
```

To find the error type and the line of error type, see 'USR variables'.

*ON ERROR REPORT
This will resort to normal error-handling.

*ON BREAK GOTO <line number>
When BREAK is pressed, the computer will continue at the line given. Again, CONTINUE will go to the next statement.

*ON BREAK REPORT
<line number>
This will report all BREAKs.

*PROMPTS <state>
This will turn the cassette prompts (for example, Program:xx) on (1) or off (0).

*SYMBOL <chr$>, <1st byte> ... <8th byte>
This will allow you to re-define all characters between 32 and 127 and also 144 to 164.

USR variables

USR value	Number returned
60854	Line of last error (only when using *ON ERROR GOTO)
60859	Type of last error (only when using *ON ERROR GOTO)
60864	Free memory in bytes
60869	X plot coordinate
60874	Y plot coordinate
60879	Y print coordinate
60884	X print coordinate

OSCLI extensions
The program needs a lot of description, but rather than go into detail here I recommend a book, published by Melbourne House at £9.95, called *The Complete Spectrum ROM Disassembly*. If you compare the routines at &12A9 with mine, you will understand the system used.

Here's a short description of my routine. If you wish to add more commands, simply type in the listing and add to CLIST. First comes the name in upper case, the last character of which has 128 added; then the address of a syntax routine; then the command. All commands may be entered in upper or lower case.

The following syntax routines may be helpful:

Address	Notes
1C7A	Expect two numbers
IC82	Expect one number
1C8C	Expect one string

You must call each of these—*FONT should use 1C82, and so on.

Execute time routines

Address	Notes
IE94	Get 8-bit number (places it in AF)
1E99	Get 16-bit number (places it in BC)
2BF1	Get string parameters (places length in BC, start in DE)

Helpful routines

RST 10	Print character in AF
1601	Open channel in AF
0DAF	Clear screen

```
;
; SPECTRUM 48K/+/128K
; BASIC PLUS VERSION 1.0
;
; COPYRIGHT 1986 JUSTIN MOFFITT
;
        ORG  #E704
;
; MAIN SYNTAX ROUTINE
;
ERROR   EQU  #E704          Address on error stack
CHRPOS  EQU  #EF00          Address of new character set in RAM
DSK     LD   A,(#5C3A)      Find error type
        CP   #0B            Is it Nonsense in Basic?
        JP   Z,CHK@1        Yes
RET@    BIT  7,(IY+1)       Where are we?
        JR   NZ,RET1        In a program
        JP   OPER           Editing
RET1    LD   A,(FLAGS)      Find Basic Plus FLAGS state
        BIT  7,A            *ON ERROR GOTO set up
        JP   NZ,RET2
RET3    LD   A,(FLAGS)
        BIT  6,A            *ON BREAK GOTO set up
```

PROGRAM FILE

```
        JP    NZ,RET4
RET6    LD    HL,(#5C59)          Produce error message
        CALL  #11A7
        HALT
        LD    A,(#5C3B)
        RES   5,A
        LD    (#5C3B),A
        LD    A,(#5C6A)
        BIT   1,A
        LD    (#5C6A),A
        CALL  NZ,#0ECD
        LD    A,(#5C3A)
        INC   A
NROOM   PUSH  AF
        LD    HL,0
        LD    A,H
        LD    (#5C71),A
        LD    (#5C60),A
        LD    (#5C0B),HL
        LD    HL,A
        LD    (#5C16),HL
        CALL  #1680
        LD    A,(#5C71)
        RES   5,A
        LD    (#5C71),A
        LD    A,(#5C3C)
        SET   5,A
        LD    (#5C3C),A
        POP   AF
        LD    B,A
        CP    #0A
        JR    C,ASC
        ADD   A,7
ASC     CALL  #15EF
        LD    A,#20
        RST   #10
        LD    A,B
        LD    DE,#1391
        CALL  #0C0A
        XOR   A
        LD    DE,#1536
        CALL  #0C0A
        LD    BC,(#5C45)
        CALL  #1A1B
        LD    A,#3A
        RST   #10
        LD    A,(#5C47)
        LD    C,A
        LD    B,0
        CALL  #1A1B
        CALL  #1097
        LD    A,(#5C3A)
        INC   A
        JR    Z,ASC3
        CP    9
        JR    Z,ASC2
        CP    #15
        JR    Z,ASC6
ASC2    LD    A,(#5C47)
        INC   A
        LD    (#5C47),A
ASC6    LD    BC,3
        LD    DE,#5C70
        LD    HL,#5C44
        LD    A,(#5C44)
        BIT   7,A
        JR    Z,ASC7
        ADD   HL,BC
ASC7    LDDR
ASC3    LD    A,#FF
        LD    (#5C3A),A
        LD    (#5C44),A
        LD    A,(#5C3B)
        RES   3,A
        LD    (#5C3B),A
        JP    MAIN2               Do not go back to #12AC, but our routine
RET2    LD    HL,(#5C45)          Error routine
        LD    A,H                 Is the line number #FFFE, ie a direct
        CP    #FF                 Basic command?
        JP    NZ,BERR
        LD    A,L
        CP    #FE
        JP    Z,RET3              Yes
BERR    LD    A,(IY+0)
        CP    #FF
        JP    Z,RET3
        CP    8
        JP    Z,RET3
        CP    #14
        JP    Z,RET3
        CP    #0C
        JP    Z,RET3
        LD    (SERL),HL           Set up ERL variable
        LD    B,0
        LD    C,(IY+0)
        INC   C
        LD    (SERR),BC           Set up ERR variable
        LD    (IY+0),#FF          Reset ERR NUMBER
        LD    HL,(ERL)
        LD    D,0
RET7    CALL  #1E73               Set CONTINUE variables to present ones
        LD    HL,(#5C45)
        LD    A,(#5C47)
        INC   A
        LD    (#5C6E),HL
        JP    CHK0A               Continue as normal in Basic
RET4    LD    A,(IY+0)            Break routine
        CP    #14
        JP    Z,RET5
        CP    #0C
        JP    NZ,RET5
RET5    LD    HL,(#5C45)          Again, is line number #FFFE
        LD    A,H
        CP    #FF
        JP    NZ,RET8
        LD    A,L
        CP    #FE
        JP    Z,RET6
RET8    LD    (IY+0),#FF
        LD    D,0
        JP    RET7                Set CONTINUE variables
MAINE   LD    (IY+#31),2          Editor routines
        CALL  #1795               See #12AC in Spectrum ROM
MAIN1   CALL  #1680
MAIN2   LD    A,0
        CALL  #1601
        CALL  #0F2C
        CALL  #1B17
        LD    A,(IY+0)
        CP    #0B                 Is this a special error, ie a * command?
        JP    Z,ERROR             Yes
OPER    BIT   7,(IY+0)
        JP    NZ,MAIN3
        BIT   4,(IY+#30)
        JP    Z,ERROR
        LD    HL,(#5C59)
        CALL  #11A7
        LD    (IY+0),#FF
        JR    MAIN2
MAIN3   LD    HL,(#5C59)
        LD    (#5C5D),HL
        CALL  #19FB
        LD    A,B
        OR    C
        JP    NZ,ACCEPT
        RST   #18
        CP    #0D
        JR    Z,MAINE
        BIT   0,(IY+#30)
        CALL  NZ,#0DAF
        CALL  #0D6E
        LD    A,#19
        SUB   (IY+#4F)
        LD    (#5C86),A
        LD    (IY+#0A),1
        LD    (IY+0),#FF
        SET   7,(IY+1)
        LD    HL,ERROR            Make sure that we do not return to the
        PUSH  HL                  Spectrum ROM
```

PROGRAM FILE

```
                JP    $1B8A
CHK01           LD    HL,($5C5D)          *commands?
                DEC   HL
                LD    A,(HL)
                CP    $2A                 Is the error at a "*"?
                JP    NZ,RET0
                LD    HL,($5C5D)
                LD    (THL),HL
                LD    A,(HL)
                LD    DE,CLIST            Set value of command list
CHK02           CP    $20                 Is next character a space?
                JR    Z,CHK02A            If so do not make it upper case!
                RES   5,A                 Make all others into upper case
CHK02A          LD    B,A
                LD    A,(DE)
                CP    0
                JP    Z,RET0
                RES   7,A
                CP    B
                JP    NZ,CHK03
                LD    A,(DE)
                BIT   7,A
                JR    NZ,CHK05
                CALL  $74                 Get next character in line
                INC   DE
                JR    CHK02
CHK03           LD    HL,(THL)            Set the value of THL to hold address of
                LD    ($5C5D),HL          character after "*"
CHK04           LD    A,(DE)              NB:THL is our own variable, as are TDE
                INC   DE                  TAF and TBC, There are temporary values
                BIT   7,A                 Last character?
                JR    Z,CHK04             Yes, then we have the right command
                INC   DE                  No, we must pass over the DEFW syntax and
                INC   DE                  command values in CLIST
                INC   DE
                INC   DE
                LD    A,(DE)
                JR    CHK02
CHK05           LD    (TDE),DE
CHK06           RST   $20                 Get rid of spaces, and control codes
                CP    $20
                JR    Z,CHK06
                LD    (IY+0),$FF          Set ERR NUMBER to $FF, no errors
                LD    DE,(TDE)
                INC   DE
                LD    A,(DE)
                LD    L,A
                INC   DE
                LD    A,(DE)              Get syntax check value, ie the first DEFW
                LD    H,A                 after the command name in CLIST
                LD    (TDE),DE
                JP    (HL)                Jump to that place
CHK07           BIT   7,(IY+0)            Error?
                JP    Z,RET0              Yes
                CP    $0D                 EOL
                JR    Z,CHK08             or
                CP    $3A                 ":"
                JP    Z,CHK08             after command?
                LD    (IY+0),$0B          No!
                JP    RET0
CHK08           LD    (IY+0),$FF          Yes!
                LD    (IY+$26),0          Set K marker
                BIT   7,(IY+1)
                JR    NZ,CHK09
                LD    HL,ERROR            Push ERROR value onto stack
                PUSH  HL
                LD    HL,OPER
                PUSH  HL
                JP    $1B76               Check next line or statement
CHK09           LD    DE,(TDE)
                INC   DE
                LD    A,(DE)
                LD    L,A
                INC   DE
                LD    A,(DE)
                LD    H,A                 Now we are in a program, and a command
                JP    (HL)                execution address is got and executed.
CHK0A           LD    HL,ERROR            Go to next statement in line
                PUSH  HL
                JP    $1B76
ACCEPT          LD    ($5C49),BC          Allow a line to go past editor
                LD    HL,($5C5D)
                EX    DE,HL
                LD    HL,NROOM
                PUSH  HL
                LD    HL,($5C61)
                SCF
                SBC   HL,DE
                PUSH  HL
                LD    H,B
                LD    L,C
                CALL  $196E
                JR    NZ,PT1
                CALL  $19B8
                CALL  $19E8
PT1             POP   BC
                LD    A,C
                DEC   A
                OR    B
                JR    Z,PT2
                PUSH  BC
                INC   BC
                INC   BC
                INC   BC
                INC   BC
                DEC   HL
                LD    DE,($5C53)
                PUSH  DE
                CALL  $1655
                POP   HL
                LD    ($5C53),HL
                POP   BC
                PUSH  BC
                INC   DE
                LD    HL,($5C61)
                DEC   HL
                DEC   HL
                LDDR
                LD    HL,($5C49)
                EX    DE,HL
                POP   BC
                LD    (HL),B
                DEC   HL
                LD    (HL),C
                DEC   L
                LD    (HL),E
                DEC   HL
                LD    (HL),D
PT2             POP   AF
                JP    MAINE
;
; MAIN BASIC ENTRY POINT
;
ENTRY           LD    DE,ERROR
                LD    HL,($5C53)
                LD    (HL),E
                INC   HL
                LD    (HL),D
                LD    HL,$EE00            Set address of character set-256
                LD    ($5C36),HL
                RET
ENTRYD          CALL  ENTRY               This is where we normally enter the code
                CALL  ENTRYA
                CALL  ENTRYC
                CALL  $15D4               Wait for a key
                RET
ENTRYA          LD    DE,CHRPOS           Move that character data from ROM to RAM
                LD    HL,$3D00
                LD    BC,$0300
                LDIR
                RET
ENTRYC          LD    A,$FD               Print a message and clear screen
                CALL  $1601
                LD    A,$38
                LD    ($5C48),A
                LD    ($5C8D),A
                LD    ($5C8F),A
                LD    A,7
                OUT   ($FE),A
                CALL  $0D6B
```

```
        XOR   A
        LD    DE,PRMSA                    PRMSA is the actual message, with last
ENTRYB  LD    A,(DE)                      character 128 added to it
        RES   7,A
        CALL  $0C3B
        LD    A,(DE)
        BIT   7,A
        INC   DE
        JR    Z,ENTRYB
        LD    A,($5C3C)
        SET   5,A
        LD    ($5C3C),A
        RET

;
; IT IS HERE THAT I END THE DISASSEMBLY, NEXT COME THE BASIC COMMAND ROUTINES,
; BUT I WILL SHOW YOU HOW TO SET UP THE CLIST (COMMAND LIST) AND SYNTAX ROUTINE.
; FIRSTLY THE SYNTAX ROUTINE, YOU MUST READ THE DOCUMENTATION BUT ALL CALL'S TO
; THE ROM ECT., WHEN FINISHED MUST RETURN CONTROL TO THE PROGRAM, THIS IS DONE
; WITH :-
;
SN01    LD    HL,($5C5D)                  Set HL to next character
        LD    A,(HL)                      Set A to its contents
        JP    CHK07                       Return to routine
;
; THIS CHECKS THAT AFTER THE PARAMETERS THERE IS AN EOL OR ":"
;
; TO SET UP A COMMAND LIST, HERE IS AN EXAMPLE :-
;
        DEFB "HEL"                        Main name body
        DEFB "P"+$80                      Last characters have 128 added to them
        DEFW SN01                         Syntax routine, see above
        DEFW BC01                         Actual command routime
        DEFB 0                            Show that this is the end of the table

;
; ALL COMMAND ROUTINES MUST END WITH THE FOLLOWING :-
;
        JP    CHK0A
;
; THERE ARE NO REGISTER CONDITIONS AT ALL
;
```

Program 1 - Basic Loader

```
  10 REM
  20 REM Spectrum 48k/+/128k
  30 REM
  40 REM Basic Plus Loader
  50 REM
  60 REM Copyright 1986 Justin Moffitt
  70 REM
  80 CLEAR 59139:LET LNE=0
  90 DEF FN H(H$)=16*(CODE H$(1)-48-(7 AND H$(1)>"9"))+CODE H$(2)-48-(7 AND H$(2
)>"9")
 100 FOR F=59140 TO 61150 STEP 30
 110  LET TOT-0
 120  READ H$
 130  FOR G=0 TO 29
 140   LET BYTE=FN H(H$):POKE (F+G),BYTE:LET TOT=TOT+BYTE
 150   LET H$=H$(3 TO )
 160  NEXT G
 170  READ CHK:IF TOT<>CHK THEN PRINT "DATA ERROR IN LINE ";LNE:STOP
 180  LET LNE=LNE+10
 190 NEXT F
 200 PRINT "DATA OK":SAVE "BASIC CODE"CODE 59140,2040
 210 STOP
1000 DATA "3A3A5CFE0BCABFE8FDCB017E2003C36EE83A19EECB7FC2DAE73A19EECB77",4190
1010 DATA "C229E82A595CCDA711763A385CCBAF32385C3A6A5CCB4F326A5CC4CD0E3A",3244
1020 DATA "3A5C3CF52100007C32715C32605C220B5C21010022165CCDB0163A715CCB",2293
1030 DATA "AF32715CCD6E0D3A3C5CCBEF323C5CF147FE0A3802C607CDEF153E20D778",3345
1040 DATA "119113CD0A0CAF113615CD0A0CED4B455CCD1B1A3E3AD73A475C4F0600CD",2479
1050 DATA "1B1ACD97103A3A5C3C2822FE092804FE1528073A475C3C32475C01030011",1911
1060 DATA "705C21445C3A445CCB7F280109EDB83EFF323A5C32445C3A385CCB9F3238",2823
1070 DATA "5CC358E82A455C7CFEFFC2E9E77DFEFECA1DE7FD7E00FEFFCA1DE7FE08CA",5013
1080 DATA "1DE7FE14CA1DE7FE0CCA1DE72215EE0600FD4E000CED4317EEFD3600FF2A",3535
1090 DATA "11EE1600CD731E2A455C3A475C3C226E5C32705CC35AE9FD7E00FE14CA36",3028
1100 DATA "E8FE0CC225E72A455C7CFEFFC245E87DFEFECA25E7FD3600FF2A13EE1600",4277
1110 DATA "C316E8FD363102CD9517CDB0163E00CD0116CD2C0FCD171BFD7E00FE0BCA",3242
1120 DATA "04E7FDCB007E2013FDCB3066CA04E72A595CCDA711FD3600FF18D42A595C",3544
1130 DATA "225D5CCDFB1978B1C261E9DFFE0D28B7FDCB3046C4AF0DCD6E0D3E19FD96",4010
1140 DATA "4F32865CFD360A01FD3600FFFDCB01FE2104E7E5C38A1B2A5D5C2B7EFE2A",3495
1150 DATA "C20CE72A5D5C220BEE7E1142EEFE202802CBAF471AFE00CA0CE7CBBFB820",3506
1160 DATA "0B1ACB7F2019CD7400131BE32A0BEE225D5C1A13CB7F28FA131313131A18",2316
1170 DATA "D0ED530DEEE7FE2028FBFD3600FFED5B0DEE131A6F131A67ED530DEEE9FD",4089
1180 DATA "CB007ECA0CE7FE0D280CFE3ACA36E9FD36000BC30CE7FD3600FFFD362600",3557
1190 DATA "FDCB017E200B2104E7E5216EE8E5C3761BED5B0DEE131A6F131A67E92104",3220
1200 DATA "E7E5C3761BED43495C2A5D5CEB2143E7E52A615C37ED52E56069CD6E1920",3698
1210 DATA "06CD8819CDE819C1793DB02828C50303030328ED5B535CD5CD5516E12253",3135
1220 DATA "5CC1C5132A615C2B2BEDB82A495CEBC1702B712B732B72F1C351E81104E7",3458
1230 DATA "2A3D5C7323722100EE22365CC9CDB3E9CDD0E9CDDCE9CDD415C91100EF21",3960
1240 DATA "003D010003EDB0C93EFDCD01163E3832485C328D5C328F5C3E07D3FECD6B",2968
1250 DATA "0DAF1122EE1ACB8FCD3B0C1ACB7F1328F43A3C5CCBEF323C5CC9CD29EA3E",3429
1260 DATA "FF37CD5605DA5AE9C222EAFD36001AC30CE7FD36000CC30CE7CD991E5059",3694
1270 DATA "D5CD991EED43B05CDD2A805CD1C93EFDCD0116AF11A2091ACBBFCD3B0C1A",3742
1280 DATA "CB7F1328F43A3C5CCBEF323C5CCDD415CD29EA3EFF37CDC204D222EAC35A",3943
1290 DATA "E9CD941E320AEEFD7E00FEFFC20CE73A0AEECB27CB27CB27D4D0E9CB27DC",4386
1300 DATA "A1EACB27DCBBEACB27DCD2EACB27DCF8EACB27DCE4EAC35AE9065F110400",4692
1310 DATA "2100EFF5C506047ECB3F7723A710F819C110F1F1C9065F2100EFF5C50608",3447
1320 DATA "7ECB3FB67723A710F7C110F1F1C90660110700210EFF5193EFF772310F9",3454
1330 DATA "F1C906602100EFF5C506087E2F772310FAC110F4F1C906602100EFF5C506",3582
1340 DATA "08C506084ECB111F10FB7723C110F2C110ECF1C92104E7E5CD991E60697C",3517
1350 DATA "CD9FED7DCD9FED3E20CD6CEDE506067ECD9FED3E20CD6CED2310F4E10606",4115
1360 DATA "7ECBBFFE203806FE80300218023E2ECD6CED2310EB3E0DCD6CED18C5CD99",3474
1370 DATA "1EC5CD941EC116005F21005C1978FE0028057977237B4F7977C35AE9CD94",3074
1380 DATA "1E320AEEFD7E00FEFFC20CE73A0AEEFE1C30073DFD7700C30CE7FD36000A",3484
1390 DATA "C30CE7CD991EED430FEECD991E2A535CCDCAEB220BEEED4B0FEE235E2356",3728
1400 DATA "2319CDCAEB235E23562319ED5B0BEE1BCDE519C35AE9EB2A4B5CA7ED52CA",3725
1410 DATA "E5EBEB56235EEBED42EBC8235E235623191BE5E1FD36000AC30CE7CD991E",3818
1420 DATA "ED4311EE3A19EECBFF3219EEC35AE93A19EECBBF3219EE2100002217EE22",3559
1430 DATA "15EEC35AE9CD991EED4313EE3A19EECBF73219EEC35AE93A19EECBB73219",4110
1440 DATA "EEC35AE9CD941EFE023014FE01200B3E0632125CC35AE93E1032125CC35A",3027
1450 DATA "E9FD36000AC30CE7211AEE220BEE0608ED430FEECD941E2A0BEE7723220B",3012
1460 DATA "EEED4B0FEE10E8CD941EFE2038D5FE80302DED4B365C6F26002929290922",3240
1470 DATA "0DEE0608ED430FEE2A0BEE2B7E220BEE2A0DEE7723220DEEED4B0FEE10E6",3108
1480 DATA "C35AE9FE9038A0FEA5309CD6908787870726006FED4B785C09220DEE060818",3526
1490 DATA "C7CD941EFE02308 1FE0128083E00326A5CC35AE93E08326A5CC35AE9CD07",3194
1500 DATA "23ED430FEEED530DEE2A7D5C220BEECD10EDCD20ED2A0BEE22705CCD20ED",3653
1510 DATA "CD10EDCD07EDC35AE9FDCB007EE1CA0CE7E9ED5B0DEEED4B0FEE06001601",4083
1520 DATA "CD8A24C9ED5B0DEEED4B0FEE0E001E01CD8A24C9CD7A1C2A5D5C7EC31FE9",3612
1530 DATA "CD821CC333EDCD821CFE2C2019CD791C0603ED430FEEFE2C200CCD791CED",3417
1540 DATA "4B0FEE10EFC333EDFD36000BC30CE73E0DC36CEDE5C5D9E5D5C5F52A515C",4179
1550 DATA "E5F53EFECD0116F1D7E132515CF1C1D1E1D9C1E1C9E57ECB7F2007CD6CED",4900
1560 DATA "E12318F3CBBFE1CD6CEDC9F51F1F1F1FCDA8EDF1E60FFE0A3802C607C630",4135
1570 DATA "CD6CEDC9ED4B15EEC9ED4B17EEC9CDD9EDC900CDE5EDC900CDEDEDC900CD",5114
1580 DATA "F4EDC900CDFFEDC900CD1A1F21FFFF37ED42E5C1C9ED4B7D5C480600C9ED",4411
1590 DATA "4B7D5C0600C9ED4B885C3E18904F0600C9ED4B885C3E21914F0600C90000",2621
1600 DATA "00000000000000000000000000000000000000005820535A5820535045435 4",0796
1610 DATA "52554D20455854454E44454420424153494320563 12E30A0424F58A030ED",2354
1620 DATA "DEEC424C4F4144A030ED0CEA42534156 45A030ED3CEA43415053204C4F43",3160
1630 DATA "4BA03AEDC3EC44454C455445A030ED99EB44554D50A03AED14EB4552524F",3561
1640 DATA "52A03AED76EB464F4E54A03AED6BEA4658A030ED58EB4F4E204252454 14B",3469
1650 DATA "20474F544FA03AED13EC4F4E204252454 14B20524 5504F52D433ED25EC4F",2877
1660 DATA "4E204552524F5220474F544FA03AEDEDEB4F4E204552524F52205245504F",2701
1670 DATA "52D433EDFFEB50524F4D505453A03AED30EC53594D424F4CA040ED52EC00",3625
```

Program 2 - Loader

```
  10 REM
  20 REM Basic Plus Loader
  30 REM
  40 REM Save as Microdrive RUN file
  50 REM
  60 CLEAR 59139
  70 LOAD "BASIC CODE"CODE
  80 RANDOMIZE USR 59843
  90 *DELETE 10,90
```

To SAVE :-

Tape : SAVE "BASIC LOADER" LINE 10

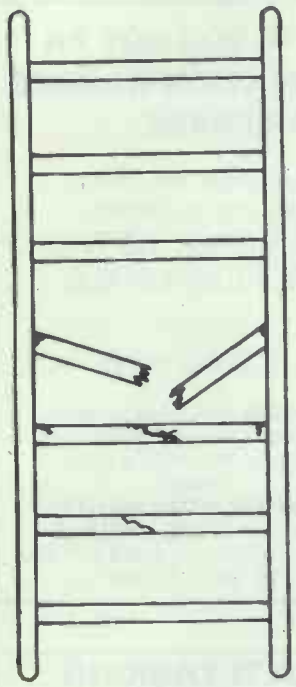
Mdrv : SAVE *"M";1;"RUN" LINE 10

To LOAD :-

Tape : LOAD ""

Mdrv : RUN

THE PC LADDER



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● SIRUS PUBLIC DOMAIN SOFTWARE. Includes Sirius/IBM transfer package, games, utilities, applications, etc. Send large SAE to M. Palaci, 122 Kilburn High Road, London NW6 4HY. Tel: (01) 328 0460.
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● ATARI 520ST. All usual software plus Lattice 'C' compiler and Deadline adventure. £500. Tel: 0420 88022 Ext 204 daytime, 0730 892944 Eves. (Hampshire).
● SHARP MZ80A. Cover, manual, good condition, £125. Reading 65644, Eves.
● OLIVETTI M24. 640k, 20Mb hard disk, 10 months old, £1500 Including VAT. Price includes Dataease, Sage, Accountant, Supercalc 4 and various software. VAT invoice provided. Tel: Robert 0773 556910 days.
● BBC MASTER 128. Teac 40 track drive and Philips green screen monitor. Dustcover, ref manuals 1+2, leads and discs. Ready to use and all V.G.C. £540. Tel: (01) 769 8559 Eves.
● VIDEOSHOP (AMSTRAD). Film rental control system, 2500 films. Issues, returns, bookings, sales, till balance, members details, management reports. £85. For details 061 439 4841 or S.A.E. 38 South Parade, Stockport, SK7 3BJ.
● SHARP PC1251 POCKET COMPUTER. Basic programmable but calculator sized. Including separate printer and microcassette recorder for programs and data. Good condition. Cost £180, yours for £50. Roger Wilkins (01) 881 8151/0836 246826.
● TATUNG EINSTEIN COMPUTER.Disk drive, Tatung TP100 printer, joystick, Wordpro, and other software, manuals, etc. £275 o.n.o. Tel: (0272) 871453. Buyer collects Clevedon, Avon.
● APPLE II PERIPHERAL CARDS: Z80 CP/M, speech, £27 each. Alf music, mockingboard, £45 each. Grappler, communications, RS232, £35 each. IC test, £75. 128k, £70. AD/DA, £60. Pascal, Fortran, Cobol, Format 80, Wordstar, dBase II, offers! Tel: (01) 736 7809.
● COMMODORE 64. 1541 disk, MPS 801 matrix printer. Cost £600, price £200. Tel: Heywood (01) 993 1855 (London).
● BBC MODEL-B. Acorn DFS, 40/80T double-sided drive, 32k sideways RAM, Eprom programmer, joystick and cassette. Many Eproms, manuals and disks. Moden WS2000 also available. £350. Tel: Kevin, Basildon (0268) 21930.
● SANYO 555. 256k RAM, twin 360k drives, MSDOS 2.1, green monitor, Chess, Cardbox, Calstar, D.Base II, Supersort, Norton utilities, Turbo Pscal, Wordstar, Spellstar, Macro assembler, Basic compiler, etc. £350. Tel: Stoke (0782) 619895.
● AMSTRAD CPC6128 colour. DK tronics 256k silicon disc, dual serial interface, Pascal/MT+, Devpac 80 (screen based editor, Z80 assembler, debugger), Firmware manual, discs. Excellent condition. Cost £750+ accept £500. Tel: (0264) 54446 Eves.
● APPLE IIe. Two drives, monitor, 80-col/64k card, super serial, Z80, parallel interface, TV-modulator, WS2000 modem, joystick and over 100 disks, business and games, £750 o.n.o. Tel: Kevin. Basildon (0268) 21930.
● MICROVITEC COLOUR MONITOR MODEL 1431MZ. Direct input for Sinclair Spectrum, £150. Also 007 microdrive and tape backup board, transfers all programs, £15. Brookwood 80266 ask for Martin.
● ATARI 1050 DISK DRIVE WITH HAPPY ENHANCEMENT AND LATEST SOFTWARE. £200. Atari 810 disk drive with happy enhancement plus upgrade chip and latest software, £150. All instructions included. Tel: (01) 577 6568.
● AMSTRAD PCW 8256 WORD PROCESSOR FOR SALE. 10 months old. Mint condition, previous owner home user. Don't be fooled by the price (£399 + VAT = £458 in Dixons) £349! Tel: (0424) 430279.
● WANTED FOR SHARP MZ80k. RS232 universal Eprom Centronics cards or W.H.Y? Also 4 MHZ Quantum hi-res etc. David 0423 66373 (Harrogate).
● 48k SPECTRUM. Professional keyboard, interface 1, microdrive and lightpen. Much software. V.G.C. Includes leads, manuals, etc. Worth £275, asking £160. First offer secures. Edward Dearie, 5 Commercial Street, Heckmondwike, West Yorkshire, WF16 9JN.
● LVL duble density disk interface for BBC B. Easy to fit. Requires no soldering. £35. Tel: 0636 73397.
● EPSON PX8 LAP-HELD. Complete with 120k RAM extension, and Wordstar, Basic, Card-box, portable calc, scheduler, etc. Plus cables, manuals, all boxed as new, first offer. £300. Tel: 041 884 5901.
● PRINTER BUFFER. 48k, Serial/parallel. New condition, only £125. Tel: 0860 323288 9am–6pm.
● SHARP MZ80B. Twin discs, RS232C, CPM 2.2, Wordstar, Supercalc, DBII, MBasic. Compilers: Supersort, Pascal, many others. Plus manuals, modem. Printer available, suit hobbiest business. £600. Offers! Tel: Newbury 200395 Anytime.
● SINCLAIR QL. £95. PCML disk interface & 256k RAM, £200. Dual 3.5" disk drives, £180 o.n.o. Books, software, magazines, others. Tel: for details. Complete system: £555. Everything excellent condition. Tel: Buckley (0244) 547323 anytime.
● COMMODORE 64 EQUIPMENT SALE. 64 plus 1541. Easiscript and Practicalc progs, plus others. Expansion boards, loads of books, etc. £300 the lot. All perfect working order. Tel: Tony (01) 504 3364 Eves.
● EPSON LX-80 DOT MATRIX PRINTER. With tractor feed and manual. 100 cps. Original box. Used for three months. £175 o.n.o. Tel: 0385 64466 Ext. 559 daytime.
● BBCB. DFS, Torch Z80 disc pack, Sanyo green monitor, DBase, Supercalc, Aviator, Wordstar, and 'perfect' software. All manuals. £700 incl. (Hants) 0794 512518 Eves. Can deliver.
● WATFORD ROM/RAM BOARD FOR BBC MICRO. Complete 128k dynamic RAM, 16k plug-in static RAM, etc. £75. Unused. Tel: 0480 62666.
● ACT SIRIUS. 128k RAM, 2.4 MB floppy. Software: Pulsar nominal, sales, purchase, invoicing, payroll, games, DOS 1.2, MS Basic, utilities. £950. Tel: (01) 868 2201 Eves.
● BBC B. Acorn DFS, graphics ROM. Single 40/80T, DS400k disc drive plvs Torch Z80 2nd processor with CP/N and perfect software (word processor, spreadsheet). Music system, joystick, manuals. Offers around £520. (021) 4597740 Eves.
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● TRANSTEC HD5. CP/M 2.2 64k, 5MB Winchester, 388k floppy, serial and parallel ports, keyboard, monitor. Wordstar, DBase II, languags and utilities. £550 o.n.o. Tel: (0903) 207868. After 8 pm.
● AMSTRAD PCW8256. VDU, disk drive, printer. Less than 24 hrs use. Packages include: Wordstar, Locoscript, Scratchpad spreadsheet, Basic, CPM plus operating system. Plus five discs, £350 o.n.o. Tel: Simon 0742 460385 Eves.
● ATARI 1040 STF. Plus hi-res mono monitor and Basic in ROM. Includes twenty + discs and all original packing. Cost £1150+, sell £900. Tel: Bill (01) 572 2917 (take QL clone as part payment).
● PSION ORGANISER. With Wessex construction materials software. Boxed as new, unwanted competition prize. Offers to Gary Barnes. Tel: 0234 41320 Eves or w/es.
● EPSON PX8 LAPHELD. With 120k RAM disk; Wordstar, Calc, Basic, and leads for printer and modem. £525 o.n.o. Bryan Wells 0246 568435.
● SWAP. My leather

TRANSACTION FILE

Chesterfield (light brown) three seater settee for an Apple imagewriter printer. Tel: Dave (01) 422 9001 (daytime) (Greenford, London).

● CBM64. Disk MPS801, printer paper and labels plus 20 disks. Also 500+ of games and utilities including: Diskmate, Pilot, Logo, Easyscript, valued £1300, sell £400 o.n.o. Tel: Hitesh Shah after 6 on (01) 888 7305.

● APRICOT £250. 256k portable fitted with standard monochrome monitor output, lots of software and disks. Also 512k RAM board, £75 or £300 for both. Tel: Bolton (0204) 41459.

● DRAGON 64. Disk drive, recorder, joystick, 300+ games/utilities. Including OS9 o/system, Stylograph, Dynacalc RMS etc. All issues D/user, 5 books, plus other items too numerous to list. Only £250. Crawley (0293) 883753.

● APRICOT XI10. 512k, 10Mb HD. Supercalc, Superwriter, and other software. £950. Tel: Doncaster 859035.

● TANDY TRS80 MODEL II. Plus Wordstar software for sale. £250 o.n.o. With accounts software, £400. Also Jiki 6100 tractor feed, un-used, offers please. Tel: (01) 943 4322.

● APRICOT F1. Including DR, MS, and Logo packages from Apricot, £400 o.n.o. Or as above, plus 30+ disks of software including: Wordstar, DBase II, Supercalc 3, etc. £800 o.n.o. Tel: (0592) 771726 anytime.

● NORTHSTAR HORIZON 64DQ. Televideo TV1950. Software: Wordstar, Infostar, Calcstar, Supersort plus Supercalc 2, DBase II MBasic, Superfile, comms utilities. 100 discs. Manuals. £660. Free Epson MX80 and faulty LA34 printers. Tel: (01) 979 8284.

● APRIXOT PC. 256k RAM plus twin 315k disks and monitor. Supercalc, Superword, Superplanner and GW Basic plus manuals. £750 o.n.o. Tel: (0283) 222130 (Midlands).

● OLIVETTI M24. 640k, 20MB Winchester floppy drive, Bus converter, green monitor, PC keyboard, v. little used, 9 months old £1850. Hastings 0424 51843.

● EPSON LX80 PRINTER/ SHEETFEED £180. Star DP8480 printer £100. M Miracles WS2000 modem £60. Sinclair QL no powerpack or manuals £80. Hastings 0424 51843.

● TORCH GRADUATE UPGRADE FOR BBC/BBC+. 256k RAM, MS-DOS, twin DS disc drives, Psion Exchange software, manuals. Boxed. £390. Tel: Otford 2807.

● EPSON FX80 DOT MATRIX PRINTER. Hardly used. Offers. Tel: (01) 337 5663 after 6pm.

● BBC B. OS 1.2, DFS. Microvitec cub standard resolution colour monitor, Cumana 5¼" double sided 40/80 track drive, Acorn cassette recorder. Also books, magazines, games software. Excellent condition. £650 o.n.o. Tel: (0524) 423478.

● WANG PC. 256k, 10MB. With Wang wordroc, database, graphics, multiplan, manuals and monitor, plus NEC P2 NLQ printer (will split). 9 months old, superb condition, £2400 o.n.o. Tel: (0282) 843405 (Lancs/Yorks).

● 20MB HALF HEIGHT HARD DISK FOR I.B.M. With or without controller, disk, £315. Complete subsystem £356. 10MB hard disk with controller £300. Will demo. Mr Eaves 0844 43953 (Bucks area).

● CBM 8032 COMPUTER. With 8050 dual disk drives, 3022 tractor feed printer, cassette unit, toolkit and MIKRO assembler ROMs. All cables and manuals. £300 the lot. (058 285) 2315 (Herts).

● BBC B. With everything. High res. colour monitor, Torch Z80 second processor, twin double sided disc drives, 140 cps printer, modem, penman plotter, ROM/RAM board, shadow RAM, mouse, £750. Hughes (041) 637 4785.

● COMMODORE 3032. Supersoft hi-res board. Dual CzN cassettes. 2031 drive. Aculab printer interface, all cables, manuals, some software. £350 o.n.o. Tel: 0254 86337 (Nr Blackburn).

● TAXAN KAGA KP810. Almost new. 160 CPS, Centronics I/F 3k buffer, NLQ. Must sell. Incompatible with computer, £160 o.n.o. Tel: (01) 671 9887 before 2pm or 488 2388 Ext. 3167 after 4pm.

● COMMODORE 64. Cassette recorder, 1541 disk drive, disks, software and magazines. £200 o.n.o. Plus carriage. Tel: Chris. Days (0823) 70345. Eves and W/es (0823) 78713.

● COMMODORE 128. With datasette, joystick, seven games, books, mags. £150. Tel: 073081 6798 after 8pm (West Sussex).

● DE RE ATARI. In binder, £11.80. Technical ref. notes +DOS 2 utilities source listing in 3 binders. £18.50. Assembler/editor ROM cartridge, £7.50. All prices include postage. Buckley (0244) 547323 anytime.

● TANDY MODEL II. 64k, full disk expansion (4 drives), DMP 105 dot matrix printer (new), Scripsit versions 1.0a and 2.0, Cobol, Profile, Pofile+, Visicalc, TRS DOS 2.0, some manuals (not Profile, Visicalc) £850 o.n.o. Tel: (0752) 772597 Eves.

● OSBORNE EXECUTIVE. 128k, CP/M 3.0, Wordstar, Personal Pearl, Supercalc, MBasic, CBasic, R System, megabytes of public domain software, original documentation. (Technical manuals, HP printer extra) Excellent condition. £475 o.n.o. Fife (0383) 419267.

● APPLE II3 64k. Compatible disk drives, controller, printer card, 80 col, Z80, colour card, joystick, Amdek VDU, Epson FX80 printer, many programs and manuals. Bargain £590. Tel: 0925 64017 after 6pm.

● SUPERBRAIN 64k. CP/M, Wordstar, Datastar, two drives, manual, good condition. £400. Tel: 0602 864472 day, 0602 279473 eves.

● CPC 664/6128 SOFTWARE FROM £6.95. Includes database, disk utility, 3D graphics program, graphic data editor plus games. For details write to O Temple, 12 Lynmoor Road, Weymouth, Dorset DT4 7TW.

● SEIKO DATA 2000 COMPUTER WATCH. With keyboard, alarm, stopwatch and calculator functions. Brand new, unused and boxed with manuals. Cost £120, accept £50. Tel: Nott'm (0602) 506320 daytime.

● DARTS SCORE BOARD. Calculates the score, what is required and what double you need (501). Amstrad 464. Send £1.50 to D Cooper, 65 Newsam Road, Kilnhurst, Rotherham, S Yorks, S62 5UL, England.

● FUTURE COMPUTERS FX20. Dual disk drive, CPM-86, CCPM-86, MS DOS. Wordstar, Supercalc, D-Base II, and modem software, £800. Ardevora Veor, Philleigh, Truro, Cornwall. Tel: 0872 501547.

● COMMODORE C128. Two 1570 drives, MPS 802 printer, 1520 plotter, two C2Ns. Comes complete with all the latest books, manuals, software, mouse, joysticks. Can't list all here! £700 o.n.o. Tel: 051 423 5493 (Eves).

● APRICOT PC KEYBOARD. In 'as new' condition. Excellent opportunity to acquire a spare or replace your faulty keyboard. Bargain £95. Tel: Reading (0734) 478274 Eves/W/es.

● PROFESSIONAL DAISYWHEEL PRINTER. Triumph Adler TRD170S, serial interface, continuous or cut sheet stationery, cost over £600. In 'as new' condition, bargain £295. Tel: Reading (0734) 478274 Eves/ W/es.

● ATARI 1040 STF. Second 1M Atari drive, Philips colour monitor, latest TDI Modular 2 language, toolkit, textbook and GEM manual, Centronix printer cable. Boxed, all leads, month old. £1100 o.n.o. Tel: (Herts) (09277) 62403.

● COMMODORE +4 COMPUTER. 1551 disk drive, MPS 802 printer, Philips amber monitor, all new and unusued, £380 o.n.o. Due to cancelled project will split if need. Tel: 051 423 5192 (Cheshire). Must go this week.

● AMSTRAD PCW 8256. FD2 second disk drive, one megabyte (720k formatted) capacity. Includes user manual and installation instructions. Hardly used £70. Peter Darvell, 79 Cock Lane, High Wycombe, Buckinghamshire.

● GEMINI RACK SYSTEM. Quantum 2000 twin 800k disks, 512k, RAM disk, CP/M 2.2, masses of software including: Aztec C, LMP Forth, many DB's, WP's, languages and DBase II applications. £690. Tel: 0908 510803 or (01) 949 7426.

● WANTED DBasell for ICL PC31. CP/M 2.2 and manuals. Contact 37a Thistle Street, EDINBURGH EH2 1DY. END

LEISURE LINES

Brain-teasers provided by JJ Clessa.

A happy and prosperous New Year to all our puzzlers. Here are two easy problems.

Quickie

A golden oldie. A bottle and a cork cost 25p. The bottle cost 20p more than the cork. What did the cork cost?

Prize puzzle

The number 27 has the following property. It is the sum of three different sets of consecutive integers — each of which contains at least two integers:

a) 2+3+4+5+6+7 = 27
b) 8+9+10 = 27
c) 13+14 = 27

The number 21 also has three such sets:

a) 1+2+3+4+5+6 = 21
b) 6+7+8 = 21
c) 10+11 = 21

Can you find the smallest number that has 10 such sets?

Answers on postcards, please, or backs of envelopes only, to reach *PCW*, Leisure Lines January 1987, 32-34 Broadwick Street, London W1A 2HG, no later than 31 January 1987.

October prize puzzle

Less than 100 entries this month. Perhaps the problem was a bit more difficult than usual, or perhaps Bingo isn't as popular as it used to be. Anyway, Fred's Bingo card could have looked like any of the three shown opposite.

The winning entry, chosen at random from the pile, came from A Simpson of Perth. Congratulations Mr (or Ms) Simpson — your prize is on its way!

		25	36				73	
	17				53	64		
4				49				81

4				49				81
		25	36				73	
	11				59	64		

1						61	71	
		25		49	59			
	16		36					81

To all the also-rans — keep trying, it could be your turn next month. END

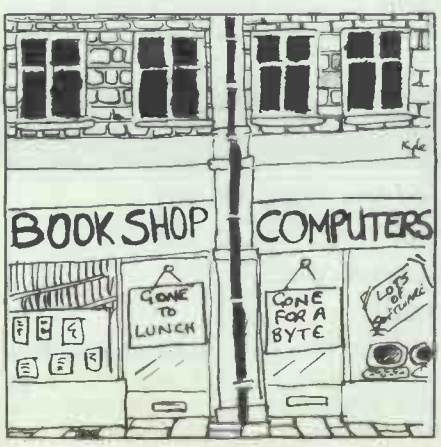
ACC NEWS

If you're wondering what to do with that micro you got for Christmas, why not get in touch with the ACC? Rupert Steele is your contact.

Welcome to this month's festive ACC news. Among the piles of torn wrapping paper and discarded toys lacking batteries, I imagine there will be more than a few micros delivered by Santa this year. And it's a fair bet that a good many of these micros will find their way to the back of the cupboard because Santa's customers aren't sure how or why to use their machines.

And that is where computer clubs come in. There are computer clubs in many schools, among the staff associations of many companies and, of course, in many localities. Here people can gather together to find out about the latest machines, software and tips. Favourite subjects include communications (and especially what you can do on the Prestel system or using bulletin boards), clever graphics tricks, and making your computer talk to assorted bits of mechanical and electrical equipment. As well as these there are, of course, user groups. These offer practical help, so I would recommend that you join the user group for the machine you own or are thinking of buying.

And this is where the ACC comes in. The ACC is a national association that covers all types of computer clubs. We have a list of 600–700 in our national database, and a good proportion of those have taken the further step of 'affiliating' to the ACC. As a result, they receive free public liability insurance cover, as well as the option of cheap insurance through the ACC for computer equipment at or in transit to club meetings. Regular readers will also know that the ACC runs, through its Electronic Publishing Committee, the ClubSpot database on the Prestel system. We also have a number of bulletin boards on the FIDO network. John Bone, who was last year's ACC chairman, runs a board for ComputerTown NE! using equipment made available to the ACC by Sperry (which we have loaned to CTNE for this purpose). It's called 'Log-on-the-Tyne' and is on (091) 477 3339 from 10pm–7pm (21 hours) daily or via FIDONET net 503 node 17. For more details, send an sae to John at 3 Claremont Place, Gateshead, Tyne & Wear NE8 1TL.



To help keep down the cost of ACC services, the ACC will sell its list of computer clubs to suitable commercial companies at a fee of £50 per set. This helps computer clubs to keep in touch with special offers that may be made, and also plays an important part in keeping the ACC's finances running smoothly. For more details contact me, Rupert Steele (at the address below).

Finally, the ACC gives publicity to clubs which contact it. One of the major such routes is through this column — but please remember that I'm not psychic, so I need you to write to me if you want a mention for your club. The rest of this column is devoted to people who have done just that . . .

Around the UK

Michael Ryan has written to me from Forfar (north of Edinburgh) to tell me of the Econet User Group for Scotland. This was formed in early 1986 as a result of a widespread feeling among users of Econet systems that more support was needed for such a complex system than the manufacturers appeared ready to provide. The group has a newsletter which, as one would expect, is packed with technical information about how to run Econet systems and how to get round the bugs in various implementations of Econet. Although the group is nominally for Scotland, it welcomes members across the UK and from abroad. If you are interested, and would like to hear the 'NEUS' (that's the name of the club newsletter), contact Michael Ryan at Balkeerie Cottage, Eassie, by Forfar, Angus DD8 1SR, Scotland.

I have had a note from Alan Owen, chairman of the Wigan Computer Club. The group has been running for almost four years and caters for all kinds of computer users, although most members tend to be BBC, Commodore 64 or Spectrum owners. The group meets on the first and third Wednesday of each month at Mesnes High School, Wigan. At the meetings you will find a workshop, and talks or demonstrations on occasion, and most of the local computer dealers offer discounts to members. More information is available from the secretary, Tom Sim, on Wigan (0902) 214499, or write to Alan Owen at 1 Lidgate Close, Winstanley, Wigan, Lancs WN3 6HA.

Paul Edmonds has also notified the ACC about the Crewe Computer Users Club, of which he is club secretary. The club has around 50 members and covers all kinds of micros. It meets on alternate Fridays from 7.30–10pm at the Christ Church Hall, Crewe. Write to Paul at 25 Oak Tree Drive, Crewe, Cheshire CW1 1LB for more information — and include an *sae*.

DE Whittick has also written to me from Crewe, where he runs the Mid-Cheshire QL User Group. This consists of him and a group of QL enthusiasts who intend to meet fortnightly in Crewe. Please contact Mr Whittick on Crewe (0270) 255753 or write to him at 72 South Street, Crewe, Cheshire CW2 6HL for more details.

While we are on the subject of the QL, I ought to mention the National Independent QL Users' Group. This was the enthusiasts' answer to Clive Sinclair's 'QLUB' which never really caught the public's interest. The independent group has now been re-named 'QUANTA' and offers support for the QL and the various forthcoming compatibles (that is, machines with QL logic and *proper* keyboard/disks). For more details, contact Brian Pain at 24 Oxford Street, Stoney Stratford, Milton Keynes MK11 1JU.

And, finally, I have heard from the Random Access Computer Club. This serves the Newark area in Nottinghamshire. The meetings are held on alternate Thursdays at Balderton Parish Council Hall, Pinfold Lane, Balderton, Newark Notts, starting at 7pm. The club caters for all machines and more information is available from Peter Hare on Newark (0636) 73495 — or you can write to him at 208 London Road, Balderton, Newark, Notts NG24 3HD.

For a mention in this column, to tell the ACC about your club, or to obtain labels for mailing to the ACC's register of computer clubs, contact Rupert Steele at 12 Philbeach Gardens, London SW5 9DY.

For any other enquiry, including the details of your local computer club, send an SAE and details of the enquiry to John Dale, 12 Poplar Road, Newtown, Powys SY16 2QG.

END

END ZONE

NUMBERS COUNT

Mike Mudge explains the relevance of Bernoulli and Euler numbers as related to Kummer's regular primes.

The subject area of Bernoulli and Euler numbers was proposed by Albert N Debono, of 21 St Anthony Street, Rabat, Malta, who would be pleased to receive any comments or suggestions for further work in connection with this topic.

Let us begin with an optional mathematical digression:

(1) Some readers will be familiar with:

$e=1+1/1!+1/2!+1/3!+1/4!\ldots\approx 2.718281828$; and also with the exponential function:

$\exp(x)=e^x=1+x/1!+x^2/2!+x^3/3!+x^4/4!\ldots$; convergent for all values of x.

It will come as no surprise to these readers to learn that:

$F(x)=x/(e^x-1)$

can be expanded as a power series in ascending powers of x. Thus we may write:

$F(x)=B_0+B_1x/1!+B_2x^2/2!+B_3x^3/3!+B_4x^4/4!\ldots$

This expansion defines the Bernoulli Numbers B_r, for $r=0,1,2,3,4\ldots$

(2) We define a sequence of rational numbers $B_r=N_r/D_r$, (these are fractions expressed in their lowest terms; N_r and D_r having no common factors) by $B_0=1$, $B_1=-\frac{1}{2}$ and for $n\geq 2$ by:

Equation 2.1 ... $B_0/(n!\ 0!)+B_1/((n-1)!\ 1!)+B_2/((n-2)!\ 2!)+\ldots+B_{n-1}/(1!(n-1)!)=0$.

(where 0! is defined to be 1 and $(n-1)!=1\times 2\times 3\times\ldots\times(n-1)$).

Thus $B_0/(3!\ 0!)+B_1/(2!\ 1!)+B_2/(1!\ 2!)=0$ yielding $B_2=1/6$.

It is readily seen that $B_3=B_5=B_7=\ldots=0$ now $B_4=-1/30$, $B_6=+1/42$, $B_8=-1/30$, $B_{10}=+5/66$, $B_{12}=-691/2730$, $B_{14}=+7/6\ldots$

$N_{36}=26315271553053477373$, $D_{60}=56786730$ where in these last two values any reference to sign has been omitted, for convenience in typing. Clearly in B_{4n} for integer n, either N_n or D_n must have a negative sign associated with them, in order to render B_{4n} negative, as the above pattern suggests.

Euler Numbers are defined in a similar manner using the secant function, thus:

$1/\cos x=\sec x=E_0-E_2x^2/2!+E_4x^4/4!-\ldots$

or alternatively:

$(1-x^2/2!+x^4/4!-\ldots)(E_0-E_2x^2/2!+E_4x^4/4!\ldots)=1$.

It is readily seen that $E_0=1$, $E_2=-1$, $E_4=5$, $E_6=-61$, $E_8=1385$. However, it is somewhat more time-consuming to obtain:

$E_{24}=15514534163557086905$.

Now Ernst Eduard Kummer (1810–1893) defined a 'regular prime', P, to be a prime number which does not divide any of the numerators of the Bernoulli Numbers up to B_{P-3}; all other primes are 'irregular'.

For example 37 is irregular since it divides $N_{32}=7709321041217=37\times 208360028141$.

The sequence of irregular primes begins 37, 59, 67, 101, 103, 131, 149, 157; these were known to Kummer in 1874.

Subsequently E Stafford and HS Vandiver used desk calculators to determine all of the 'irregular primes' up to 617 by 1937.

The relevance of the above concepts are best demonstrated in *13 Lectures on Fermat's Last Theorem* by Paulo Ribenboim (Springer 1979).

This month's problems are:

(a) to construct a computer program (using equation 2.1 above or otherwise) incorporating a cancelling routine to determine, given a positive integer N, the members of $B_r=N_r/D_r$ for $r=0,1\ldots N$.

(b) to use the N_r together with a table of prime numbers, or otherwise, to obtain a sequence of irregular primes; and

(c) to determine Euler Numbers together with their prime factors.

Attempts to solve these problems may be submitted to Mike Mudge, 'Square Acre', Stourbridge Road, Penn, Near Wolverhampton, Staffordshire WV4 5NF, tel (0902) 892141 to arrive by 1 April 1987. It would be appreciated if such submissions contained a brief summary of results; together with thoughts relating to these problems, in a form suitable for future publication in *PCW*.

These submissions will be judged using suitably vague criteria, and a prize will be awarded to the 'best' contribution received.

Mike Mudge welcomes correspondence on any subject within the areas of number theory and other computational mathematics. Particularly welcome are suggestions for future 'Numbers Count' articles; all letters will be answered in due course.

Isolated readers can be put in contact with others sharing common interests; however, greater efficiency regarding published problems should result from contacting the prize-winner directly.

Please note that submissions can only be returned if a suitable stamped addressed envelope is provided.

Review: S_k sets & extensions

Readers wishing to study 'Sets in which xy+k is always a square' for x and y in the set and k given are referred to the paper of the above title by Ezra Brown in *Mathematics of Computation* (Vol 45, Number 172, October 1985, pp613–670).

That paper together with its bibliography represent the state of the art as far as is known to the author. Further information is welcome.

This month's prize-winner is Geoff Lockwood, of 254 Crystal Palace Road, East Dulwich, London SE22 9JH. Geoff programmed his Apricot F1e in Fortran to list S_k sets with elements less than any given number (up to 6000) for any value of k.

Prompted in some way by 'Numbers Count', a letter from Donald Cross, of 66 Pennsylvania Road, Exeter EX4 6DF, posed a number of Diophantine problems (as well as the issue of multi-grades). I hope to return to this topic at a later date. END

MICROCHESS

By now many of you will already know the results of the 1986 World Microcomputer Chess Championship, but several months prior to the game Kevin O'Connell had to speculate on the outcome. How did he score? Read on, and find out.

By the time you read this article, the 1986 World Microcomputer Championship will already be over. The event, which as I write is still in the future, promises to be fascinating since it features another battle between Fidelity (who has won the Championship every time it has played) and Mephisto (who shared first with Fidelity in 1984 and then took sole first in 1985), while London's own Intelligent Chess Software can

never be ruled out.

In anticipation of the World Championship in Dallas, it is interesting to see how the top of the line commercially available programs from the contenders shape up to each other. There is such great rivalry between all the leading chess computer manufacturers, and the outcome of games between their different machines is of such commercial importance that it is extremely difficult to get any reliable comparative information about their various machines. *Computer Chess News Sheet*, published by Eric Hallsworth, of West Winds, Aberdovey, Gwynedd LL35 0EA, is an invaluable source of just such comparative information, and I am indebted to it for the following games.

White: Fidelity Par Excellence. Black: Mephisto Amsterdam. Opening: Philidor's Defence.

1	e2–e4	e7–e5
2	Ng1–f3	d7–d6
3	d2–d4	Ng8–f6
4	d4xe5	Nf6xe4
5	Qd1–d5	

Nb1–d2 is more usual, but this is an acceptable line.

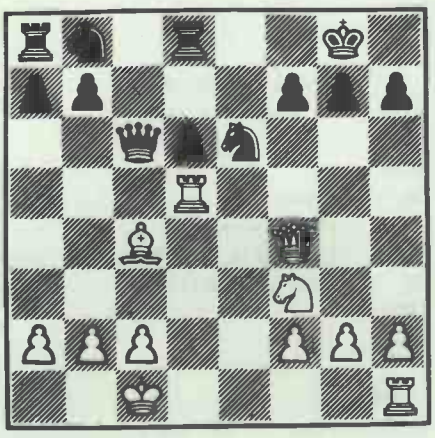
5	...	Ne4–c5
6	Bc1–g5	Bf8–e7
7	e5xd6	c7xd6

Here 7 ... Qd8xd6 8 Nb1–c3 h7–h6 9 Bg5–e3 c7–c6 10 Qd5xd6 Be7xd6, with a level game, is 'book'.

8	Nb1–c3	Bc8–e6
9	Bg5xe7	Qd8xe7
10	Qd5–d4	O–O
11	O–O–O	Rf8–d8
12	Nc3–d5	Qe7–d7

I prefer the immediate 12 ... Be6xd5 13 Qd4xd5 Nb8–c6.

13	Qd4–f4	Be6xd5
14	Rd1xd5	Qd7–c6
15	Bf1–c4	Nc5–e6

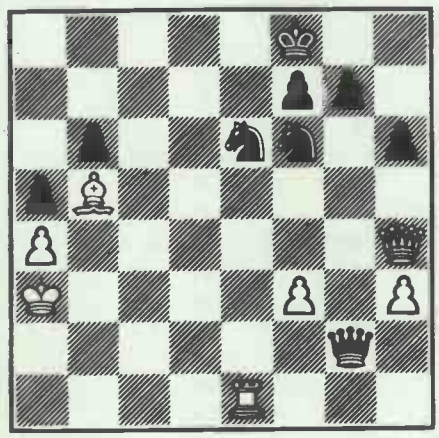


Chessboard 1

White has a clear edge thanks to his lead in development, greater space and Black's weak d-pawn. Black's only real chance is a counter-attack along the c-file.

16	Qf4–e4	

Avant Garde vs Mephisto Amsterdam varied with 16 Qf4–g4 but Black triumphed in a long and interesting game: 16 ... Nb8–d7 17 Rd5–d1 (avoiding the knight fork) 17 ... Nd7–f6 18 Qg4–h4 Rd8–c8 19 Bc4–d3 a7–a5 20Rh1–e1 Qc6–c5 21 a2–a4 Rc8–c7 22 h2–h3 Ra8–c8 23 c2–c3 h7–h6 24 Bd3–c2 d6–d5 25 Bc2–f5 Rc8–e8 26 Nf3–e5 Kg8–f8 27 f2–f3 b7–b6 28 Bf5–d3 d5–d4! 29 Bd3–b5 d4xc3! 30 Bb5xe8 c3xb2+ 31 Kc1xb2 Qc5–c2+ 32 Kb2–a1 Rc7–c3 (threatening mate) 33 Rd1–d3 Rc3xd3 34 Ne5xd3 Qc2xd3 35 Be8–b5 Qd3–c3+ 36 Ka1–a2 Qc3–c2+ 37 Ka2–a3 Qc2xg2



Chessboard 2

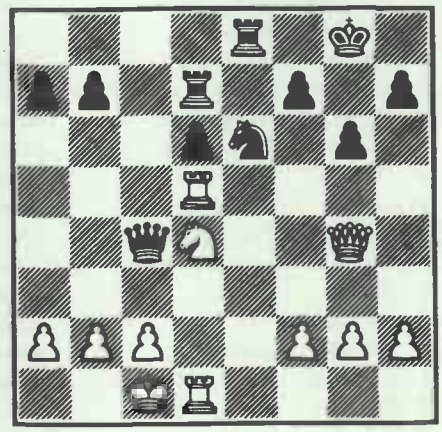
(Black has regained material equality and has much the better position (White's king is in the open, White's bishop is a miserable piece and the knight pair can wreak havoc) 38Re1–f1 Qg2–d2 39 Qh4–g3 Ne6–f4 40 Rf1–e1 Kf8–g8 41 Re1–g1 Qd2–c3+ 42 Ka3–a2 Nf6–d5 43 Ka2–b1 Nd5–b4 44 Qg3–h2 (to stop the mate threatened by 44 ... Qc3–c2+) 44 ... Qc3xf3 45 Qh2–b2 g7–g6 46 Rg1–e1 Nf4–e6 47 Bb5–f1 h6–h5 48 Re1–c1 Ne6–c5 49 Qc2–c3 Qf3–e4+ 50 Kb1–a1 Nc5xa4 51 Qc3–d2 Kg8–g7 52 Bf1–g2 Qe4–e5+ 53 Ka1–b1 b6–b5 54 Rc1–f1 Na4–c3+ 55 Kb1–c1 Nc3–d5 56 Kc1–b1 Nd5–e3 57 Rf1–c1 Qe5–f5+ 58 Kb1–a1 Nb4–c2+ 59 Rc1xc2 (59 Ka1–a2 fails to 59 ... Qf5–e6+ 60 Bg2–d5 — otherwise 60... Ne3–c4 forks king and queen — 60 ... Ne3xd5 and 61 ... Nd5–b4+, mating or getting an easily won queen and pawn ending) 59... Ne3xc2+ 60 Ka1–b2 Nc2–b4 61 Qd2–d4+ Kg7–h7 62 Qd4–d2 Nb4–d3+ 63 Kb2–b1 Nd3–f4+ 64 Kb1–a2 b5–b4 65 Qd2–f2 a5–a4 66 Bg2–f1 Qf5–d5+ 67 Ka2–b2 a4–a3+ 68 Kb2–c1 Qd5–e5 69 Qf2–a7 Qe5–b2+ 70 Kc1–d1 Kh7–g7 71 Bf1–c4 (this loses the bishop, but all was lost anyway) 71 ... Qb2–a1+ 72 Kd1–c2 Qa1–c3+ 0–1.

16	...	Nb8–d7
17	Bc4–b5	Qc6–b6
18	Bb5xd7	Rd8xd7
19	Nf3–d4	Ra8–e8
20	Qe4–f5	

Another Avant Garde-Amsterdam game went rather better for White after 20 Rh1–d1 g7–g6 21 Nd4xe6 f7xe6 22 f2–f4 Re8–e7 23 Rd5–d3 d6–d5 24 Qe4–e5 Rd7–c7 25 Rd3–e3 Qb6–b4 with fairly level play.

The text is somewhat irrelevant since it gives Black too much time on the queen-side against the white king.

20	...	g7–g6
21	Qf5–g4	Qb6–b4
22	Rh1–d1	Qb4–c4



Chessboard 3

23	Nd4–f5?	

The other Avant Garde-Amsterdam game varied here with the definite improvement 23 Rd5–a5 and then went on 23 ... b7–b6 24 Ra5–a3 Ne6xd4 25 Rd1xd4 Re8–e1+ 26 Kc1–d2 Qc4–e6 27 Qg4xe6 Re1xe6 28 Ra3–d3 Kg8–g7 29 c2–c4 with a small but clear advantage for White.

23	...	Qc4xa2!

23 ... Qc4xg4 is simply answered by 24 Nf5–h6+ and recapturing on g4.

24	Rd5xd6	Rd7–c7
25	c2–c3	Re8–c8
26	Qg4–g3	Qa2–a1+
27	Kc1–c2	Qa1–a4+
28	Kc2–c1	Qa4–a5
29	Nf5–h6+	Kg8–g7
30	Qg3–h4	

White's attack is illusory, but Black's is very real.

30	...	Rc7xc3+
31	Kc1–b1	

31 b2xc3 Rc8xc3+ 32 Kc1–b1 (32 Kc1–b2 Qa5–a3+ 33 Kb2–b1 Rc3–b3+ and 34 ... Qa3–b2 mate) 32 ... Rc3–b3+ and 33 ... Qa4–c3 is mate.

31	...	Rc3–c4
32	Nh6–g4	

32 Qh4–e7 loses the knight and other queen moves allow mate after 32 ... Rc4–a4.

32	...	Qa5–f5+
33	Rd1–d3	Rc4xg4
34	Qh4–e7	Ne6–f4
35	Qe7–d7	Qf5xd7
36	Rd6xd7	Nf4xd3
37	Rd7xd3	Rg4xg2
	0–1	

END

END ZONE

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(0001)185 4179	Dublin Fido	Dublin	10pm-8am	10pm-8am	3/1275	
(0001)885 634	DUBBS-Dublin	Dublin	8pm-8am	24	3-24	
(0001)903 341	IACCBBS	Eire	24	24	3	Irish ACC. Runs on Comodore 64
(01)200 3439	Airtel - TBBS	London	24	24	3/1275	Pilots area
(01)200 7577	TBBS London NW	London	24	24	3/1275	TBBS, Tandy Users Group
(01)207 2989	Dark Crystal Fido	London	24	24	3-12	
(01)248 5747	Prestel 24 hrs	London	24	24	3	No graphics on this number
(01)346 7150	Marctel	London	24	24	3/1275	FBBS system.
(01)348 9400	TBBS London	London	24	24	3-12	
(01)399 2136	MG-Net	London	-	Sun 5pm-10pm	3	
(01)429 3047	OSI Lives!	London	24 Ring back	24 Ringback	3	
(01)435 6246	London Dungeon Fido	London	?	?	3/1275	
(01)450 9764	Techno Line	London	24	24	1275v	Commercial + 452 1500 eve +w/e
(01)452 1500	Techno-line 2	London	evenings	24	1275v	Commercial
(01)455 6607	NNBBS London	London	24	24	3/1275	
(01)542 3772	WBBS Wimbledon	London	-	sat7pm-mon8am	3/1275	
(01)542 4977	TBBS Rovoreed	London	24	24	3-24	
(01)543 7020	Dataflex Fido	S.London	24	24	3/1275	
(01)573 8822	Taecom	London	7pm-8am	all day Sun	300	Interak micro section
(01)580 1690	Poly Fido	London	24	24	3-12	
(01)638 2034	CyberZone	London	24	24	3	
(01)624 5338	Twighlight Phone	London	24	24	3	
(01)648 0018	MBBS Mitcham	London	24	24	3/1275	
(01)658 6942	Typnet	London	24	24	3	
(01)679 1888	Distel	London	24	24	3	Display electronics -Commercial
(01)679 6183	Distel	London	24	24	3/1275	Display Electronics - Commercial
(01)735 6153	Brixton ITeC	London	24	24	1275	
(01)853 3965	Assylum	London	24	24	3	Writers and comms areas
(01)863 0198	London U'ground Fido	London	24	24	3/1275	Fido -Amiga,Atari ST sigs
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(01)888 8894	Gnome at home	London	24	24	1275v	
(01)927 5820	Owltel	London	24	24	1275v	
(01)941 4285	Metrotel	London	24	24	1275v	
(01)960 4742	ITCU Exchange & Mart	London	24	24	1275v	ITeCs central system?
(01)968 7402	Communitel	London	24	24	1275v	
(01)985 3322	Hackney BBS	Hackney	24	24	1275v	
(01)986 4360	Health data	London	24	24	1275v	
(0204) 43082	Bolton BBS	Bolton	8pm-8am	24	3-24	8am-8pm on ring back
(0206)862 354	Pete's Place	Colchester	24	24	3	
(021)430 3761	CBABBS	Birmingham	24 (not Thurs)	24	300	
(021)444 1484	TUG II	Birmingham	8am-10pm R/B +	10pm-8am	3	
(0222)461 824	Capital Data Line	Cardiff	24	24	3	Computer repair company
(0222)464 725	Cardiff ITeC	Cardiff	24	24	1275v	
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(0224)641 585	ABERDEEN ITEC	Aberdeen	24	24	1275v	
(0224)781 919	Aberdeen Commodore	Aberdeen	24	24	300	Commodore 64 based
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(0258)54 494	TBBS Blandford	Dorset	24	24	300	Blandford Computers
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(0268)25 122	BITEC	Basildon	24	24	300	
(0268)710 637	RICBBS	Basildon	5pm-10pm	24	?	
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(0274)480 452	OBBS Bradford	Bradford	24	24	3/1275	Colour for BBC users
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(0702)552 941	Maptel	?	24	24	300	Commercial system
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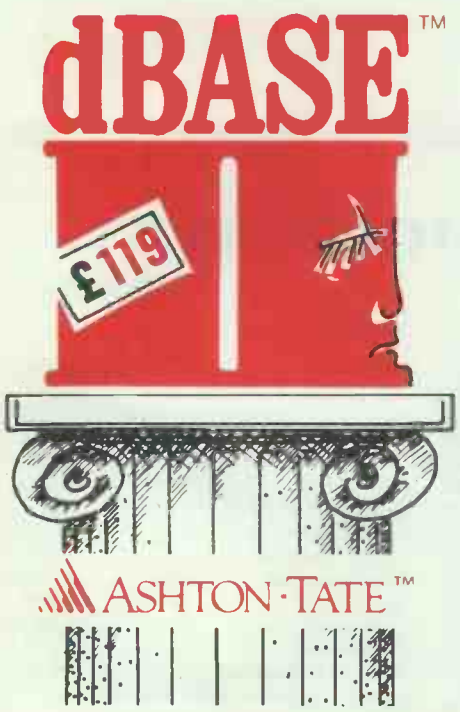

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SOFTWARE UPDATE

JANUARY 1986

ABLE TO COPE?

New Productivity Package Released In UK Frees Untapped Business Potential

By Tony Pickard, Director, Concept Data Limited.

Able One is not a panacea to cure all business ills, but it does indeed represent a fundamental step forward in the field of business software. Its UK launch heralds an important new era, an era in which the way software is written and designed is vital to the user.

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"INITIAL DEMONSTRATIONS WERE VERY IMPRESSIVE"

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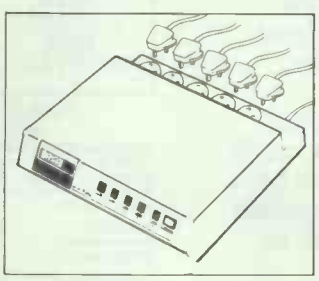

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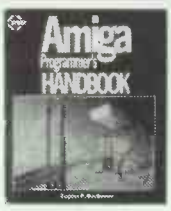

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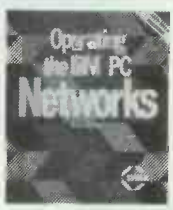

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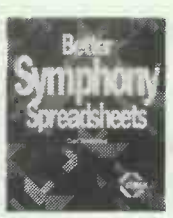

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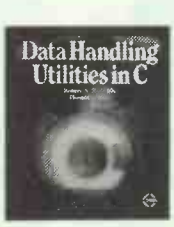

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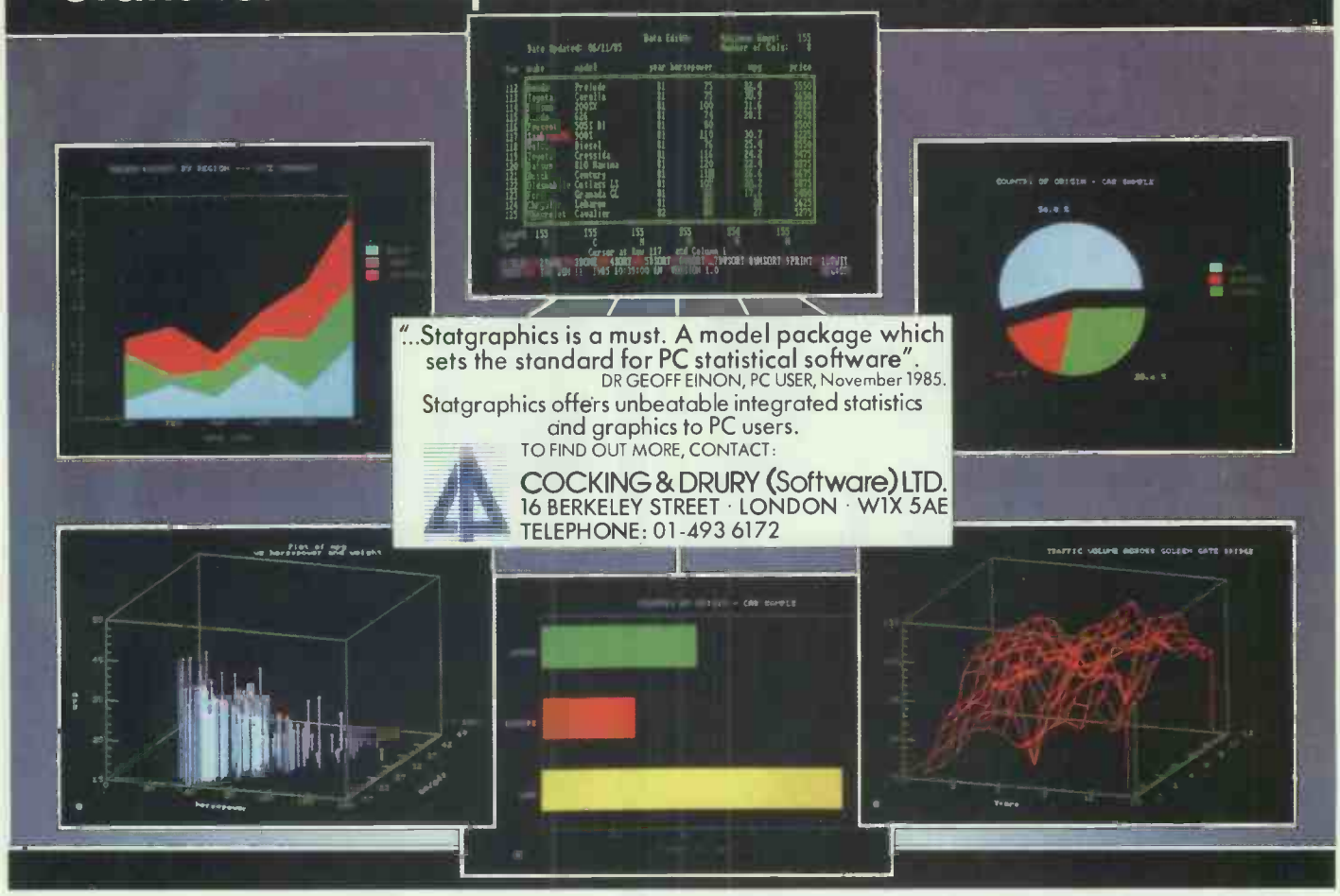

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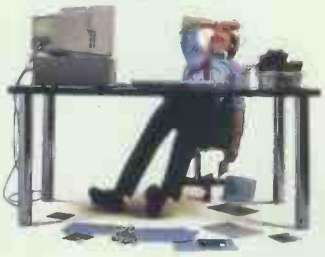

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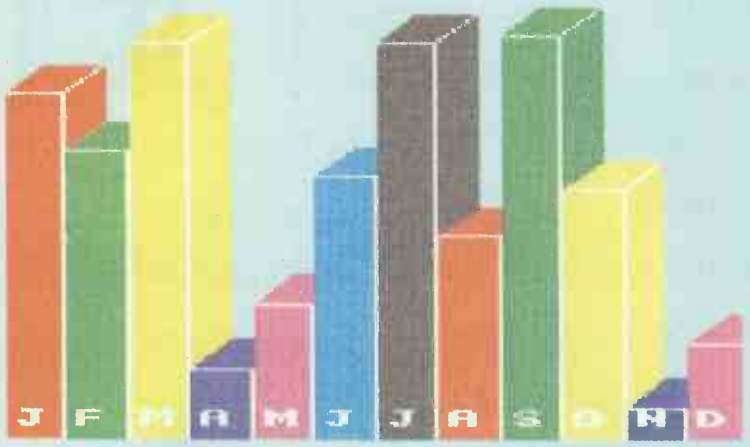

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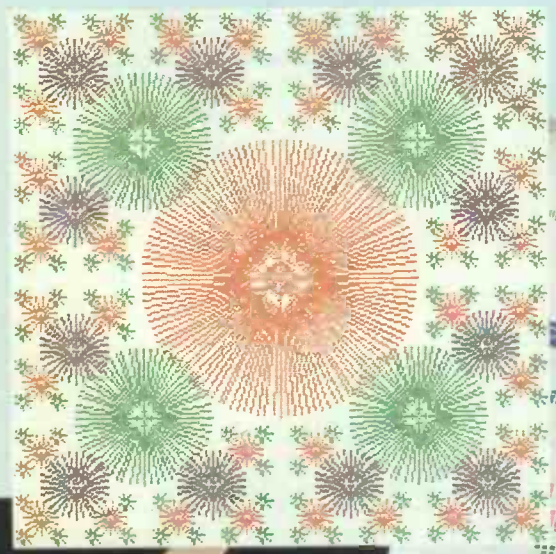

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520ST PACKAGES

The 520ST-M keyboard costs only £346.96 (+VAT=£399) and includes an RF modulator and cable, allowing you to connect it to an ordinary domestic TV set. The keyboard is supplied with 512K RAM, a mouse and a free set of 3½" disks containing applications software. For a limited period from August 11th 1986, we have some special packs offering combinations of the 520ST-M keyboard with a ½ Mbyte SF354 Atari disk drive and an Atari monitor (either the Mono SM124, or Colour CM36512). These packages offer up to £200 extra discount on a system. If purchased from Silica, they also come with our free 'ST STARTER KIT'. All of the pack prices shown in the chart include VAT.

		PACK 1	
£100 DISCOUNT 1 DISK DRIVE	ALL PACK PRICES INCLUDE VAT	Keyboard	£399
		Disk Drive	£149
		Normal Price	£548
		Discount	£100
		Pack Price	£448

£150 DISCOUNT 2 DISK DRIVES + MONITOR	PACK 2 (MONO)		PACK 3 (COLOUR)	
	Keyboard	£399	Keyboard	£399
	Disk Drive	£149	Disk Drive	£149
	Disk Drive	£149	Disk Drive	£149
	Mono Monitor	£149	Colour Monitor	£299
	Normal Price	£846	*Normal Price*	£996
	Discount	£150	*Discount*	£150
	Pack Price	£696	Pack Price	£846

£200 DISCOUNT 2 DISK DRIVES + MONITOR + PRINTER	PACK 4 (MONO)		PACK 5 (COLOUR)	
	Keyboard	£399	Keyboard	£399
	Disk Drive	£149	Disk Drive	£149
	Disk Drive	£149	Disk Drive	£149
	Mono Monitor	£149	Colour Monitor	£299
	Printer (SMM804)	£199	Printer (SMM804)	£199
	Normal Price	£1045	*Normal Price*	£1195
	Discount	£200	*Discount*	£200
	Pack Price	£845	Pack Price	£995

UPGRADE TO 1024K RAM

We are pleased to be able to offer a 1Mbyte upgrade on the standard 520ST keyboard to increase the memory from 512K to a massive 1024K. It has a full 1 year warranty and is available from Silica at an additional retail price of only £86.96 (+VAT=£100). Any of the five packs can be upgraded to 1Mbyte for only £100. The 1Mbyte ST offers a low price alternative to the 1040, but also gives you the benefit of an RF modulator (not normally fitted on the 1040).

REDUCED PRICES

Atari's ST personal computers are now firmly established both in the USA and Europe. The main attraction of the ST range is the value for money which these computers represent, giving both private and business users a powerful asset at a very modest price. There are now several ST packages available from Silica at a reduced price, further enhancing the Atari 'Value for Money' reputation. In addition, we are giving away a FREE Silica 'ST STARTER KIT' with every 520 or 1040 ST purchased at Silica Shop. These offers will only be available for a limited period and commence on 11/8/86.

POWER FOR BUSINESS

The list below shows some of the new business products which have been recently launched for the Atari ST range. It gives an indication of the ST's potential to business buyers looking to install a powerful, low-cost system:

CP/M EMULATOR
20Mbyte HARD DISK
LOTUS 123™ CLONE
dBASE III CLONE
IBM COMPATIBILITY
VT100 EMULATOR
MICROSOFT WRITE
dBASE II

Any ST computer will provide its user with a very powerful asset, utilising a vast range of applications, particularly in the business world. Many software companies have been quick to recognise it for its business potential, and have produced programs for the ST which harness this potential. In addition, there are several peripheral and hardware products becoming available to add to the ST's 'Power For Business'. Software now available includes dBMan, a dBASE III clone as well as H&D Base, a dBASE II clone. In fact, First Software have now launched Ashton Tate's original dBASE II program for the ST. In addition, PC Intercomm is a VT100 emulator which enables you to use any ST keyboard as a terminal connected to a mainframe or mini. Other programs include a powerful accounts package by Cashlink and a Lotus 1-2-3™ clone called VIP Professional. Microsoft have announced that their powerful word processor 'Microsoft Write' will soon be available for the ST. Many packages are available for very specific market applications including a powerful CAD (Computer Aided Design) program called Easy Draw from Migraph. In addition, there is an engineering tool called PC Board Designer by Abacus Software which will enable the user to design printed circuit boards. For further details of how the ST can help in your business, return the coupon below. We will be pleased to send you our latest newsletter and price list.

PRICE MATCH PROMISE

We hope you will find that the combination of our low prices, FREE delivery service, FREE Starter Kit and after sales support, will be enough to make you buy your Atari equipment from Silica Shop. If however, there is something you wish to purchase, and you find one of our competitors offering it at a lower price, please contact Owen Pascoe (Office Manager), or one of the telesales staff in our sales department. When you telephone us, please provide us with our competitors name, address and telephone number. Providing our competitor has the goods in stock, we promise to match his offer (on a 'same product - same price' basis) and still provide you with our normal free delivery. You will also be entitled to our full after sales service, including free newsletters and technical helpline support. We don't want you to go anywhere else for your Atari products. So shop at Silica, the U.K.'s undisputed No1 Atari specialist.

FREE SOFTWARE

When you buy a 520 or 1040 ST computer keyboard from Silica Shop, you will receive a large and varied software package free of charge. This package consists of twelve programs. Wherever you purchase your Atari ST computer, you should receive the first six software titles as standard. However, if you purchase your ST from Silica, you will also receive a further six extra titles, giving you a total of twelve. All ST's now have TOS/GEM already installed on ROM, so the list of free software you should receive is as follows:

1) GEM - *DR Desktop environment with WIMP (fitted in ROM)*
2) TOS - *Tramiel Operating System (fitted in ROM)*
3) 1st WORD - *Word Processor by GST using GEM*
4) BASIC - *Personal Basic by DR (with manual)*
5) LOGO - *Logo language by DR (with manual)*
6) NEOCHROME - *A powerful colour paint and graphics package (only useable with colour systems)*

If you purchase your ST from Silica, not only will you receive the standard six pieces of software as listed above, but we will also give you the following six additional programs FREE OF CHARGE:

7) MEGAROIDS - *Asteroids type game by Megamax*
8) DOODLE - *Simple paint/doodle drawing package (works on mono or colour systems)*
9) CP/M EMULATOR - *Allows use of DR's Z80 CP/M software to run on the ST range*
10) CP/M UTILITIES - *Various utilities to use with CP/M*
11) DEMONSTRATION & PUBLIC DOMAIN SOFTWARE - *Various games, demos and accessories*
12) CARDS - *A unique set of card games from Microdeal*

These additional free software titles are all part of the FREE Silica 'ST STARTER KIT', return the coupon below for further details.

FOUR FREE MANUALS

In addition to the free software which will be given to you when you buy your ST from Silica, you will receive four free manuals:

1) **ST OWNERS MANUAL (80 pages):** *Easy access to the information you require to unpack, set-up and become familiar with the ST.*
2) **ST BASIC SOURCE BOOK & TUTORIAL (240 pages):** *Gives you the information to increase your level of programming expertise.*
3) **ATARI LOGO SOURCE BOOK (77 pages):** *A source book for Logo, showing how to use the language in the GEM environment.*
4) **1st WORD MANUAL (48 pages):** *Instructions for 1st Word.*

ST NEWSLETTER

8 PAGES OF INFORMATION TO HELP YOU TO DECIDE
RETURN THE COUPON FOR A FREE COPY

1040ST-F

For the businessman and the more serious home user, there is the 1040ST-F with 1028K RAM. This can be used in a business environment as a stand-alone system, or can support a mainframe computer as a terminal. The 1040ST-F keyboard with integral 1Mb disk drive costs only £699 (+VAT=£803.85). As the 1040ST-F was manufactured solely with business use in mind, it does not come with an RF modulator for use with a domestic TV. Instead, it requires a monitor. There are three Atari monitors available and the prices for the 1040 with these monitors are as follows:

1040 Keyboard Without Monitor - £699 (+VAT= £803.85)
1040 Keyboard + High res mono monitor - £799 (+VAT= £918.85)
1040 Keyboard + Low res colour monitor - £899 (+VAT=£1033.85)
1040 Keyboard + Med res colour monitor - £999 (+VAT=£1148.85)

The 1040ST-F includes 1Mbyte of RAM as well as 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. The 1040ST-F is supplied with a set of software disks as well as our own FREE Silica 'ST STARTER PACK'. Call into your nearest branch of Silica Shop for a demonstration.

1-4 The Mews, Hatherley Road, Sidcup, Kent, DA14 4DX
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£699

FREE STARTER KIT

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At Silica we have been successfully dedicated to Atari ever since their products first appeared on the UK market. We can attribute our success largely to the Atari specialisation which we practice and to the user back-up we provide. Rest assured that when you buy a piece of Atari hardware at Silica you will be fully supported. Our mailings giving news of software releases and developments will keep you up to date with the Atari market and our technical support team and sales staff are at the end of the telephone line to deal with your problems and supply your every need. With our specialist bias, we aim to keep stocks of all the available Atari hardware, software, peripherals and accessories. We also stock a wide range of Atari dedicated books and through us, the owners on our list can subscribe to several American Atari dedicated magazines. We can provide a full service to all Atari owners and are now firmly established as the UK's NUMBER ONE Atari specialists. Here are just some of the things we can offer to our customers.

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If you would like to be registered on our mailing list as an Atari computer owner, or as a person interested in buying an Atari machine, let us know. We will be pleased to keep you up to date with new Atari developments free of charge. So, return the coupon today and begin experiencing a specialist Atari service that is second to none.

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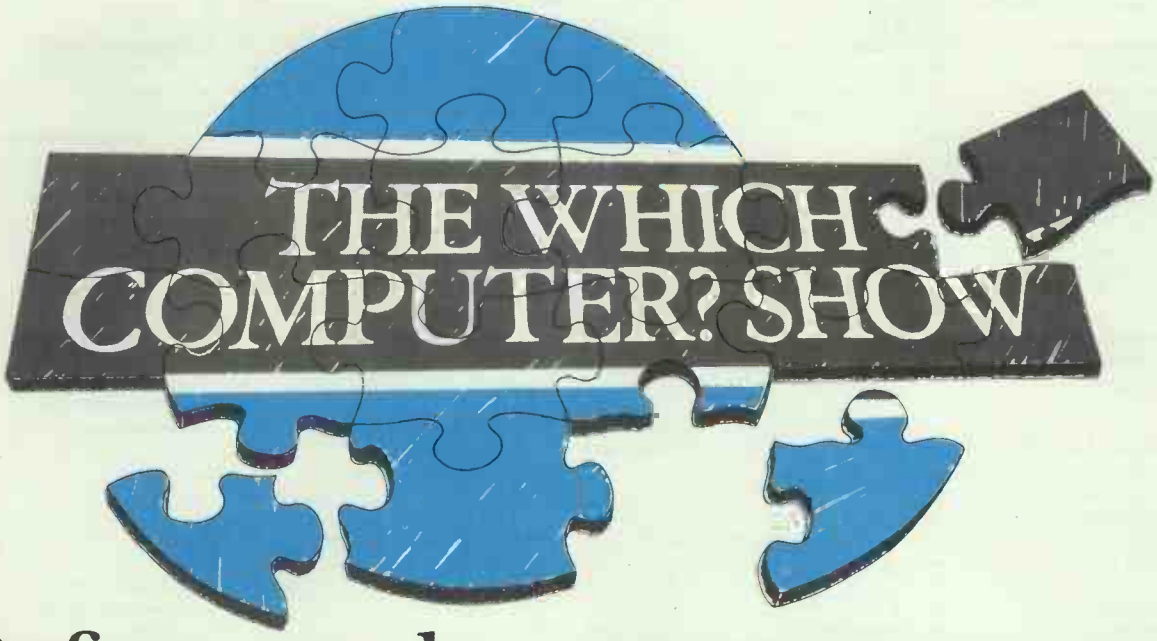
If so, which one do you own? .....



Before you buy your computer get the complete picture

Buying a computer is easy. Buying the right computer is more difficult.

The Which Computer? Show is the best place to start. It's Britain's largest business computer show with over 400 companies including *all* the big names. Hardware, software, peripherals, services... if you can't find it here it probably doesn't exist.

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The show is specifically designed to make your job easier. Take a look at some of the special features...

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BUYER'S GUIDE: With your free Show tickets comes a Guide with guidelines on choosing the right computer and how to make the most of your visit to the Show.

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P-11

The WHICH COMPUTER? Show IS THE SOLUTION?!

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Prices do not include VAT or other local taxes but do include delivery in UK and Europe. Please check prices at time of order, ads are prepared some weeks before publication.

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Not all assemblers are supplied with a linker. Check before ordering.

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We supply cross-assemblers by Avocet, 2500AD, and IAR Systems for more than thirty target processors to run on MS-DOS, CP/M-86 and CP/M-80. This totals more than 200 products and we do not have space to list them all here. We hold some stock but you should allow 10-14 days for delivery. Please call for information or advice.

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For more information please call us.

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We stock many items for which there is no space in these advertisements.

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CHIP CHAT

So you think your computer information is safe because you've protected it with a password? A survey conducted by Hogg Robinson showed that a significant proportion of users choose one of only 10 passwords: 'PASSWORD', 'PASS', 'FRED', 'LOVE', 'SEX', 'GOD', 'GENIUS', 'HACKER', 'SECRET', 'MINE'. If your password is among these, you have been warned.

Other tales of poor security include an account of how Hogg Robinson's investigators were able to walk unchallenged into *secure* computer rooms.

Another case study concerned a company whose two leading engineers carried £1,000,000 worth of information in their heads and daily travelled in the same car on London's busy North Circular Road to have lunch together in the same pub. One car accident could have wiped out the company. . .

Talking of living dangerously: at the end of November Apple Computer UK's leading lights set off to climb Kilimanjaro, Africa's highest mountain. Managing director David Hancock along with such other notables as Sonja Garsvo and Keith Philips set off to raise money for the Stoke Mandeville Spinal Injuries Centre.

Supermicro manufacturer Rair sponsored a car in the annual Beaujolais run from the vineyards of Villefrance to Dover. Marketing director Nick Flowerdew was on hand to welcome the drivers back. Thanks for the photo, Nick. But our bottle of plonk seems to have gone missing in the post. . .

One shudders to think that one avalanche could threaten a large part of the UK desktop publishing industry. . .

Talking of foreign parts, Olivetti has issued a denial that it is to expand its operations in South Africa. Nice one, Olivetti. Now, how about following the lead of IBM and Barclays and pulling out completely?. . .

'Info Technologi es u neo skience de kollekti stora, processi, e transmitte info.' If you understand any of that, then you're a prime candidate for a new language which its authors claim can be learned in an hour.

'Esperanto has failed, Glosa won't. It's modern, far simpler and ideal for computers,' claims author Ron Clark.

Glosa uses the Latin and Greek roots of European languages. So if your computer knows that 'hippo' means horse, and that 'face' means make, it's well away. Otherwise it would be better off sticking to conversing in hex. . .

Whether you use MS-DOS or PC-DOS, and whether you buy it from IBM or Wishy Washy Computers, the original code comes from Microsoft. And you might thus imagine that, if you find bugs in DOS, Microsoft would be delighted to hear from you.

Think again. Microsoft maintains that all responsibility for product support lies with the suppliers. 'Computer manufacturers are at liberty to modify our source code,' claims the Microsoft representative. 'So we cannot be responsible for the bugs that they might introduce.'

The fact that the bugs are in *all* versions of DOS, except where the computer manufacturer has explicitly removed them, makes no difference. And if you *do* try to get Wishy Washy Computers to make VDISK work properly, or to explain why your prompt keeps getting truncated, you will probably come up against the same brick wall. *PCW* would love to hear your favourite patches for DOS. if they're nice to us, we might even let Microsoft in on some of your bug fixes. . .

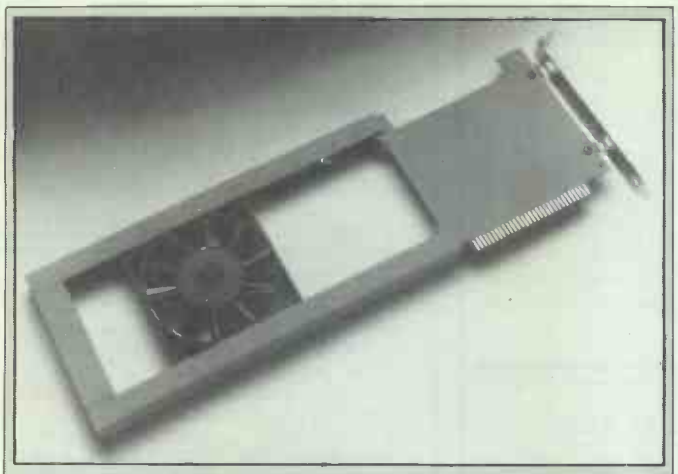
'I realise I was lucky to escape — but it was dreadful to have to watch helplessly as Apricot was totally destroyed.' Fortunately, these were not the words of a jobless Roger Foster walking the streets of Birmingham, but of Tony Bullimoree, captain of the trimaran called Apricot. Let's hope the large floating object which sunk the vessel in high seas wasn't called IBM . . .

Talking of sinking ships, we would have shed a tear at the demise of PC Upgrade, sponsor of our Innovation '86 competition, had it not reneged on the deal and failed to provide the winner with his £1000 prize. The directors of PC Upgrade are also responsible for a dealership called PC Compatibles. . .

We ought to be flattered that Apricot used the cover of September's *PCW* in its advert for the Xen-i. But why has it deleted the cover lines which said 'Apricot steps into line — Xen-i: Fresh start or final fling'? And why didn't it even include *PCW*'s comments among the review extracts?

Apparently our cover was the best photo of the machine that Apricot could find. . .

Users of Telecom Gold joining the Microlink network can gain telex facilities by paying an extra £10 joining fee. Good news, until they log on and discover a service called Telex2 which is absolutely free. . .



The saga of the overheating Amstrad PCs would have quickly burnt itself out, had it not been for inflammatory statements by Alan Sugar. Sugar proclaimed that he was fitting the fans but recommended that people didn't use them.

Computer Services, a Leatherhead company with an eye to a quick market, sent PCW *a release about its 'fan card'. This, of course, is a solution to a problem that Alan Sugar claims does not exist.*

While the company claims that the card has an ultra-low power consumption, we wonder what fire risks are posed by adding yet another power-consuming device to a bus already loaded with hardcards, memory boards and the like.

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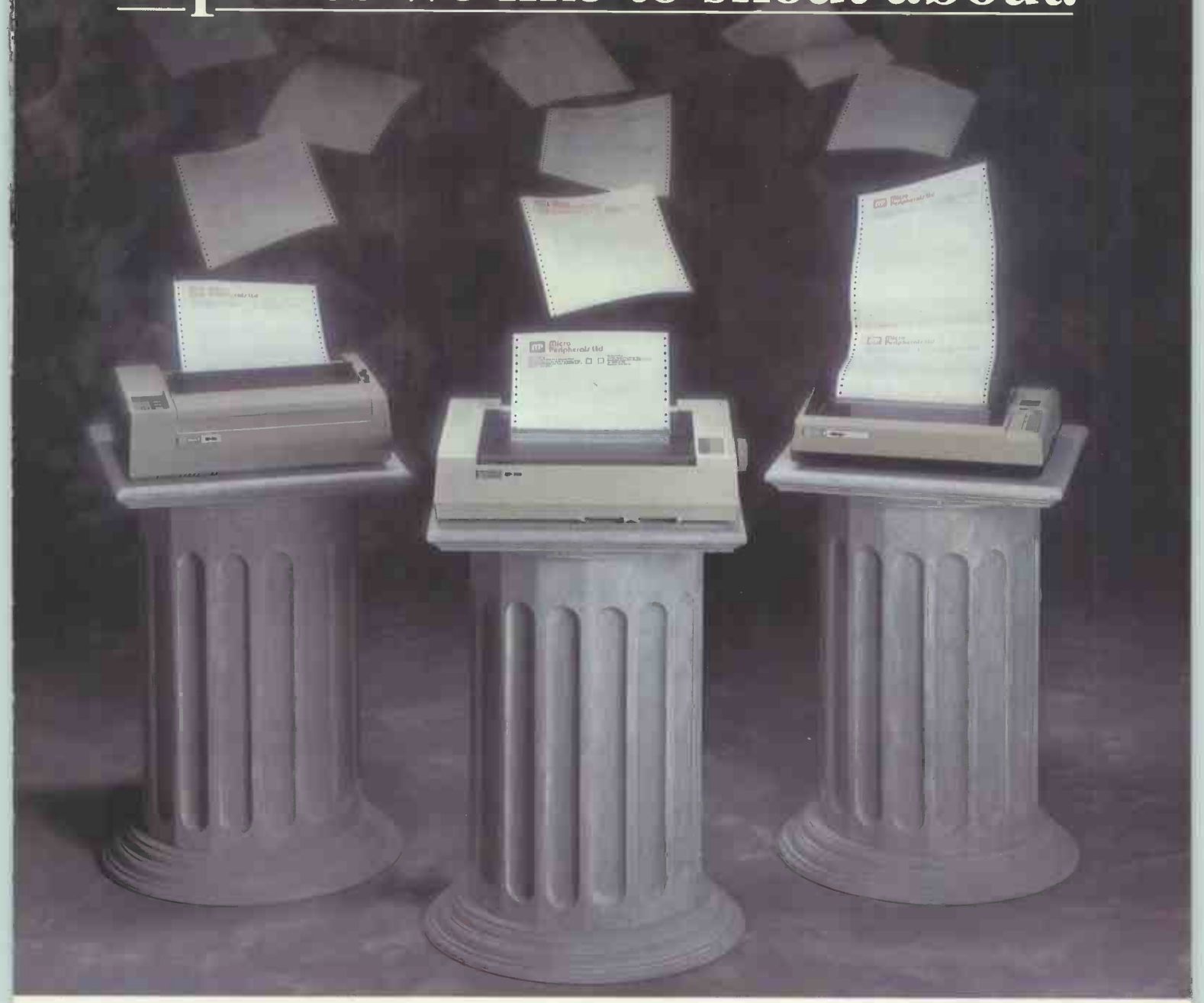

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