40p EVERY WEEK · JAN 27 1985 · No 96

PERSONAL Computer NEWS

3 SPECTRUM DISK DRIVES TO BE WON

FULL REPORTS FROM LAS VEGAS AND BIRMINGHAM

COMMODORE STRIKES BACK

PLAY POWER
New games for 64, Spectrum & BBC

64 IN TOUCH
Powerful program for the Koala Pad – p12

SHARP PRACTICE
Japan's latest business system – p24

SPECTRUM SPARKLE
Extra polish for your screen displays –

ROBOTS COME HOME

Get to grips with the BBC Micro

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MENU

COVER STORY

COMMODORE hits back 2

In the face of last week's onslaught from Atari, Commodore has re-grouped. It can't match Jack Tramiel's new outfit for numbers, but the three new systems demonstarted as far apart as Las Vegas and Birmingham will carry its standard into battle this summer.

OUTPUT

SPECTRUM novelty 10

The character set on your Spectrum can come in all shapes and sizes with our routines to interface to Basic programs.

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It's the real thing, a program to let Commodore 64 owners turn their Koalapad graphics tablets to something more inventive than pretty doodles.

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With an 8086 and an NEC graphics chip, the Sharp MZ5600 looks fast enough to give most of its rivals in the PC stakes a run for their money — and GEM is on the way.

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We check out three programs for serious star-gazers. Will they eclipse Elite? Can they outshine Star Wars? Judge for yourself.

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MONITOR

Grand alliance plots IBM's fall

Digital Research has announced a project that may do to IBM what DR's GEM threatens to do to Apple's Macintosh.

DR president John Rowley told a seminar in London that

his company will release an upgraded version of Concurrent DOS to run all software written for both PCDOS and Topview without modification.

Dubbed Concurrent DOS-286, it is a dedicated operating system for Intel's 80286 microprocessor — the powerhouse in IBM's AT machine. DR says: 'Concurrent DOS-286 will open up the market significantly by enabling systems which are based on the 80286, but which are not necessarily IBM compatible, to run IBM DOS applications unmodified.

The occasion of the announcement was billed as 'a joint seminar' held in London, Tokyo and New York by DR and Intel. The three-day international event graduaily emerged as a platform from which DR, Intel and several other collaborators launched an attack on IBM's near-monopoly.

Sharing the platform in London were ICL, Software Products International (producer of Open Access on the IBM PC), and Professor Martin Healey of the University of Wales. In New York Ashton-Tate joined in.

Most direct of the speakers was Ninian Eadie, director of ICL's office systems division, who termed IBM's market position 'not healthy for the industry or the end user'.

John Rowley summed up,the promise of the 80286/Concurrent DOS project as 'compatibility with IBM and, at the same time, it will open the door to innovative system designs'.

ICL and Acorn, on its top-of-the range ABC machines, have already signed high volume licences for Concurrent DOS-286 which DR intends to ship before June this year.

Microvitec moves to touch screen tutoring

Touch screen technology is set to invade the nation's classrooms. Microvitec, manufacturer of the top-selling monitor in schools, today (Wednesday) unveils the Touchtech 501.

At £210 (plus VAT) the Touchtech is a stand into which a standard metal cabinet Microvitec monitor is fixed, with a screen bezel which houses infra-red sensors.

Infra-red beams are projected across the front of the monitor screen and the sensors detect when the beams are broken. The exact coordinates are fed back to the serial port of the micro.

The system is ideal for software involving a choice between one or more alternatives.

The Touchtech 501 works with the BBC Micro; models to work with other popular micros are in the pipeline.

Atari's new stars due for spring UK debut

Atari's Las Vegas show-stoppers could be in the UK as early as April at prices close to straight $1/£1 conversions.

The six new micros from Atari's US stable (issue 95) are due to make the UK journey by May according to the company's UK subsidiary. But one of Atari's leading UK distributors, Silica Shop, is giving an April date for the machines to make their appearance.

A spokesman from Silica revealed that he expected the XE 8-bit range to be available in late April with the ST range following shortly.

On pricing he said: 'We estimate the XE range to sell from around £150 to £400 and the ST range won't go above £700.' This would be virtually a $1/£1 conversion from the prices announced in the US.

In fact, Silica expects to sell the 65XE for under £150, the

Atari 520ST — spring launch.

65XEM with a music synthesiser for less than £400 and at the top end of the XE range the 128K 130XE and the 65XEP nearer the £400 mark.

Commodore covers new angles at Vegas

We make no apology for taking our coverage of the Las Vegas Consumer Electronics Show into a second week. There was too much on show to do it full justice last week — and the Commodore machines in particular deserve a closer examination.

One of the biggest disappointments was the non-appearance of Amiga's Lorraine, the 16-bit computer acquired by Commodore, but it showed two new products which both look like winners.

The Commodore 128 is a triple processor computer with 6510, 8502 and Z80 microprocessors. Like the Atari STs, the 128 has a professional keyboard with numeric keypad and a whole new range of peripherals.

When switched on, the computer initialises to 128 mode which has 58K RAM available for Basic text and a further 64K for variables and data storage. This is run by Commodore's new 8-bit 8502, which is compatible with the 6502 (BBC Micro) and 6510 (C64's cpu).

The Basic is version 7.0 and is a vastly improved version of the old Commodore 64's Basic 2.0. Not only can the 7.0 handle sprites and high-resolution graphics from Basic but it has a number of structured features that computer buffs love, such as DO — LOOP and BEGIN — BEND.

There is 64K of ROM for the 128 mode: 48K for 7.0 Basic and 16K for the improved Disk Operating System.

The 64 mode is 100 per cent compatible with the Commodore 64, ensuring a whole range of games software for the 128 before its launch.

It also supports all the 64's peripherals, so 64 owners can upgrade their machines without having to throw away peripherals and games.

The third mode is CP/M, running on a Z80A processor. The Commodore 128 will therefore be able to run business software such as Wordstar and dBase II.

The 128 is a revolutionary machine for Commodore. First, the 128 has an improved Basic. Second, and most important, the 128 is compatible with other computers. Commodore has always made its machines totally incompatible with anything else in the field, but this machine has not just one, but two compatibilities.

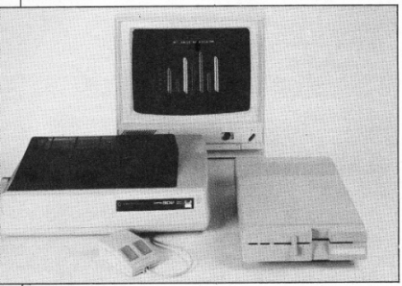
The 128 will be selling at around $300 from this spring and every indication is that the 64 will be reduced. There is uncertainty over what will happen to the Plus 4 and C16.

Commodore is also joining the lap-held bandwagon by releasing the Commodore LCD. Weighing approximately 3lbs, the Commodore LCD has an 80 by 16 column liquid crystal display which is bigger than Epson's PX-8.

It runs on the CMOS 65C02 which is yet another version of the 6502 and has 96K of business and telecommunications software. The LCD also has a built-in 300 baud modem and runs on rechargeable batteries.

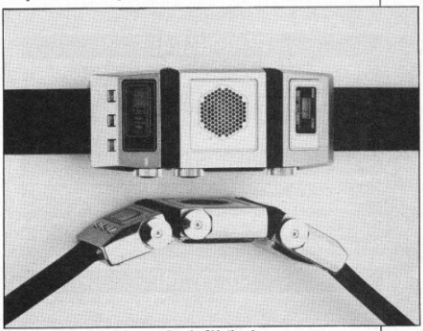
LCD has Basic 3.6, and 32K of CMOS RAM. The keyboard is strange. The photographs in press hand-outs showed a normal full-travel keyboard but when the machine turned up at the show it had different, flattish, keys.

The 128 and LCD indicate that Commodore is moving out of the games computer market into middle of the road business computers. The departure of CBM from this field is a perfect opportunity for the MSX crowd to move in.



Trim peripherals — Commodore's add-ons for the C128.

Commodore LCD — great white hope in the light-weight division.



Sinclair's radio wrist-watch — stealing the QL's thunder.

MSX circus hits town at last

After all the-will-they-won't they speculation, the MSX circus hit Las Vegas by showing a whole range of computers. Microsoft played host to almost all the MSX manufacturers in Japan, Holland, Korea and the US. The MSX stand was saturated with computers in many variations.

The current trend in MSX is to have a built-in 3.5in disk drive. Sony, Panasonic and Spectravideo showed their latest MSX with disk drive included and most of the manufacturers are hoping to launch these 'value added MSX' systems in the US.

Although most manufacturers will not comment on launch dates or prices, Harry Fox, founder of Spectravideo and now a spokesman for Microsoft commented that MSX will definitely be launched in the United States this autumn at prices between $200 and $300. He said that as most American manufacturers are moving away from the lower end of the home computer market, MSX will soon dominate the field.

Panasonic, Sony and Pioneer now have video superimposition units and video editing facilities for MSX. Pioneer made an impressive demonstration of its MSX laser disk system, Palcom, which showed a new game called Star Fighters produced by ASCII's high technology laboratory. Star Fighters has graphics generated by a super mini VAX 11/780 with the MSX game itself superimposed on top of the computer generated image, recorded on the laser disk.

Of all the manufacturers, New York-based Spectravideo showed the largest number of products. Spectravideo now has MSX Express which is a full 64K RAM computer with a 3.5in disk drive built in. Also it has RS232, 80 column card, and modem cartridges. Spectravideo was the first to announce a Local Area Network (LAN) for MSX which enables 32 systems to be connected.

Toshiba showed the follow-up to its HX10 MSX computer, the HX-22. This has much better styling than its predecessor and has a word processor written by Broderbund Software. Toshiba's machine is said to be ready but it is waiting for

other manufacturers to launch their products in the US.

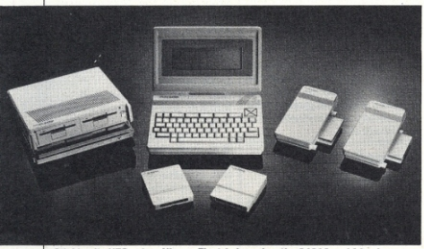
Sony and Panasonic displayed similar machines, both with separate keyboards and built-in disk drives. Philips' latest VG8020 48K MSX was also on show for the first time.

The MSX stand also hosted three software companies, Infocom of Zork fame, Lisp Company and Nexa Corp. Infocom displayed its latest interactive detective game called Suspect.

The Lisp Company showed its Logo, which it claims is faster than Digital Research's DR Logo. Nexa Corp also showed an impressive F15 Combat flight simulator.

Konami had a large stand adjacent to MSX's, showing six new MSX games.

Not to be outdone by Epson and Commodore, NEC launched a follow-up to the much-acclaimed PC8201. The new PC8401A is a battery-powered lap-held with 64K RAM. The LCD screen is 80 by 16, which is the same size as Commodore LCD and twice that of Epson's PX-8. The screen is placed inside a lid which protects the keyboard in transit.



Sticking its NEC out — Nippon Electric launches the 8401A and friends.

The PC8401A also has a 300 baud built-in modem and telecommunications software which can emulate a DEC VT100 terminal. It's a CP/M compatible machine, and Wordstar and Personal Filer are included in ROM.

The price is set to under $1,000, similar to that of CBM LCD and Epson PX-8.

The biggest surprise for any British visitor to CES was undoubtedly the Sinclair wristwatch radio. While Sinclair announced its 'car' in the UK, here at CES it gave a preview of the world's smallest FM radio.

British presence is worth watching

The biggest surprise for any British visitor to CES was a compact FM radio. The result is a totally portable radio timepiece which will sell for under $100 when it goes on sale in the US later in 1985.

The watch component includes all standard time and calendar functions, 24 hour alarm with hour chime, and light. The radio operates on a 1.5 volt battery housed in the watchband's clasp.

The radio antenna is entirely self-contained inside the watchband. The miniature loudspeaker eliminates the need for a separate earphone.

Sinclair has also announced that the QL will be on sale for $499. US sales will be conducted exclusively via mail order from Sinclair's US office in Boston but in this age of mass marketing and high performance machines like the Atari ST and Commodore 128, QL may turn out to be doomed from the beginning.

The one and only British software house at CES, Mastertronic, introduced a range of arcade games on disk for the Commodore 64. The price is set at $9.99 which sounds incredibly expensive by British standards but in the US it is seen as a major price breakthrough for computer software. Previously most 64 games sold for around $20 to $30.

The first ten games to be launched in the US include Chiller (without Thriller) and Monty Python's The Quest for the Holy Grail.

The company has already sold 140,000 programs since its October debut in Canada and hopes to repeat the success in the US.

A new Silicon Valley company called Soniture showed an unusual device called a Space Tabulet. This comprises a receiver frame that can be placed on top of the computer display and a pencil-like pointer (transmitter) that you hold.

It acts like a light pen but the receiver frame can detect the position of the pen in three dimensions using ultrasonic waves.

This ingenious device is to be marketed in Britain by Dragon off-shoot Touchmaster.

An Apple a day keeps rumours at bay

An old favourite has just been re-issued from the Stale Rumours and Baseless Predictions Department. Apple won't survive 1985, it says. The same thing was said this time last year but 1984 didn't rhyme with 'survive' so nothing came of it.

It's comforting when life is predictable in this way. Old Moore could put a regular insertion under January in his famous almanack: 'Heavy snow blankets Witney; royal corgis whelp; doomsayers point finger at Apple Computer.'

It's a measure of Apple's success that the competition should regularly claim to detect signs of terminal illness in the company. 'The Mac can't succeed,' they cry, and then they rush out to implement Digital Research's GEM so that their systems look like a Macintosh. They already looked like an IBM PC because IBM compatibility takes less in the way of imagination.

Apple's prospects for 1985 are a matter of reasonable public interest, but it's unfair to single Apple out as the runt of the litter. You could make a case for any number of micro makers coming under a lot of pressure in the next few months, and there are better reasons than an intuitive leap for doing so.

The falling pound, for example. It may not be having much impact over in Cynical Valley, land of high technology and constant sunshine, but in the UK there will be pricing policies in tatters all over the country.

The one dollar pound has been a fact of life in the micro industry for a long time, but that dates back to when the pound stood above $1.40. When the official rate starts to draw close to £1 = $1 something will have to give.

Anybody who imports systems or components will have noticed the difference. In most cases they'll be paying in dollars, which is to say that they'll be paying more for the same goods.

The most obvious way to keep the existing profit margin on what they sell is to bump prices up to compensate — but the trend over the whole industry is in the opposite direction. Prices fall regularly. The competition for sales is so intense that a price increase from one company would probably drive it immediately out of business. Go to the wall, go directly to the wall, do not pass Go . . .

There isn't any prospect of safety in numbers; the manufacturers couldn't orchestrate a coordinated price rise to protect themselves. Even the MSX manufacturers found their members breaking ranks when the general level of prices looked unacceptable. In the business micro market if IBM was to put up the price of its PC, one or two others might get away with following suit. The rest would simply increase their production and rub their hands happily.

So the companies are faced with a dilemma. Their costs are rising but their prices are already under pressure — downwards. Some of them will already be operating uncomfortably close to the edge of unprofitability, cutting corners wherever they can just to stay in business. Many will have few opportunities of improving productivity and absorbing the extra costs that way.

For a while, they may be able to absorb these costs and keep prices competitive by cutting their mark-up. The unofficial cost of building a Macintosh is $500 — if that figure is accurate Apple still has some room to manoeuvre. But it isn't a recipe for long-term success. The next generation of machines is developed from the profits made by the present generation.

Under these circumstances, the most diversified companies have a clear edge. A computer maker that also produces (for the sake of argument) a best-selling roller-skate powered by a hair-dryer motor might be able to cover a loss on his computer operations from the profits on his roller-skates. Big companies can erect similar bulwarks by drawing on reserves set aside for those rainy days.

But companies with only one line of business and one main product could be in trouble. Maybe that's why people always pick on Apple, whose UK boss David Hancock admits that a lot depends on the Macintosh. But it's obvious that a number of other companies are going to feel the cold winter chill before Apple does.

David Guest

MONITOR: WHICH? SHOW

'Shy' Commodore PC has nothing to hide

The Mad Hatter is alive and well, if Commodore's Alice in Wonderland performance at last week's *Which Computer?* Show is anything to go by. The company had its new PC-compatible up and running, but wasn't saying anything about its price or capabilities, so you could play with it provided you didn't mind Commodore not telling you how to play with it.

Similarly, although a 'full support package' for the machine was unveiled to existing dealers, Commodore wouldn't say what the package comprised. If it's at all exciting we'd be happy to hear from tame Commodore dealers . . .

Commodore is apparently sensitive to allegations that it has pre-announced products in the past, and has therefore gone over the top on the rebound by installing padlocked zippers on mouths throughout its public relations department.

The box, however, looks nice, if a trifle large, and those nice people at Commodore are prepared to admit it's a 16-bitter.

From other sources we can tell you that the Commodore PC has plenty to be shy about. Its 8088 runs at 4.7MHz, its 256K of RAM can be expanded to 640K, its 12in monochrome

Commodore PC — cloak of secrecy.

monitor offers 640 by 200 pixels, and there are five expansion slots besides parallel and serial interfaces. You can have two 360K floppies or one floppy and a 10Mb hard disk. This combination sounds depressingly familiar.

The machine is due to be launched in the spring as part of Commodore's 'offensive' on the UK business market. It looks as though it could get stuck in the mud.

Toshiba inscrutible about new releases

Toshiba made its entry into the business computer market with two machines: the T1100, a 7lb portable and the T1500, a desktop IBM compatible machine. Both are built around the 8088 processor.

The T1100 comes complete with 256K of memory and an 80 character by 25 line liquid

Toshiba T1100 — no tosh here.

crystal display.

The larger T1500 desktop claims full IBM compatibility and has 128K RAM, either dual 5.25in floppy or floppy/hard disk drives and, unlike the IBM, a colour graphics interface is included as standard.

Ascertaining prices for these machines was a process fraught with difficulty. Without a translator present, the charming and helpful Toshiba representatives chose to answer every enquiry whatever its aim with the words: 'IBM compatible'.

Leather-bound ABMs whip market

Not everybody's approach to IBM compatibility was as lacklustre as Commodore's. ABM Computers had luggables starting at £1,095 in three styles — leather-bound, Kaypro-clone, and specially toughened.

These are called respectively the Ambassador, the Envoy and the Commando. They're driven by 8088s with 128K and twin 320/360K floppies at the bottom of the range.

Through its Far Eastern connections ABM also imports two desktop machines from Sun Electronics — the Suntac PC6000 and PC6700 are also MSDOS compatible.

But the company aims to build systems in this country.

Tandy all-in-one best yet to come

Tandy has unveiled the latest addition to its wide range of business microcomputers. The Model 1000 compares very favourably with the IBM PC, with a lower price and colour graphics supplied as standard.

For £1,099 the Tandy 1000 has an 8088 processor, 128K RAM (expandable up to 640K) and a double-density 5.25in disk drive giving 360K of storage when formatted.

Included in the price is Deskmate, which gives you a simple word processor, electronic spreadsheet, filer, communications program, diary and mail package.

It is not intended to compete with the larger packages that are about, such as Lotus 1-2-3, but is designed so that any one who buys the machine will be able to use it without having to spend any more money.

But the version of MS-Windows that graced the 1000 on the Tandy stand is still not the polished production version. Summer is the best guess on the availability of Microsoft's elusive Windows.

Sagesoft/OCP drive for Sinclair

Sagesoft is a company with designs on the QL — Sage Accounts will shortly be available through Sinclair at £89.95, including VAT. This may seem an unpleasantly high price to you, but versions for the more conventional business machines come in at £375, so the QL program is something of a bargain.

Sagesoft will also be converting its payroll program, and is working on an unspecified non-business project for the QL.

Meanwhile, Oxford Computer Publishing provided the vehicle for the first showing of the Abbeydale Designers' SPDOS disk drive for the Spectrum, which is being marketed by Watford Electronics. OCP revealed its 'silicon office' concept, which is intended to turn the Spectrum into a business system, and which is based around SPDOS.

The first disk program out of the traps is Stock Manager, which is to be followed shortly by Purchase Manager and Sales Manager.

OCP wins the accolade of being one of the first companies giving software support to SPDOS, the other notable being HiSoft, which is scheduled to issue its Pascal program in SPDOS format.

TI MSDOS shows friendly front-end

Fronting up the Texas Instruments stand was the Prolite portable, launched in the UK ten days ago. But TI also demonstrated some of the fruits of its extravagant spending on artificial intelligence — a natural language front-end to MSDOS and an expert system on a micro.

TI's argument is that systems that treat you like an idiot are fine when you're finding your feet, but after six months it may become a little tiresome. So its friendly front-end to MSDOS is something that you can switch in and out of.

Not that you have to type in complete English sentences to work your way through it — the selection of English commands is by a rotating series of menus. It costs £75.

Antipodean micro stages a return

There wasn't a tinny of Fosters in sight on the Australian stand, but the Dulmont Magnum has found a UK distributor and could soon be a regular feature of trade shows.

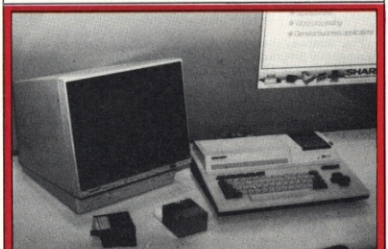
Professional Micros, of Longstanton, near Cambridge (0954-81991) is supplying the £2,195 portable in this country. The machine, with an 80186, 96K of CMOS RAM, 128K of ROM, and a flip-up 80 by 8 LCD screen, weighs about 8lbs and runs MSDOS.

Trilex puts colour into its Doodles

Back on the genuine IBM front, Trilex was showing a colour version of its Doodle Computer Aided Design package for the IBM PC and Olivetti M24.

Doodle is a competent design package, and it is compatible with IBM DOS files.

It costs around £600.



MZ800 — Sharp's new micro [issue 91] made its first public appearance at the show. Look out in a forthcoming *PCN* for a full Pro-Test. The machine couples MZ700-compatibility with Personal CP/M, and falls into the home/business range of the QL and the Plus/4.

MONITOR

IN BRIEF

DK Tronics, new owner of Currah Computer Components (issue 95) is now putting the finishing touches to Currah's Micro Source. This high level assembler for the Spectrum was the last product Currah was working on before it went under. DK Tronics says that Micro Source will be available in a month, with versions for other popular computers following later.

Cheetah will donate all profits from sales of its game The Perils of Bear George to the Ethiopian famine relief appeal. Universal Software is also chipping in £1.50 from each sale of its £2.99 Starship Adventure game for the Dragon.

Lynx fans with that neglected feeling can take comfort from a new surge of interest in their micro. Phoenixx Software (no relation to the now-defunct Phoenix Software) is releasing Jet-Set Willy at £7.95 for the 48K and 96K Lynxes. A version for the 128K model is on the way. Phoenixx (0928-35525) claims the support of Romik, Gem and Level 9 in its effort to give the Lynx the kiss of life.

Database Software's Mini Office — rated 'quite exceptional value' by *PCN*'s reviewer in issue 93 — is due out in new versions for the Amstrad and the Commodore 64. The package gives the user a rudimentary word processor, database, spreadsheet, and graphics for an amazing £5.95. The new versions should be on sale by the end of the month through Boots and WH Smith.

Software Projects and Ocean have patched up their differences over the use of the Hunchback character in computer games. Ocean has withdrawn its legal action against Software Projects and has allowed it to go ahead with its Hunchback at the Olympics game. In return, Software Projects has acknowledged that Ocean owns the copyright to Hunchback and will not be producing any other games featuring the character.

There are now more 16-bit micros being launched than eight-bit machines. Who says so? BIS-Peddar (01-633 0866) which publishes a Quick Reference Guide to microcomputer systems. According to its latest figures there are now 295 eight-bit micros on the market, 185 16-bit machines and 71 32-bit machines. Depressingly, 64 micros are described as being IBM compatible. In 1984, 191 new micros were launched of which 88 were 16-bit and only 64 eight-bit.

QL — one today, jam tomorrow

Sinclair is celebrating the first birthday of the QL with acres of advertising and proud promotions. Keen wait-watches will notice that the company has lost none of its '28-day delivery' panache.

'See how far we've come,' says Sinclair as it details the software and hardware available or planned for the QL. Languages from Metacomco, Computer One, Micro APL and GST. Applications from Psion, Harcourt and Accountancy Software. And a range of peripherals from Kaga, Quest, CST, Miracle Systems and Sigma Research.

However, the hard disk 'available shortly from Quest' is still some way off delivery. 'We don't know when it will be available,' said a Quest sales executive.

Similarly, Quest's memory expansion boards are still in the pending category. The 64K and 128K boards are due 'any day now'. But the 512K board is in the 'don't know when' category.

Interestingly, the peripherals and add-ons from Quest and other third party suppliers cover almost exactly the list of products that Sinclair implied at the QL launch that it was developing itself.

The non-availability of the hard disk is particularly intriguing. For the rest of the software and hardware Sinclair could suggest that it was always intended that they would be developed by third parties.

But Quest's Firefly, of course, can only be used for CP/M and not QDOS. So how much longer will users have to wait for a version that works with the QL's own operating system?

And for a machine that has been around for a year there is still a depressingly small amount of software around. As recently as November, Sinclair was issuing to the press information claiming that 'the extensive hardware development is paralleled by extensive software development activities involving over 200 houses'.

Sinclair is still making promises of goodies to come. 'Two things are now certain about QL software,' the advert claims. 'First, there's going to be plenty of it. And second, it's going to set completely new standards for microcomputers . . .'

'At the moment, there are well over 100 software programs in development,' it proudly trumpets.

Nice to know there's jam tomorrow . . .

Sinclair milestone marked by gold QL

Are you one in five million? If you own one of Uncle Sir Clive's micro marvels you are. Sinclair celebrated the sale of its five millionth micro at the *Which Computer?* Show last week by holding a free raffle for a gold painted QL. Well, it perhaps makes a welcome change from 'you can have any colour providing it is black'.

Micro Power hurls down the gauntlet

'Probably the most challenging game ever devised for the BBC Micro'. That's Micro Power's catch phrase for Castle Quest, and from what we've seen it's not far short of the mark.

Micro Power is staking a lot on the game; there's a £500 high-score competition and if you crack the game within three months of purchase, Micro Power will pay you £1. Mind you, the game cost £12.95, so a less-than 10 per cent refund isn't much to write home about.

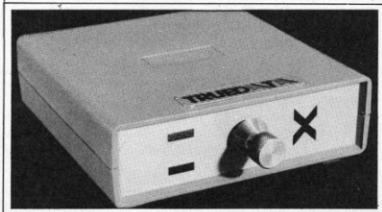
The game is basically an arcade platform affair, with some unusual features. There are a number of problems to be solved which require rather more thought than normal arcade games.

Research Machines cuts disk prices

School micro specialists Research Machines (RML) has cut the price of its hard disk drives. a 10Mb Winchester and controller now costs £2,344 and a 20Mb Winchester and controller costs £2,771.

The controller can handle up to four Winchesters and RML is quoting £1,536 for extra 20Mb drives. The prices don't include VAT, so they still look overpriced. But schools do get an educational discount.

Users preferring to opt for high capacity floppies might like to know that RML has cut the priced of its quad density drives to £924 which is only £125 more than the cost of RML's double density drives.



JEKYLL AND HYDE — With the flick of a switch Truedata X Switch allows you to swap add-ons from one computer to another. Costing £113 for an RS232 mode and £136 for a Centronics mode, it allows up to two computers and two add-ons to be hooked up to the box. The Truedata switch from DNCS (0706-67567) is reasonably priced compared to Inmac's devices of the same ilk. Inmac's Centronics box costs £258 and its RS232 £223. In addition, DNCS has a 32K buffer-to-T-switch up for grabs for anyone with an RS232 interface on their micro. It costs £228.

RADIO

PROGRAMME	DATE & STATION	AUDIENCE
Using your computer	Starting Wednesday May 1, 11.40-Noon, Radio 4 VHF	9-12-year-olds
Computers at work	June 12, 19, 26, 11.40-Noon, Radio 4 VHF	9-12-year olds
The Mole concept	May 16, 00.30-01.10am, Radio 4 VHF	General public
Uniformally accelerated motion	May 17, 00.30-01.10am, Radio 4VHF	General public

TV

Micro Live	February 8, 6pm BBC 2 March 8, 6pm BBC 2	General public General public
The Learning Machine	From October 1985 the programme goes weekly Weekly starting March for seven weeks, late night BBC 1	General public
Computers and the disabled	Starting June, five weekly programmes	General public

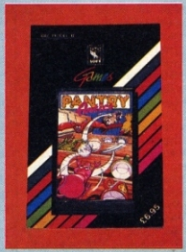
For those dreary days and nights when time drags, here are the BBC radio and TV programmes.

BRITISH BROADCASTING SOFT CORPORATION

EXCITING NEW SOFTWARE FOR YOUR MICRO

Doctor Who and the War Lord
An intriguing text adventure featuring the quirky and irrepressible Doctor. It increases in difficulty as the adventure unfolds, presenting a real challenge to the player.
BBC Model B: Cassette
£7.95

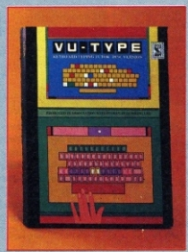
Loco Motion
A remarkable animated game that gives the player control of a train travelling around an extensive network comprising about 50 screens.
BBC Model B and Acorn Electron: Cassette
£6.95



Pantry Antics
A fast, amusing and addictive game. The player takes the part of a mischievous mouse, running along the pantry shelves and earning points for each piece of crockery knocked over.
BBC Model B: Cassette
£6.95

White Knight Mark 12
A new, more powerful version of Martin Bryant's award-winning chess program. It includes a 'save-game' facility and other useful features.

BBC Model B: Cassette
£9.95



Vu-Type Disc
Vu-Type is an exciting personal aid that teaches you to touch-type without tears, using colour graphics, sound and musical tones. It is now available in a disc based version.
BBC Model B: Disc
£18.40 ***(Cassette version still available: £16.10)***

Vu-Type Professional
An enhanced and expanded version of Vu-Type that includes many new Pitman-approved exercises and comprehensive documentation.

BBC Model B: Disc
£21.95 (approx)

All software is for the British Broadcasting Corporation Microcomputer except where indicated.
Prices include VAT. Available from booksellers and computer shops.

RANDOM ACCESS

Pull out your pens and printers. Send your letters to Random Access, Personal Computer News, 62 Oxford St, London W1

Game for a Memotech . . .

I was most surprised to read your answer to the enquiry for a computer offering backgammon, chess and bridge (issue 93).

As the only magazine, in my brief experience, to print Memotech listings, I would have expected you to recall that this excellent machine can also offer pontoon, blackjack, draughts and reversi, as well as the three requested.

However, please carry on the good work with, perhaps, a games listing or two, to convince the computer buying public that the one reason for not buying a Memotech, *ie* lack of software, no longer exists.

D R Jones,
Kingham, Oxon.

. . . and holding the key to the MTX

Although the technique for reading the Memotech keyboard described by Keith Hook (issue 75) is fast (in machine code) and detects multiple key presses, it is still cumbersome to work out the sense-bytes for each key. This is especially true when ASCII values are required for the key currently depressed.

In cases where multiple key presses aren't needed, a call to the system ROM at address #79 (decimal 121) returns to the ASCII value of the key being pressed in the accumulator. Before calling this routine # FD7C must be cleared, for example:

```
xor a clear accumulator
ld (FD7C),a
call #79 get ASCII of current key
```

This returns the ASCII value of the current key or 'O' if no key is being pressed. The routine preserves all but the AF registers.

Nic Joynson,
Christchurch, Dorset.

Unravelling another link in the chain

I am glad that Mr Smith (Random Access, issue 94) gained some intellectual stimulation if not practical application from my article, Unchaining VU-FILE (issue 86).

He is quite correct in saying memory can be further saved by the use of VAL (I had a 1K ZX81 too). However in order to support a second Microdrive you would have to find another 595 bytes — no amount of VALs and SGN PIs are going to achieve that. It was my intention to make the conversion as simple as possible.

However I think it's time for *PCN* to bend over and take a few lashes — the confusion over the filenames is due to a couple of misprints. To clear up any confusion there are in fact two mistakes. There should be a space between VU-CODE and MD in the SAVE . . . CODE statement, and as Mr Smith points out, Vu-File should be VU-FILE.

Oh, and before the eight thousandth person tells me that it is much easier to convert VU-FILE with Trans-Express — I know, but I wrote the article before Trans-Express was launched.

Carl J Lawrenson,
Prescot, Merseyside.

CHARTS

GAMES

TW	LW	TITLE	PUBLISHER	MACHINE	PRICE
1	1	Ghost Busters	Activision	SP,C64	£9.95
2	3	Match Day	Ocean	SP	£6.90
3	2	Airwolf	Elite	SP	£6.95
4	5	DT's Decathlon	Ocean	SP, C64	£7.90
5	7	Knight Lore	Ultimate	SP	£9.95
6	6	Elite	Acornsoft	AC	£15.00
7	4	3D Star Strike	Real Time	SP	£5.95
8	8	Skool Daze	MicroSphere	SP	£5.95
9	9	HunchBack II	Ocean	SP,C64	£6.95
10	13	Gift of the Gods	Ocean	SP	£9.95
11	11	Doomdark's Rev.	Beyond	SP	£9.95
12	10	Select 1	Comp Records	SP, C64	£12.49
13	12	Staff of Karnath	Ultimate	C64	£9.95
14	17	Raid over Moscow	US Gold	C64	£9.95
15	18	Booty	Firebird	SP, C64	£2.50
16	16	Combat Lynx	Martech	SP,C64	£8.95
17	—	Spy Hunter	US Gold	C64	£9.95
18	—	Impossible Mission	CBS/Epyx	C64	£9.95
19	—	Pole Position	AtariSoft	Various	£7.99
20	—	Int Soccer	Commodore	C64	£7.99

SPECTRUM

TW	TITLE	PRICE
1	GhostBusters	£9.95
2	Match Day	£6.90
3	Air Wolf	£6.95
4	Knight Lore	£9.95
5	Skool Daze	£5.95
6	DT's Decathlon	£6.90
7	Gift of the Gods	£9.95
8	Doomdarks Rev	£9.95
9	Select 1	£12.49
10	HunchBack II	£6.90

COMMODORE

TW	TITLE	PRICE
1	Ghost Busters	£9.95
2	Staff of Karnath	£9.95
3	Raid over Moscow	£9.95
4	Booty	£2.50
5	DT's Decathlon	£7.90
6	Spy Hunter	£9.95
7	Impossible Mission	£9.95
8	HunchBack II	£7.90
9	Int Soccer	£7.99
10	Summer Games	£14.95

MICROS

BELOW £1,000

TW	MACHINE	PRICE
1	Spectrum	£125
2	CBM 64	£199
3	Electron	£199
4	Amstrad	£349
5	CBM 16	£140
6	BBC B	£399
7	Atari 800XL	£125
8	MSX (series)	£250
9	Einstein	£500
10	Sharp MZ700	£250

ABOVE £1,000

TW	MACHINE	PRICE
1	IBM PC/XT	£2,390
2	ACT Apricot	£1,760
3	Compaq	£1,795
4	Olivetti M24	£1,595
5	Dec Rainbow	£2,359
6	Televideo 1605	£2,640
7	Wang Professional	£3,076
8	ITT Extra	£1,985
9	Ericcson PC	£2,095
10	Macintosh	£1,795

These charts are compiled from both independent and multiple sources across the nation. They reflect what's happening in high streets during the week up to **January 17.** The games chart is updated every week. The prices quoted are for the no-frills model and include VAT. Information for the top-selling micros is culled from retailers and dealers throughout the country and is updated every month. PCN Charts are compiled exclusively for us by RAM/C, who can be contacted on 01-892 6596.

ROUTINE ENQUIRIES

Suffering from circuit crunch or data dyslexia? Want some sound advice on speech synthesis or the best type of printer? Then consult the experts. But remember, no SAEs, 'cos we can't reply personally. Address your queries to Routine Enquiries, *PCN*, Evelyn House, 62 Oxford Street, London W1A 2HG.

Approaches to anagram cracking

Q I am presently writing an anagram-solving program on my QL. It works by positioning any known letters, then filling the spaces with letters chosen at random. Obviously this tends to produce a lot of words which are nonsense.

I can see two ways round this. First, to use a built-in dictionary, like Psion's *Scrabble;* or second, to filter the random words. Can you tell me how Psion coded its dictionary, or suggest a source of rules for letter arrangements in English words? Tall order, eh?

Lucy Jones,
Maldon, Essex.

A First, we can't tell you how Psion coded its dictionary. We suspect the company is sitting on that information. However, data compression techniques are fairly well documented in some more advanced computer books. However, having mastered the techniques, you'd still face the mammoth task of typing your dictionary into the QL.

The second alternative would be more straighforward but no less long winded, since you would have to formulate hundreds of rules then enter those. For reference material we would point you at a good library which should be able to come up with some readable books on semantics. A further suggestion: try a book on codes and ciphers. In the days before computers, language rules were the main method of cracking codes.

As to the actual coding of the program, memory requirements may force you to split it into two programs, one to generate the random words, the other to do the checking. Save the output from the first as a data file which will act as the input to the second.

You can make a lot of progress with a few simple negative rules, like the rarity of certain double-letter combinations — ww,jj, and so on; together with a few more positive ones.

If you really want to be ambitious, you could introduce some element of interaction and expert systems programming, by allowing the user to confirm new rules as they are encountered, and having the computer 'learn' as it goes along. Tall order, eh?

Faster route to C64 disk drive upgrade?

Q I hope to upgrade my Commodore 64 with a disk drive but don't know which one to get. Everyone moans about the speed of the 1541 but it is custom-made for the job.

I have heard that Commodore now has a 1542. Is it compatible with the 64 and has it got any advantages over the 1541? Is there any other disk system that is compatible with the 64?

957 Cpl Stewart,
BFPO 16.

A Commodore has produced an upgraded disk drive in the 1540 series but so far as we know it will only work with the new Plus-4 machine. The 1541 remains the only dedicated drive for the 64.

Although the 1541 is extremely slow compared to other drives, it works very well and is certainly the cheapest around.

If speed is absolutely crucial, you should look at the drives Commodore makes for its business machines. To use these you will need to buy an IEEE interface which will plug into the user port (generally not the cartridge port). These are much faster, occasionally offer much greater storage, but alway cost another £50 or so.

Commodore's IEEE drives are compatible with the 1541 with a single proviso: don't mix disks between 1541 and the others. There is a marginal difference in format which could cause problems if you move between the two.

£10 JANUARY OFFER

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MICROWAVES

Got any good tips for Commodore users, or sparky ideas for the Spectrum? Then air your discoveries in the forum by sending them to us. £10 for every answer printed and £50 for the Microwave of the month. Send to Microwaves, *Personal Computer News*, Evelyn House, 62 Oxford Street, London W1A 2HG.

Speedy clearance of your BBC screen

This routine clears both the Beeb's graphics screen and text screen simultaneously, at the speed of the CLS command. Although assembled at page nine, it may be stored almost anywhere as it is only 29 bytes long.

Lines 1040 and 1050 perform an OSBYTE call with A%=&84; this returns HIMEM in X(lo byte) and Y(hi byte).

Lines 1060 and 1070 overwrite the operand in line 1110 with X and Y (*ie* HIMEM).

Lines 1110-1160 effectively POKE zeros into the screen memory.

To use the routine simply replace any CLG command with CALL&900. Should you wish to relocate the routine elsewhere, you must reassemble it.

Stephen Baker,
St George, Bristol.

```
1000OSBYTE=&FFF4
1010FOR C=0 TO3 STEP 3
1020P%=&900
1030[OPT C
1040.GCL LDA #&84
1050JSR OSBYTE
1060STX LOOP+1
1070STY LOOP+2
1080LDY #80
1090LDX #0
1100LDA #0
1110 .LOOP STA &5400,X
1120INX
1130BNE LOOP
1140INC LOOP+2
1150DEY
1160BNE LOOP
1170RTS
1180]
1190NEXT C
```

List Basic variables in Amstrad programs

The following short Amstrad CPC 464 routine is a useful debugging tool. It lists the lines on which a Basic variable has been used. Merge the routine into the working program, and activate with RUN 65350. Alternatively, use it as a subroutine by changing the END keywords in lines 65360, 65410 and 65440 to RETURNs.

The routine prompts for the name of the variable, and for the line numbers at which to start and stop searching. If null replies are given for the limiting line numbers, the entire program is searched. For each line on which the variable is used, the line number and the number of occurrences is printed.

The routine simply performs a search through the range of Basic program lines specified for occurrences of a text string containing the specified variable name, with bit 7 set in the last character.

D Bright,
The Hague, Holland.

```
65350 INPUT "Variable name";zz$
65360 IF zz$="" THEN END
65370 IF RIGHT$(zz$,1)="$" OR RIGHT$(zz$,1)="!" OR
RIGHT$(zz$,1)="%" THEN zz$=LE
FT$(zz$,LEN(zz$)-1):GOTO 65360
65380 zz$=UPPER$(zz$):zz1$=LOWER$(zz$):zz$=LEFT$(zz$,
LEN(zz$)-1)+CHR$(128 OR ASC
(RIGHT$(zz$,1))):zz1$=LEFT$(zz1$,LEN(zz1$)-1)+CHR$(128
OR ASC(RIGHT$(zz1$,1)))
65390 zzstart!=0:zzend!=65535:INPUT "Start Line: ";
zzstart!:INPUT "Finish Line:
";zzend!:IF zzend!=0 THEN zzend!=65535
65400 zz!=&170
65410 zz1!=PEEK(zz!)+256*PEEK(zz!+1):IF zz1!=0 THEN
PRINT "End of Prosram Reache
d.":END
65420 zz2!=PEEK(zz!+2)+256*PEEK(zz!+3)
65430 IF zz2!(zzstart! THEN zz!=zz!+zz1!:GOTO 65410
65440 IF zz2!)zzend! THEN END
65450 zz0!=0:zz3!=zz!+4
65460 IF zz3!)=zz!+zz1! THEN 65490
65470 IF CHR$(PEEK(zz3!))=LEFT$(zz1$,1) OR
CHR$(PEEK(zz3!))=LEFT$(zz$,1) THEN GO
SUB 65510
65480 zz3!=zz3!+1:GOTO 65460
65490 IF zz0!(0 THEN PRINT "Line ";zz2!;" - ";zz0!;"
occurrences"
65500 zz!=zz!+zz1!:GOTO 65410
65510 Zz5!=zz3!:FOR zz4!=1 TO LEN(zz1$)
65520 IF NOT (MID$(zz1$,zz4!,1)=CHR$(PEEK(zz5!)) OR
MID$(zz$,zz4!,1)=CHR$(PEEK(z
z5!))) THEN RETURN
65530 zz5!=zz5!+1:NEXT zz4!:zz0!=zz0!+1:
zz3!=zz3!+LEN(zz1$):RETURN
```

New year cash for winning wave

The winner of December's Microwave of the month is James Bridson of Culcheth, Warrington (issue 92). His BBC disk routine allows access to any individual sector so as to write a copy of the sector to the buffer.

Beeb window gets sideways scroll

A sideways scrolling screen within a window is possible with this machine code program for the Beeb (see right).

A normal window in the BBC is set up with the command VDU 28, LEFT X, LOWER Y, RIGHT X, UPPER Y

and vertical scrolling is easily carried out by a succession of VDU 13 commands.

For right to left scrolling, however, a different solution is needed.

The data in line 10 holds the parameters for the machine code in the same format as the VDU 28 command above. This can be altered to whatever values you require.

A word of caution: if the screen display has scrolled due to text filling the screen the addresses used by the code will be wrong — with unpredictable effects. The routine is for mode 7 only.

Jeff Tullin,
Gateshead, Tyne & Wear.

```
L.
  10DATA 5,20,34,5
  20REM data for window.syntax as for
       VDU28 window commands- see
       USER GUIDE if unsure
  30
  40READA,B,C,D
  50A%=&7C00+(D*40+A)
  60
  70DIMS%255
  80
  90FOR X=0  TO 3  STEP3
 100P%=S%
 110[OPT X
 120
 130STA&70:STA&72
 140LDA# A% DIV 256
 150STA&71:STA&73 '
 160\ loads address of top left of
      window into locations &70-&73
 170
 180
 190LDX#0
 200.outerloop
 210  DEC&72
 220  LDY#1
 230
 240.innerloop
 250  LDA(&70),Y:STA(&72),Y:
    \ shifts character one space left
 260  CPY#(C-A):BEQ loopend:
    \ if whole line finished, leave
      innerloop
 270  INY:JMP innerloop:
    \ otherwise get next byte & repeat
 280
 290
 300.loopend
 310  LDA#32:STA(&70),Y:
    \ empty last space on right
 320  INX:CPX#(B-D):BEQ OUT:
    \ if last row reached, then exit
 330
 340  CLC:LDA&70:ADC#40
 350  STA&70:STA&72
 360  BCC outerloop
 370\ this routine adds 40 to working
      addresses (ie. moves to next
      screen line)
 380  LDA&71:ADC#0
 390  STA&71:STA&73
 400  JMP outerloop
 410
 420.OUT
 430RTS
 440]:NEXT
 450 CLS
 460 FOR X=1 TO40:PRINT"PERSONAL COMPUT
ER NEWS!";:NEXT
 470
 480 FOR X= 1 TO 30:CALL S%
 490 FOR N= 1 TO 30:NEXT,:REM (DELAY)
```

COOL CHARACTERS

Expand your character sets with these machine code listings by Ben Willcocks.

This machine code program for the ZX Spectrum can be used in conjunction with Basic to print the standard character set in several expanded formats.

To promote this easy interfacing with Basic programs, a novel method of transferring data has been employed; certain Basic variables are reserved for the control of the machine code program, and the latter searches the variables area to obtain the necessary data.

Extensive details of the way in which the Spectrum Basic system stores variables are to be found in chapter 24 of the user manual; however, to summarise, the variables are stored immediately above the Basic program, starting at the address given by the system variable, (VARS), and terminated by a byte #80.

There are six different categories:

- Numbers with single-letter names.
- Numbers with names longer than one letter.
- Number arrays.
- For-next loop control variables.
- Strings.
- String arrays.

It is not difficult to distinguish between them, as the first byte of each category has a unique range of values (see the manual, pages 122 to 124), but a search of the variables area will be far from simple, because the different lengths of the different categories must be taken into account. Fortunately there is an easy way to achieve the search. It is obvious that the Basic system will need to search the variables area; therefore the ROM must contain a routine for this purpose. The routine to use is at adds #19B8. It is entered with HL pointing to the first byte of a variable, and -will return with: HL unchanged; DE pointing to the first byte of the next variable; BC — the length of the variable 'skipped'.

With this routine at hand, searching becomes easy: to find a number variable, for example 'x', the first bytes of each variable are checked until a byte #78 (ASCII for 'x') is found, or until #80 is found, in which case the end of the variables area has been reached. The code for a string will be #20 less than the corresponding code for a variable (eg 'x$' will be #58) — see Figure 1.

18▶

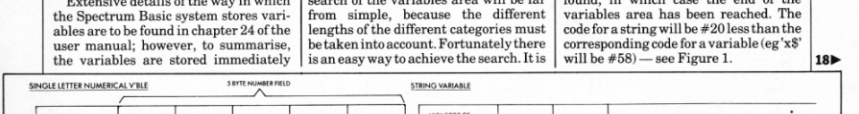


Fig 1

In Figure 1, you can see a comparison of variable and string codes.

Program notes

PRIN (04000) Print character and attributes at position (HORI),(VERT) in mode (MODE). Increment (HORI) and (VERT) as appropriate. If co-ordinates are out of range, reset them to 0,0.

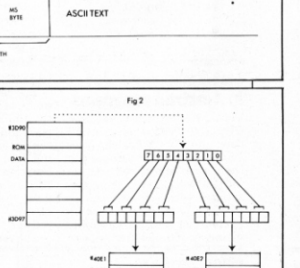
PRLN (05010) Print a line of the display file. If in double width mode, this will be two bytes. On entry, BC points to the ROM data, DE points to the display file.

PRJL (05260) / PRJR (05300) Double up left / right nybble of A, to fill all of A.

PRAL (05410) Put value of A into attribute location addressed by DE; if in a double width mode, do the same for the next attribute on.

EXCH (06000) Exchange the values of the program variables (HORI),(VERT), and (MODE) with the values of the basic variables h,v,&m respectively. If any of the latter are not found, return with the carry flag set.

FIND (08000) Search variables area for the variable (or string) defined by the contents of A. If found, return with HL pointing to the number data (or 1st character of string). If not found, return with the carry flag set.



This is an example of doubling up the data.

Hexdump

```
FDE8 CD DF FE 38 16 3E 54 CD FE88 E6 1F 77 20 0F 23 3A 18
FDF0 F9 FE 38 0F 2B 2B 4E 23 FE90 FF 1F E6 01 3C 86 FE 18
FDF8 46 23 7E CD 07 FE 0B 78 FE98 38 01 97 77 F1 C1 D1 E1
FE00 B1 20 F6 CD DF FE C9 E5 FEA0 C9 CB 46 28 0E 0A CD C4
FE08 D5 C5 F5 21 19 FF 3A 18 FEA8 FE 12 1C 0A CD C8 FE 12
FE10 FF 2F E6 01 C6 1E BE 38 FEB0 1D 18 02 0A 12 14 7A E6
FE18 0D 23 3A 18 FF 2F 1F E6 FEB8 07 C0 7B C6 20 5F D8 7A
FE20 01 C6 16 BE 30 06 21 00 FEC0 D6 08 57 C9 0F 0F 0F 0F
FE28 00 22 19 FF F1 F5 D6 20 FEC8 C5 06 04 0F 07 CB 19 0F
FE30 CB BF 06 0F 87 87 CB 10 FED0 CB 19 10 F7 79 C1 C9 12
FE38 87 CB 10 04 4F ED 5B 19 FED8 CB 46 C8 1C 12 1D C9 DD
FE40 FF 7A 0F 0F 0F 57 E6 E0 FEE0 21 18 FF 06 03 DD 7E 03
FE48 B3 5F 7A E6 03 C6 58 57 FEE8 CD F9 FE D8 7E DD 4E 00
FE50 D5 3A 1A FF E6 18 C6 40 FEF0 DD 77 00 71 DD 23 10 ED
FE58 57 21 18 FF CB 4E C4 A1 FEF8 C9 D5 C5 F5 2A 4B 5C 7E
FE60 FE CD A1 FE 03 79 E6 07 FF00 FE 80 28 0E C1 C5 B8 28
FE68 20 F2 D1 3A 8D 5C CD D7 FF08 06 CD B8 19 EB 18 F0 23
FE70 FE CB 4E 28 09 EB 01 20 FF10 23 23 17 C1 78 C1 D1 C9
FE78 00 09 EB CD D7 FE 21 19 FF18 00 00 00 6D 68 76 00 00
FE80 FF 3A 18 FF E6 01 3C 86
```

Hexloader

```
10 INPUT "Start address?"!a
20 PRINT "Enter code one byte at
a time"
30 PRINT "in upper case"
40 PRINT "ADDRESS = "!
70 INPUT a$
80 IF a$="XX" THEN STOP
90 IF LEN a$<>2 THEN PRINT
"error - retype": GO TO 70
100 LET b=CODE a$(1)-48
110 IF b>9 THEN LET b=b-7
120 LET d=b*16
130 LET c=CODE a$(2)-48
140 IF c>9 THEN LET c=c-7
150 LET d=d+c
160 PRINT a$
170 POKE a,d
180 GO TO 40
```

The screen file occupies addresses #4000 to #57FF. The usual style of character cell on the Spectrum is 8×8 pixels; 8 bytes in the screen file are thus required for each cell. The addresses are not allocated sequentially. The screen is best thought of as three blocks corresponding to rows 0 to 7, 8 to 15, and 16 to 23 (the latter contains the 'messages' area). These blocks occupy addresses #4000 to #47FF, #4800 to #4FFF, and #5000 to #57FF respectively. For each block, the LS byte of the address defines the cell, and the eight possible values of the MS byte define the lines within the cell. For example, the cell corresponding to the position of "PRINT AT 10, 10" uses addresses:

#484A
#494A
#4A4A
#4B4A
#4C4A
#4D4A
#4E4A
#4F4A

The data for the character forms is stored in the ROM, from #3D00 for 'space', to #3FF8 for '©', *eg* to print '©' normal size, the eight bytes #3FF8 to #3FFF are simply transferred to the eight bytes constituting the required cell.

If we wish to print double height characters, two vertically adjacent cells are used, and each data byte is inserted twice. To print in double width format, it is necessary to 'double up' each of the two nybbles of the data and then insert them in horizontally adjacent cells, for each of the eight lines. Figure 2 shows an example of this process.

The Basic program should set up the following variables: h (Horizontal print coordinate); v (Vertical print coordinate); m (Mode; 0=Normal, 1=Double width, 2=Double height, 3=2×2).

The text to be printed must be put in t$. Note that: t$ must be a normal string as opposed to a string array; and that h, v, and m must be integer values, and set up as normal variables, not by means of FOR-NEXT statements.

The attributes used will be those current at the time, as for normal PRINT operations. The machine code is run by RANDOMIZE USR 65000. The code could, of course, be assembled at a different address.

Assembly listing

```
00010 ORG £FDE8
01000 MAIN CALL EXCH; EX BASVAR
01010 JR C,MAINZ;    WITH VARS
01020 LD A,£54
01030 CALL FIND;    FIND t$
01040 JR C,MAINZ
01050 DEC HL
01060 DEC HL
01070 LD C,(HL); LD BC WITH NO.
01080 INC HL;        OF CHARS.
01090 LD B,(HL)
01100 MAINN INC HL
01110 LD A,(HL)
01120 CALL PRIN;    PRINT CHAR
01130 DEC BC;       DEC COUNTER
01140 LD A,B
01150 OR C
01160 JR NZ,MAINN; IF MORE LOOP
01170 MAINZ CALL EXCH; SET NEW
01180 RET; VALUES OF VARS & RET
04000 PRIN PUSH HL
04010 PUSH DE
04020 PUSH BC
04030 PUSH AF
04040 PRCH LD HL,HORI
04050 LD A,(MODE)
04060 CPL
04070 AND £01
04080 ADD A,£1E;   HORI IN RANGE
04090 CP (HL);     & COMPATIBLE
04100 JR C,PRCHA;  WITH MODE?
04110 INC HL
04120 LD A,(MODE)
04130 CPL
04140 RRA
04150 AND £01
04160 ADD A,£16
04170 CP (HL);     ALSO CHECK VERT
04180 JR NC,PROK
04190 PRCHA LD HL,£0000;ZERO IF
04200 LD (HORI),HL;OUT OF RANGE
04210 PROK POP AF
04220 PUSH AF;     A=CHAR CODE
04223 SUB £20;     1st CODE =£20
04227 RES 7,A;   ENSURE NOT >£7F
04230 LD B,£0F
04240 ADD A,A
04250 ADD A,A
04260 RL B
04270 ADD A,A
04280 RL B
04290 INC B
04300 LD C,A; BC POINTS TO CHAR
04310 LD DE,(HORI)
04320 LD A,D
04330 RRCA
04340 RRCA
04350 RRCA
04360 LD D,A
04370 AND £E0
04380 OR E
04390 LD E,A
04400 LD A,D
04410 AND £03
04420 ADD A,£58
04430 LD D,A
04440 PUSH DE;SAVE ATTR POINTER
04450 LD A,(VERT)
04460 AND £18
04465 ADD A,£40
04470 LD D,A; DE=SCREEN POINTER
04480 LD HL,MODE
04490 PROKA BIT 1,(HL)
04500 CALL NZ,PRLN; CALL TWICE
04510 CALL PRLN;  IF 2× HEIGHT
04520 INC BC
04530 LD A,C
04540 AND £07
04550 JR NZ,PROKA;     LOOP 8×
04560 PRAT POP DE; ATTR POINTER
04690 LD A,(£5C8D);  BASIC ATTR
04700 CALL PRAL;     DO ATTR ROW
04710 BIT 1,(HL)
04720 JR Z,PRAD
04730 EX DE,HL
04740 LD BC,£0020
04750 ADD HL,BC
04760 EX DE,HL;    DO NEXT IF 2×
04770 CALL PRAL;       HEIGHT
04780 PRAD LD HL,HORI
04790 LD A,(MODE)
04800 AND £01
04810 INC A
04820 ADD A,(HL)
04830 AND £1F; INC HORI ACCORD-
04840 LD (HL),A;    ING TO MODE
04850 JR NZ,PRINZ
04860 INC HL; IF NECESSARY INC
04870 LD A,(MODE);   VERT TOO.
04880 RRA
04890 AND £01
04900 INC A
04910 ADD A,(HL)
04920 CP £18
04930 JR C,PRADA
04940 SUB A; ZERO IF OVER RANGE
04950 PRADA LD (HL),A
04960 PRINZ POP AF
04970 POP BC
04980 POP DE
04990 POP HL
05000 RET
05010 PRLN BIT 0,(HL); JR IF ×1
05020 JR Z,PRLNA;    WIDTH MODE
05030 LD A,(BC);   CHAR FROM ROM
05040 CALL PRJL;EXPAND L NYBBLE
05050 LD (DE),A;   PUT ON SCREEN
05060 INC E
05070 LD A,(BC)
05080 CALL PRJR;EXPAND R NYBBLE
05090 LD (DE),A
05100 DEC E
05110 JR PRLNB
05120 PRLNA LD A,(BC); IF ×1
05130 LD (DE),A;        WIDTH
05140 PRLNB INC D
05150 LD A,D
05160 AND £07
05170 RET NZ;  IF NOT CELL BOTT
05180 LD A,E
05190 ADD A,£20
05200 LD E,A;SET E FOR NEXT ROW
05210 RET C; RET IF BLOCK CROSS
05220 LD A,D
05230 SUB £08; ELSE RE-ADJUST D
05240 LD D,A
05250 RET
05260 PRJL RRCA; L NYBBLE ENTRY
05270 RRCA
05280 RRCA
05290 RRCA
05300 PRJR PUSH BC; R NYB ENTRY
05310 LD B,£04
05320 PRJA RRCA
05330 RLCA; DOUBLE UP BITS 0 TO
05340 RR C;   4 OF A & PUT IN C
05350 RRCA
05360 RR C
05370 DJNZ PRJA
05380 LD A,C;  BACK IN A
05390 POP BC
05400 RET
05410 PRAL LD (DE),A; DO ROW OF
05420 BIT 0,(HL);   ATTRIBUTES
05430 RET Z;  RET IF ×1 WIDTH
05440 INC E
05450 LD (DE),A; NEXT ONE ALONG
05460 DEC E
05470 RET
06000 EXCH LD IX,MODE
06010 LD B,£03
06020 EXCHN LD A,(IX+£03)
06030 CALL FIND; FIND VARIABLE
06040 RET C;     IF NOT FOUND
06050 LD A,(HL);   EXCHANGE IT
06060 LD C,(IX+£00); WITH SYS
06070 LD (IX+£00),A; VARIABLE
06080 LD (HL),C
06090 INC IX
06100 DJNZ EXCHN;    DO NEXT
06110 RET
08000 FIND PUSH DE
08010 PUSH BC
08020 PUSH AF
08030 LD HL,(£5C4B); (VARS)
08040 FINDA LD A,(HL)
08050 CP £80
08060 JR Z,FINDX;    IF END
08070 POP BC
08080 PUSH BC;  B=CODE TO FIND
08090 CP B
08100 JR Z,FINDZ;  IF FOUND
08110 CALL £19B8; IF NOT FOUND
08120 EX DE,HL; GO ON TO NEXT.
08130 JR FINDA
08140 FINDZ INC HL
08150 INC HL; POINT TO NO. OR
08160 INC HL;       1st CHAR.
08170 FINDX RLA;  IF NOT FOUND
08180 POP BC;          SET CF.
08190 LD A,B;    "POP A NOT F"
08200 POP BC
08210 POP DE
08220 RET
09000 MODE DEFB £00;  VARIABLE
09010 HORI DEFB £00;  VARIABLE
09020 VERT DEFB £00;  VARIABLE
09030 DATA DEFB £6D,£68,£76
```

TOUCH AND GO

With these routines from Simon Taylor, you can turn your graphics tablet into an extra set of function keys.

Listing 1

```
line £ loc  code      line
00001 0000                        ;koalapad function key generator
00002 0000                        ;          (c) 1985
00003 0000                        ;        simon taylor
00004 0000                        ;          for
00005 0000                        ;    personal computer news
00006 0000                        ;
00007 0000        nqueue=$00c6    ;number of chars in kybd queue
00008 0000        irqvec=$0314
00009 0000        keyq=$0277      ;keyboard queue
00010 0000        ptr=$00fb       ;spare zero page
00011 0000        xlook=54297
00012 0000        ylook=54298
00013 0000        screen=$0400    ;screen memory
00014 0000        colour=$d800    ;colour memory
00015 0000              *=$9d00
00016 9d00 78     init  sei       ;disable interrupts
00017 9d01 ad 14 03       lda irqvec
00018 9d04 8d 18 9e       sta oldvec
00019 9d07 ad 15 03       lda irqvec+1
00020 9d0a 8d 19 9e       sta oldvec+1    ;save old irq vector
00021 9d0d a9 19          lda #<start
00022 9d0f 8d 14 03       sta irqvec
00023 9d12 a9 9d          lda #>start
00024 9d14 8d 15 03       sta irqvec+1    ;and enable new one
00025 9d17 58             cli             ;re-enable interrupts
00026 9d18 60             rts
00027 9d19                        ;
00028 9d19 ac 1d 9e start ldy type
00029 9d1c f0 26          beq notype      ;no command in progress
00030 9d1e a5 c6          lda nqueue
00031 9d20 f0 03          beq empty       ;buffer empty
00032 9d22 6c 18 9e       jmp (oldvec)
00033 9d25 b1 fb    empty lda (ptr),y     ;get char
00034 9d27 8d 77 02       sta keyq        ;put in buffer queue
00035 9d2a a9 01          lda #1
00036 9d2c 85 c6          sta nqueue      ;one char from keyboard ! ?
00037 9d2e c8             iny
00038 9d2f b1 fb          lda (ptr),y
00039 9d31 f0 06          beq endstr      ;end of string
00040 9d33 ee 1d 9e       inc type
00041 9d36 6c 18 9e       jmp (oldvec)
00042 9d39 a9 00    endstr lda #$00
00043 9d3b 8d 1d 9e       sta type        ;no more chars
00044 9d3e 8d 1a 9e       sta code        ;and no bounce !
00045 9d41 6c 18 9e       jmp (oldvec)
00046 9d44 ad 1e 9e notype lda justrd
00047 9d47 f0 06          beq oktord      ;ok to read
00048 9d49 ce 1e 9e       dec justrd      ;for delay to debounce
00049 9d4c 6c 18 9e       jmp (oldvec)
00050 9d4f ad 19 d4 oktord lda xlook      ;ok to read
00051 9d52 18             clc
00052 9d53 6a             ror a           ;get rid of msb
00053 9d54 8d 1b 9e       sta xreg
00054 9d57 c9 08          cmp #8          ;> 8 ?
00055 9d59 10 03          bpl checky      ;pen down so check y
00056 9d5b 6c 18 9e       jmp (oldvec)
00057 9d5e ad 1a d4 checky lda ylook
00058 9d61 18             clc
00059 9d62 6a             ror a           ;get rid of msb
00060 9d63 8d 1c 9e       sta yreg
00061 9d66 c9 08          cmp #8
00062 9d68 10 03          bpl gotnum
00063 9d6a 6c 18 9e       jmp (oldvec)
00064 9d6d a2 05    gotnum ldx #5
00065 9d6f 18             rotlop clc
00066 9d70 6e 1b 9e       ror xreg        ;bottom nibble only required
00067 9d73 ca             dex
00068 9d74 d0 f9          bne rotlop
00069 9d76 ad 1c 9e       lda yreg
00070 9d79 6a             ror a
00071 9d7a 6a             ror a
00072 9d7b 29 1c          and #%00011100
00073 9d7d 0d 1b 9e       ora xreg
00074 9d80 d0 10          bne
00075 9d82 ad 1a 9e
00076 9d85 d0 03          bne
00077 9d87 6c 18 9e
00078 9d8a a9 01          lda #1          oktox
00079 9d8c 8d 1d 9e       sty type
00080 9d8f 6c 18 9e       jmp (oldvec)
00081 9d92 8d 1a 9e       sta code        comand
00082 9d95 a9 10          lda #16
00083 9d97 8d 1e 9e       sta justrd
00084 9d9a a9 1f          lda #31
00085 9d9c 85 fb          sta ptr
00086 9d9e a9 9e          lda #>screen    .
00087 9da0 85 fc          sta ptr+1
00088 9da2 a0 00          ldy #0
00089 9da4 b1 fb          lda (ptr),y     search
00090 9da6 cd 1a 9e       cmp code
00091 9da9 f0 07          beq foundy
00092 9dab 18             clc
00093 9dac 20 04 9e       jsr inc16
00094 9daf 4c a4 9d       jmp search
00095 9db2 20 0b 9e       jsr dec16       found
00096 9db5 b1 fb          lda (ptr),y
00097 9db7 20 04 9e       jsr inc16
00098 9dba 18             clc
00099 9dbb c9 00          cmp #0
00100 9dbd f0 06          beq foundy
00101 9dbf 20 04 9e       jsr inc16
00102 9dc2 4c a4 9d       jmp search
00103 9dc5 c8             foundy iny
00104 9dc6 a9 20          lda #32
00105 9dc8 8d 00 04       sta screen
00106 9dcb b1 fb          lda (ptr),y     found1
00107 9dcd d0 0d          bne cline
00108 9dcf a9 20          lda #32         cline
00109 9dd1 99 00 04       sta screen,y
00110 9dd4 c8             iny
00111 9dd5 c0 28          cpy #40
00112 9dd7 30 f6          bmi found1
00113 9dd9 6c 18 9e       jmp (oldvec)
00114 9ddc a9 01          lda #1          displ
00115 9dde 99 00 d8       sta colour,y
00116 9de1 b1 fb          lda (ptr),y
00117 9de3 c9 0d          cmp #13
00118 9de5 d0 05          bne notcr
00119 9de7 a9 5f          lda #95
00120 9de9 4c ef 9d       jmp stscrn
00121 9dec 99 00 04       sta screen,y    notcr
00122 9def c8             iny             stscrn
00123 9df2 cb 9d          cpy #40
00124 9df3 4c cb 9d       jmp ascok
00125 9df6                        ;
00126 9df6 b1 fb          lda (ptr),y     cvtasc
00127 9df8 c9 41          cmp #65
00128 9dfa 30 07          bmi ascok
00129 9dfc c9 5b          cmp #91
00130 9dfe 10 03          bpl ascok
00131 9e00 38             sec
00132 9e01 e9 40          sbc #64
00133 9e03 60             rts             ascok
00134 9e04                        ;
00135 9e04 e6 fb          inc ptr         incptr
00136 9e06 d0 02          bne inc16
00137 9e08 e6 fc          inc ptr+1
00138 9e0a 60             rts             not0
00139 9e0b                        ;
00140 9e0b 48             pha             decptr
00141 9e0c c6 fb          dec ptr
00142 9e0e a5 fb          lda ptr
00143 9e10 c9 ff          cmp #255
00144 9e12 d0 02          bne dec16
00145 9e14 c6 fc          dec ptr+1
00146 9e16 68             pla             notff
```

The Koalapad is a popular and versatile graphics tablet for the Commodore 64; but with a bit of inventive programming, it can be used for something more than just drawing pretty pictures. The touchpad can be utilised as a set of function keys to widen the range of options at your fingertips, not to mention saving wear and tear on the fingertips themselves.

After some experimentation, I found that the optimum number was four across and eight down, giving a total of 32 keys available for programming (one of these keys is dedicated as an Enter key, as discussed later).

Using the program

Load the program, either with a machine code loader of your choice, or with the Basic loader listed (those of you without disk drives and assemblers will have to use the Basic loader), and enable the software either by typing RUN with the Basic loader, or by a SYS or similar for the Basic loader. Then, all you will need to do is press the appropriate area on the touchpad, which will show the chosen key function on the top line of the screen. To execute the command, the top left area on the Koalapad will need to be pressed.

All that remains is to make an overlay for the touch sensitive area of the touchpad with all the commands written on it. It should be possible to write program to produce hard copy from a printer with all of the commands on it, (and send it in to Microwaves, maybe?).

How it works

The program links itself into the 1/60 second interrupt vector, and does its own processing before returning control back to the operating system's interrupt routines. It takes the X and Y co-ordinates of the pressed area of the touchpad, and rationalises these to

15 ▶

```
bne comand        ;is command - not enter
lda code
bne oktox         ;ok to execute
jmp (oldvec)
lda £1
sta type          ;set type pointer going
jmp (oldvec)
sta code
lda £$10
sta justrd
lda £<table
sta ptr
lda £>table
sta ptr+1
ldy £$00
lda (ptr),y
cmp code
beq found
clc
jsr incptr
jmp search
jsr decptr
lda (ptr),y
jsr incptr
clc
cmp £$00          ;just incremented y
beq foundy        ;zero so must be right
jsr incptr        ;jump over code
jmp search
iny               ;it's ok
lda £' '
sta screen
lda (ptr),y
bne displ
lda £' '
sta screen,y
iny
cpy £40           ;clear rest of line
bmi clline
jmp (oldvec)
lda £1
sta colour,y
lda (ptr),y
cmp £$0d          ;is it cr ?
bne notcr
lda £'_'          ;show special char.
jmp stscrn        ;and put on screen
jsr cvtasc        ;convert to ascii
sta screen,y      ;screen pic ok
iny
jmp foundl
                  ;
lda (ptr),y
cmp £$41
bmi ascok         ;not very big, so ok
cmp £$5b
bpl ascok
sec
sbc £$40          ;convert to screen code
rts
                  ;
inc ptr
bne not0
inc ptr+1         ;gone over page !
rts
                  ;
pha
dec ptr
lda ptr
cmp £$ff
bne notff
dec ptr+1
pla
```

```
line £   loc    code          line
00147    9e17   60                    rts
00148    9e18
00149    9e18   00 00         oldvec .wor $00
00150    9e1a   00            code   .byte $00
00151    9e1b   00            xreg   .byte $00
00152    9e1c   00            yreg   .byte $00
00153    9e1d   00            type   .byte $00
00154    9e1e   00            justrd .byte $00
00155    9e1f   00            table  .byte $00
00156    9e20   01            .byte  $01,'run',$0d,$00
00156    9e21   52 55 4e
00156    9e24   0d
00156    9e25   00
00157    9e26   02            .byte  $02,'list',$0d,$00
00157    9e27   4c 49
00157    9e2b   0d
00157    9e2c   00
00158    9e2d   03            .byte  $03,'open1,8,15,"i":close1',$0d,$00
00158    9e2e   4f 50
00158    9e43   0d
00158    9e44   00
00159    9e45   04            .byte  $04,'load"$",8',$0d,'list',$0d,$00
00159    9e46   4c 4f
00159    9e4f   0d
00159    9e50   4c 49
00159    9e54   0d
00159    9e55   00
00160    9e56   05            .byte  $05,'new',$0d,$00
00160    9e57   4e 45 57
00160    9e5a   0d
00160    9e5b   00
00161    9e5c   06            .byte  $06,'save"',$00
00161    9e5d   53 41
00161    9e62   00
00162    9e63   07            .byte  $07,'load"',$00
00162    9e64   4c 4f
00162    9e69   00
00163    9e6a   08            .byte  $08,'open1,8,15',$0d,$00
00163    9e6b   4f 50
00163    9e75   0d
00163    9e76   00
00164    9e77   09            .byte  $09,'print£1,"',$00
00164    9e78   50 52
00164    9e81   00
00165    9e82   0a            .byte  $0a,'load"asm",8',$0d,'run',$0d,$00
00165    9e83   4c 4f
00165    9e8e   0d
00165    9e8f   52 55 4e
00165    9e92   0d
00165    9e93   00
00166    9e94   0b            .byte  $0b,'load"edit",8,1',$0d,'sys49152',$0d,$00
00166    9e95   4c 4f
00166    9ea3   0d
00166    9ea4   53 59
00166    9eac   0d
00166    9ead   00
00167    9eae   0c            .byte  $0c,'load"loload",8',$0d,'run',$0d,$00
00167    9eaf   4c 4f
00167    9ebd   0d
00167    9ebe   52 55 4e
00167    9ec1   0d
00167    9ec2   00
00168    9ec3   0d            .byte  $0d,'poke53280,0:poke53281,0:poke646,1',$0d,$00
00168    9ec4   50 4f
00168    9ee5   0d
00168    9ee6   00
00169    9ee7   0e            .byte  $0e,'then',$00
00169    9ee8   54 48
00169    9eec   00
00170    9eed   0f            .byte  $0f,'dim',$00
00170    9eee   44 49 4d
00170    9ef1   00
00171    9ef2   10            .byte  $10,'get',$00
```

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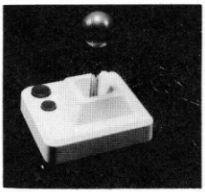

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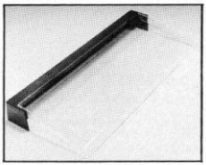

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Listing 1 (cont)

```
00171  9ef3  47 45 54
00172  9ef6  00
00173  9ef7  11              .byte  #11,'stop',#00
00174  9efa  53 54
00175  9efc  00
00176  9efd  12              .byte  #12,'close',#00
00177  9efe  43 4c
00178  9f03  00
00179  9f04  13              .byte  #13,'open',#00
00180  9f05  4f 50
00181  9f09  00
00182  9f0a  14              .byte  #14,'print£',#00
00183  9f0b  50 52
00184  9f11  00
00185  9f12  15              .byte  #15,'get£',#00
00186  9f13  47 45
00187  9f17  00
00188  9f18  16              .byte  #16,'sys',#00
00189  9f1b  53 59 53
00190  9f1f  00
00191  9f20  17              .byte  #17,'clr',#00
00192  9f23  43 4c 52
00193  9f27  00
00194  9f28  18              .byte  #18,'end',#0d,#00
00195  9f2a  45 4e 44
00196  9f2d  0d
00197  9f2f  00
00198  9f30  19              .byte  #19,'input',#00
00199  9f39  49 4e
00200  9f3b  00
00201  9f3c  1a              .byte  #1a,'next',#00
00202  9f3f  4e 45
00203  9f42  00
00204  9f43  1b              .byte  #1b,'for',#00
00205  9f46  46 4f 52
00206  9f49  00
00207  9f4a  1c              .byte  #1c,'goto',#00
00208  9f4d  47 4f
00209  9f50  00
00210  9f51  1d              .byte  #1d,'return',#00
00211  9f54  52 45
00212  9f57  00
00213  9f58  1e              .byte  #1e, gosub',#00
00214  9f5b  47 4f
00215  9f5e  00
00216  9f5f  1f              .byte  #1f,'print',#00
00217  9f62  50 52
00218  9f65  00
00219  9f66                  tabend
00220  9f66                          .end
```

Listing 2

```
100 data120,173,20,3,141,24,158,173,21,3,141,25,158,169,25,141,20,3,169,157
110 data141,21,3,88,96,172,29,158,240,38,165,198,240,3,108,24,158,177,251,14
120 data119,2,169,1,133,198,200,177,251,240,6,238,29,158,108,24,158,169,0,14
130 data29,158,141,26,158,108,24,158,173,30,158,240,6,206,30,158,108,24,158
140 data173,25,212,24,106,141,27,158,201,0,16,3,108,24,158,173,26,212,24,106
150 data141,28,158,201,8,16,3,108,24,158,162,5,24,110,27,158,202,208,249,173
160 data28,158,106,106,141,28,13,27,158,208,16,173,26,158,208,3,108,24,158,16
170 data1,141,29,158,108,24,158,141,26,158,169,16,141,30,158,169,31,133,251
180 data169,158,133,252,160,0,177,251,205,26,158,240,7,24,32,4,158,76,164,15
190 data32,11,158,177,251,32,4,158,24,201,0,240,6,32,4,158,76,164,157,200,16
200 data32,141,0,4,177,251,208,17,169,32,153,0,4,200,192,40,48,246,108,24,15
210 data169,1,153,0,216,177,251,201,13,208,5,169,95,76,239,157,32,246,157,15
220 data0,4,200,76,203,157,177,251,201,65,48,7,201,91,16,3,56,233,64,96,230
230 data251,208,2,230,252,96,72,198,251,165,251,201,255,208,2,198,252,104,96
240 data49,234,0,2,9,0,0,0,1,82,85,78,13,0,2,76,73,83,84,13,0,3,79,80,69,78
250 data49,44,56,44,49,53,44,34,73,34,58,67,76,79,83,69,49,13,0,4,76,79,65
260 data68,34,36,34,44,56,13,76,73,83,84,13,0,5,78,69,87,13,0,6,83,65,86,69
270 data34,0,7,76,79,65,68,34,0,8,79,80,69,78,49,44,56,44,49,53,13,0,9,80,82
280 data73,78,84,35,49,44,34,0,10,76,79,65,68,34,65,83,77,34,44,56,13,82,85
290 data78,13,0,11,76,79,65,68,34,69,68,73,84,34,44,56,44,49,13,83,89,83,52
300 data57,49,53,50,13,0,12,76,79,65,68,34,76,79,76,79,65,68,34,44,56,13,82
310 data85,78,13,0,13,80,79,75,69,53,51,50,56,48,44,48,58,80,79,75,69,53,51
320 data58,56,49,44,48,58,80,79,75,69,54,52,54,44,49,13,0,14,84,72,69,78,0
330 data15,68,73,77,0,16,71,69,84,0,17,83,84,79,80,0,18,67,76,79,83,69,0,19
340 data79,80,69,78,0,20,80,82,73,78,84,35,0,21,71,69,84,35,0,22,83,89,83,0
350 data23,67,76,82,0,24,69,78,68,13,0,25,73,78,80,85,84,0,26,78,69,80,84,0
360 data27,70,79,82,0,28,71,79,84,79,0,29,82,69,84,85,82,78,0,30,71,79,83,85
370 data66,0,31,80,82,73,78,84,0
1000 print"{08}copying data in now..."
1010 poke56,156:poke55,0:clrrem lower himem pointer
1020 fori=40192to40789:reada:pokei,a:t=t+a:nexti
1030 ift<>49092thenprint"error...  please check data statements.":end
1040 sys48192
```

Symbol table

```
symbol value
 ascok    9e03    checky   9d5e    clline   9dcf    code     9e1a
 colour   d800    comand   9d92    cvtasc   9df6    decptr   9e0b
 di$pl    9ddc    empty    9d25    endstr   9d39    found    9db2
 found1   9dcb    foundy   9dc5    gotnum   9d6d    incptr   9e04
 init     9d00    irqvec   0314    justrd   9e1e    keyq     0277
 not0     9e0a    notcr    9dec    notff    9e16    notype   9d44
 nqueue   00c6    oktord   9d4f    oktox    9dBa    oldvec   9e18
 ptr      00fb    rotlop   9d6f    screen   0400    search   9da4
 start    9d19    stscrn   9def    tabend   9f56    table    9e1f
 type     9e1d    xlook    d419    xreg     9e1b    ylook    d41a
 yreg     9e1c
```

◀ 13

produce a number between 0 to 31. This gives the required command number.

If it is between 1 and 31 then the command is printed on the top line of the screen. If it is 0, then the command is entered into the keyboard buffer one character at a time, waiting for each character to be removed from the buffer by the operating system before placing the next. This process continues until the whole command is accepted by the operating system.

Using your own commands

To define your own commands, alter either the assembly source, or the Basic loader. Note that the data area for each command is in the following format:

First byte: 00

Second byte: Command number (*eg* 01—31)

Consecutive bytes: Command data in ASCII

Note that after each command is a zero byte, this byte being the zero flag of the command following. The data area starts in line 240 in the Basic listing, as follows: 0,1,82,85,78,13,0, *etc*.

The zero is the zero flag, the 1 the command number, and 82,87,78,13 being RUN and carriage return in ASCII. For most applications, however, the keywords included in these listings should suffice.

Command table

No.	Command	Description
1	**RUN <cr>**	
2	**LIST <cr>**	
3	**OPEN1 8,15,"I": CLOSE1**	Initialises disk for use
4	**LOAD"$", 8 <cr> LIST <cr>**	Displays disk directory on screen
5	**NEW <cr>**	
6	**SAVE"**	
7	**LOAD"**	
8	**OPEN1, 8,15 <cr>**	Opens command file to disk
9	**PRINT£1,"**	Allows commands to be sent to disk
10	**LOAD"ASM", 8 <cr> RUN <cr>**	Loads and runs assembler from disk
11	**LOAD"EDIT",8,1 <cr> SYS49152 <cr>**	Loads and enables text editor
12	**LOAD"LOLOAD", 8 <cr> RUN <cr>**	Loads and runs Loloader
13	**POKE53280,0: POKE53281,0: POKE646,1**	Changes border 6 background to black and print colour to white
14	**THEN**	
15	**DIM**	
16	**GET**	
17	**STOP**	
18	**CLOSE**	
19	**OPEN**	
20	**PRINT£**	
21	**GET£**	
22	**SYS**	
23	**CLR**	
24	**END**	
25	**INPUT**	
26	**NEXT**	
27	**FOR**	
28	**GOTO**	
29	**RETURN**	
30	**GOSUB**	
31	**PRINT**	

Commands 14 to 31 are intended to be used when typing in program listings.

SINE LANGUAGE

Speed up your calculation of functions on the BBC with this program from Pete Johnson.

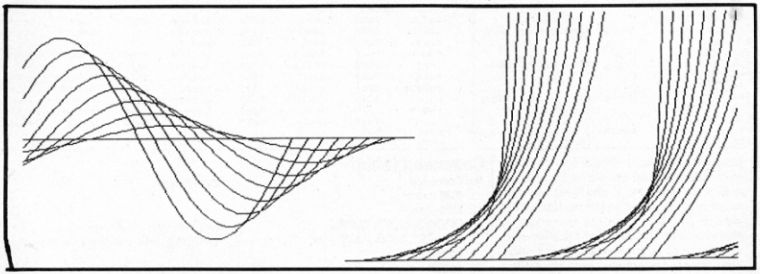
The trigonometric functions SIN, COS and TAN in BBC Basic have many uses, *eg* in plotting graphs and working out rotations in shape plotting. However, the speed at which Basic calculates the functions leaves a little to be desired, and for high-speed work the programmer has to resort to look-up tables.

This article describes one such look-up technique. Listing 1 is written in 6502 assembly language, provides the following features:

1 Sines of 0-360 degrees obtained using only 91 look-up values.
2 Results returned are accurate to 16 bits or about four decimal places. This is ample for most applications.
3 The routine may be called from machine code with the angle to be used in the A and X. The result is treturned in AX and is SIN (angle) *&8000.
4 The program may also be called from Basic with a statement of the form CALL get Sine, angle%, sin where angle% is any integer variable and sin is any real variable. Again, angle% is between 0 and 360 degrees, and the result is automatically scaled to a real, so that the CALL statement may replace an assignment such as sin=SIN(RAD(angle)).
5 The calculation is performed on average 18 times faster than the Basic's built-in sine routine.
6 The routine doesn't call Basic internal routines so is compatible with all variations of Basic and also works with the Tube.

The main sine routine starts at line 1760. This uses the look-up table at the label sinTab to find the scaled sine of the angle in AX. The actions for the four quadrants are:

0-90 degrees	The sine is simply looked up from sinTab.
91-180 degrees	the identity sin (a)=sin(180-a) is used. 180-a is in the range 89-0 degrees, so once the subtraction has been made, the routine for 0-90 degrees is called to obtain the result.
181-270 degrees	To obtain the result, the identity sin(a)=-sin(a-180) is used. First 180 is subtracted to obtain an angle between 1 and 90 de-



To the left is a Sine wave, to the right is a Tan wave.

Listing 1

```
1000 REM Pete Johnson October 1984
1010 REM Find sine of 0-360 deg. given table of 0-89 degrees
1020 REM CALL getSine,A%,A   puts sine of RAD(A%) in A
1030 REM as a value between -1 and 1
1040
1050 ptr=&70            :REM  Pointer to arguments
1060 t=&72              :REM  Temporary for result
1070 pb=&600            :REM  Addrss of BASIC parameter block
1080 DIM code 380
1090 FOR pass=0 TO 2 STEP 2
1100 P%=code
1110 [ opt pass
1120 .getSine
1130   ldx #1           Get the address of the first parm
1140   jsr getPtr       in ptr and ptr+1
1150   ldy #1           Get the two ls bytes = angle in degrees
1160   lda (ptr),Y
1170   tax              High byte in X
1180   dey
1190   lda (ptr),Y      Low byte in A
1200   jsr sin          Get SIN(RAD(AX))*&8000 in AX
1210   sta t            Save the result
1220   stx t+1
1230   txa              Was it negative?
1240   php
1250   bpl noNeg        No
1260   jsr negl         Yes, so negate the result
1270   sta t            and resave it
1280   stx t+1
1290 .noNeg
1300   ldx #4           Get the address of the second
1310   jsr getPtr       parameter in ptr, ptr+1
1320   ldx #129         Set intial exponent to 1
1330 .normalise
1340   bit t+1          Loop until ms bit of high byte is 1
1350   bmi normEnd      Got it
1360   asl t            Try again
1370   rol t+1
1380   dex              Decrement exponent to compensate
1390   bne normalise    Do it again
1400 .normEnd
1410   ldy #0           Store the exponent in first byte of real
1420   txa
1430   sta (ptr),Y
1440   iny              Then the high byte of result
1450   lda t+1
1460   and #&7F         Mask out high bit as assumed to be 1
1470   plp              Was it negative?
1480   bpl plusRes      No
1490   ora #&80         Yes, set sign bit of number
```

Listing 1 (contd)

```
1500 .plusRes
1510   sta (ptr),Y    Save mantissa 1
1520   iny
1530   lda t          Save 1s byte as mantissa 2
1540   sta (ptr),Y
1550   iny
1560   lda #0         Set mantissa 2 & 3 to zero
1570   sta (ptr),Y
1580   iny
1590   sta (ptr),Y
1600   rts            And return
1610
1620 .getPtr
1630   lda pb,X       Get pointer at pb+x and px+x+1
1640   sta ptr        in ptr and ptr+1
1650   lda pb+1,X
1660   sta ptr+1
1670   rts
1680
1690
1700 .gt90
1710   cmp #181       Is it 91-180
1720   bcs gt180      No
1730   sbc #180       sin(a)=sin(180-a)=sin(not(a-181))
1740   eor &FF        Drop through to sin
1750
1760 .sin            \ Main entry point for sin
1770   cpx #1         Test high byte of angle
1780   beq gt255      Greater than 255 degrees
1790   cmp #91        Is it 0-90
1800   bcs gt90       No
1810 .sinl
1820   asl A          Mult. by two for indexing
1830   tay            into sine table
1840   lda sinTab,Y   Get &8000*sin(AX) in AX
1850   ldx sinTab+1,Y
1860   rts            and return
1870
1880 .gt255
1890   cmp #271 MOD &100   Angle greater than 255 degrees
1900   bcs gt270           Greater than 270 degrees?
1910 .gt180
1920   sec            Angle a between 181 and 270 degrees
1930   sbc #180       sin(a)=-sin(a-180)
1940   bpl sinNeg
1950
1960 .gt270
1970   sta t                Angle a between 271 and 360 degrees
1980   lda #360 AND &FF     sin(a)=-sin(360-a)
1990   sbc t
2000
2010 .sinNeg
2020   jsr sinl       Return -sin(a), 0<=a<=90
2030 .negate
2040   sta t          AX=-AX
2050   stx t+1
2060 .negl
2070   sec            Usual negate routine
2080   lda #0
2090   sbc t
2100   tay            Save low byte in Y
2110   lda #0
2120   sbc t+1
2130   tax
2140   tya            Restore low byte
2150   rts
2160
2170 .sinTab          \ Table of sines for 0-89 degrees
2180 ]
2190 FOR i=0 TO 89
2200 [ opt pass
2210   EQUW &8000*SINRADi
2220 ]
2230 NEXT i
2240 [ opt pass
2250   EQUW &7FFF
2260 ]
2270 NEXT pass
```

grees. The sine of this is found using the 0-90 routine, and this result is then negated.

271-360 degrees The relationship this time is sin(a)=-sin(360-a). Again, the subtraction is performed, then the sin is obtained, then it is negated.

The relations described above may be neatly summarised with the Basic function:

1000 DEF FNsin(th%) IF th%<=90 THEN =SINRADth% ELSE IF th%<=180 THEN=SINRAD(180-th%) ELSE IF th%<=270 THEN =-SINRAD(th%-180) ELSE=SINRAD (360-th%)

You may notice the slight 'fudge ' in the code to set up the sine table at lines 2190 on. The sines for 0 to 89 degrees are obtained as expected, by multiplying the value returned by SIN by &8000. However, the sine of 90 degrees is obtained separately after the main loop.

The reason for this is the non-symmetry of two's component numbers: the sine of 90 is 1, therefore the entry for 90 degrees should be 1*&8000, or 32768. However, &8000 is in fact -32768 in 16 bits. The table uses the largest positive integer which is &7FFF instead. This doesn't cause any problems in practice.

The Basic interface to the sine routine starts at the getSine. The steps performed are:

1 Get the address of the first (integer) parameter in ptr.
2 Get the lower two bytes of this integer in AX. This should be in the range 0-360.
3 Call sin to obtain the scaled sine in AX.
4 If the result is negative, take its absolute value and remember that it was negative.
5 Convert the scaled integer into a floating point number. To understand how this is done, a knowledge of how BBC Basic stores floating point numbers is required.
6 Store the result in the second (floating point) parameter.

All this is performed between lines 1120 and 1600. To see the program in action type it in, run it and then try the following benchmark:

```
A=0
TIME=0:FOR A%=0 TO 360:CALL getSine,A%,A:NEXT:PRINT TIME
```

Compare the value printed with that obtained using:

```
A=0
    ξ=0:FOR A%=0 to 360:A=SINRADA%:NEXT:PRINT TIME
```

To compare the accuracy, try: `A = 0: @%=&20409 FOR A%=0 TO 360:CALL getSine, A%,A:PRINT A,SINRADA%:NEXT`

Finally a note about cosines. It is true for all angles that cos(a)=sin(a+90) where a is in degrees. Thus, a cos routine could be incorporated by including the lines in Listing 2.

Similarly, a Basic getCosine could be provided simply by replacing the JSR SIN at line 1200 with a JSR COS.

Listing 2

```
.cos
   clc                  Add 90 to get cos (AX = angle as usual)
   adc #90
   bcc noInx
   inx
.noInx
   cpx #361 DIV &100    Did we exceed 360 degrees?
   bcc lt361            No
   cmp #361 MOD &100    Maybe
   bcc lt361            No
   sbc #360 MOD &100    Adjust by subtracting 360
   ldx #0
.lt361
   jmp sin              And call the sin routine
```

THOR BLIMEY!

Resident Dungeon master Bob Chapell dons his Viking cap and embarks on a rescue mission

Plenty there is to be doing in *Erik the Viking*, a new text and graphics adventure, and like it very much I do, ya. It has been released by John Wiley (under its Mosaic Publishing imprint), and is available for the Commodore 64, BBC B and Spectrum micros.

The adventure is based on the popular children's book, *The Saga of Erik the Viking*, whose author is Monty Python star Terry Jones, and written by those wizards from High Wycombe, the Austin family, the Level 9 lords — so impressive stables all round.

Vikings rule OK

The game is set around 900 AD; the Vikings control most of England and rule the lands from Greenland to Sweden and south to the north of France. You may know that the Vikings just loved to pillage and plunder using their infamous raiding longships, but were you aware that their trading ships were called Knorrs? Now, not a lot of people know that.

The reason I feed you that educational morsel is because this adventure is said to pay meticulous attention to historic detail in both graphics and text. For instance, all the buildings shown are based on archaeological reconstructions and readings from the Viking sagas. If all this academic stuff is putting you off, don't let it. The fantasy element is there all right, so you'll enjoy playing while improving your education at the same time.

Norwegian good

Erik the Viking is played by your good self, and you begin up in the Norwegian mountains near your farm. You have just finished quietly dozing beneath the fir trees — and feel vaguely disquieted. You dreamt that an army of strange creatures swept down over the farm and dragged everybody away, including your wife. When you move down the hill and back to your farm, the dream turns out to be true — everyone has vanished. I don't know what the Viking equivalent of 'Cor blimey', is but that's exactly what Erik must feel like saying.

So off you go, scouring the surrounding area for clues. Well, this is an adventure, so what you're really searching for are objects that might assist you, and objects aplenty you will find — so much so that you'll be hard put to carry them all at once. There's a whetstone in the barn, some nails, a hammer and scales in the smithy and some trestle tables and asorted rushes near the Great Hall just for starters They *must* be of some use, so of course you take them.

One thing you learn pretty smartly is to examine or search every object in sight — this proves most beneficial, as it either reveals a further object or some useful information. For example, searching one object revealed Blueblade to me. I thought, what on earth is Blueblade? Could it be some acient Scandinavian safety razor? Last year's Danish Derby winner, perhaps?

A further examination told me it was neither — it was a sword embellished with the words 'Copyright Level 9 Computing'! Cryptic, huh?

The Great Hall had a distinct pong of wolves about it, and there were some mysterious paw prints down by the river bank. I've heard of cat burglars — but lupine looters? Never. I soon found my first Knorr — if I hadn't had the graphics switched on, I might never have known what it was. The graphics, while quite attractive and quickly drawn, do not add a great deal to the game and can be turned off if you wish to progress a little faster. The command WORDS turns them off; PICTURE turns them back on again.

The ship turned out to be my own, the Golden Dragon, so no doubt I was destined to do some sailing. But how to get the thing down to to the shore? A musical horn soon brought help running (pause here for cockily erudite question to Level 9; surely this should have been a lure, see Viking Age, in your *Lords of Time* adventure?).

Gang jawfare

The gang that turn up to aid and abet provide some delicious giggles for seasoned adventurers. From time to time the gang tell you to hurry up — they even sit down and start to sing of gold! But don't worry, *Hobbit* fans, the singing is not a sign you're about to meet a sudden demise.

Circus tightrope

Big Top fans, are you constantly falling off the tightrope , in Channel 8's *Circus*? Perhaps you have almost finished the adventure but can't work out how to get or use some petrol?

Tightrope problem:

1. TENY TEFAS ADNARAEW TOOF LAIC EPSE MOSD EENU OY.
2. NWOL CFOP LEHT SILN ETEN TCER EOT.

Petrol problem:

1. ROTA RENE GMORF TINO HPYS.
2. RACE VIRD NEHT KNAT LLIF.

QL NEWS

News from the world of Sinclair QL computing.

One year old... and look how we've grown!

When we launched the QL last year, we knew we were starting a revolution.

For the first time, the serious computer hobbyist could afford the same power and performance as the professional computer user.

A year later, and the QL is more than a unique computer, it's the heart of a unique system.

And the next 12 months promise even more for QL owners... new software options, extra storage devices, printers, monitors...

Read on, and see how far we've come, and how much further we're going!

No1

NIGEL SEARLE

Now it's the quantum leap for QL software and peripherals

Without doubt, the QL was the computer innovation of 1984. Launched to outstanding reviews, it soon gathered thousands of happy owners, and recognition from people like ICL, who have incorporated the QL and its Microdrives into the new One-Per-Desk.

The quickest glance at the QL's specification shows what the fuss was all about... 128K RAM, 32-bit processor architecture, 200K built-in mass storage, bundled software. They're features that would normally cost you three or four times as much!

But that's only half the story, because the QL is now the heart of a computer system, with a growing library of software...

As you'll see from these pages, 1985 is the year of the Quantum Leap for software and peripherals. Already there are no less than five QL languages together with special programs for software developers, a world-beating chess game... and much more on the way!

On the hardware side, there's a special QL monitor to make the most of that high resolution 512 x 256 pixel display. There are memory expansion boards, Winchester disk drives, printers, and low-cost Microdrive cartridges.

In fact, there's so much going on, we'll be running these regular Newsletters just to keep you in touch!

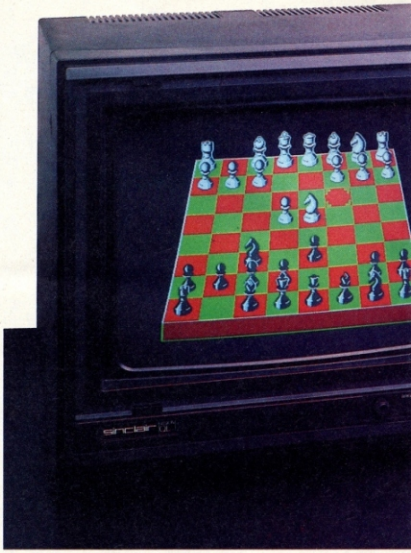
If you already own a QL, the next few pages will give you a taste of the exciting year ahead.

And if you don't . . . take a look at what you're missing. It should be all the persuasion you need!

Now read on... the Quantum Leap into serious computing starts here.

Nigel Searle

Nigel Searle, Managing Director, Sinclair Research Limited.



From sophisticated business packages to superb animated games... QL software makes the most of the computer's extraordinary specification.

New QL Software

Utilities, languages, games and business packages...with more on the way!

Two things are now certain about QL software. First, there's going to be plenty of it. And second, it's going to set completely new standards for microcomputers...

At the moment, there are well over 100 software programs in development. And the first software releases, shown here, demonstrate how exceptional the best QL software will be.

The QL already has five languages, superb programs for software developers, a top quality accounting package and in QL Chess it has its first game.

QLUB: 10,000 members and growing!

QLUB is the special Users Bureau for Sinclair QL owners. There are now well over 10,000 QLUB members, and membership is growing all the time.

For their annual subscription of £35, QLUB members are enjoying a whole range of information and advisory services, exclusive offers and special discounts.

One of the most important QLUB benefits is the special news magazine, appearing six times a year. The magazine provides a forum for QL owners to exchange views and keep in touch with all the latest developments.

Each issue is packed with updates on QL hardware and software, tips on applying the four QL Programs, and news of how other people are using the QL. QLUB members also receive a range of special discounts, with savings of at least 20% on selected software products.

Current special offers include:
QL Chess for £14.95
QL Toolkit for £19.95

QL Assembler for £31.95
QL Cash Trader for £54.95
Special subscription rates for Personal Computer News and QL User.

The multilingual Sinclair QL

BCPL – a forerunner of C, BCPL has been described as a systems programmer's delight. In the words of QL User, this compiler is a 'brilliant compromise between a high-level language and a low-level systems language'. Whilst not for beginners, this is an essential buy for anyone with a good knowledge of systems programming. Complete with manual.
Available from
Metacomco – £59.95.
Tel: 0272 428781.

LISP – already well-known for its artificial intelligence applications, LISP is a powerful and versatile language. This is a sophisticated implementation of LISP, by one of its leading exponents, Dr Arthur Norman. This package features full QL graphics, and a full manual is supplied.
Available from
Metacomco – £59.95.
Tel: 0272 428781.

Pascal – probably the most popular high-level language of all. Pascal is particularly well-suited to structured programming, sophisticated data manipulation and algorithmic problems. Pascal interpreter complete with 87-page manual.
Available from
Computer One – £39.95.
Tel: 0223 862616.

Forth – this 'new generation' language is proving both popular and easy to learn. The program provides a full implementation of the latest Forth 83 standard with graphics and sound extension.
Available from
Computer One – £29.95.
Tel: 0223 862616.

APL – the compact mathematics-based interpreted language designed for scientists and mathematicians.

APL keyword interpreter complete with manual.
Available from
MicroAPL – £99.95.
Tel: 01-622 0395.

Programmer's packs

QL Assembler – two programs operating in tandem. The first is a full-screen editor for creating and altering program files. The second, a Motorola-format compatible 68000 assembler which converts source files written in M68000 assembly language into machine code files which can run on the QL.

Both assembler and editor are written in machine code and can be multi-tasked with SuperBASIC, so you can switch between editor, assembler and SuperBASIC instantly.
Written by GST Computer Systems – £39.95.*

QL Toolkit – a programmer's toolkit with over 70 programs and extensions to SuperBASIC. Most are linked to SuperBASIC initially and can then be used from commands or from within a program. Enhancements include printer spooling (print a file while running a SuperBASIC program); improved file access (with full random input/output command); job control (allows management of multi-tasking programs including the ability to display, alter priorities, and delete jobs from the QL); and SuperBASIC screen editor.
Written by Q Jump – £24.95.*

World-beating chess!

QL Chess – fresh from its victory at the World Microcomputer Chess Championship. This program sets a completely new standard for games software.

There's a high resolution display, animated 3-D graphics, and 28 levels of play from novice to champion. Features include an openings book of nearly 4000 moves, HINT and TAKEBACK functions that help you learn from your mistakes, and the option to play a human opponent or the computer.
Written by Psion – £19.95.*

Software at work

QL Touch 'n' Go – a unique approach to learning touch-typing skills. The program is designed to give you mastery of the standard QWERTY keyboard in just 24 hours. With practice, you should soon reach 40 words per minute, with over 95% accuracy.
Written by Harcourt – £24.95.*

QL Cash Trader – a unique computerised book-keeping system for small businesses. The program provides a complete course in the principles of accountancy, and goes on to become an essential aid in the day-to-day running of a business. Complete with comprehensive manual.
Written by Accountancy Software of Torquay – £69.95.*

***This title is available from Sinclair Research on 0276 686100, and selected Sinclair stockists nationwide.**

Psion trouble-shooting service

All QLUB members can obtain special assistance from Psion on using the QL Quill, Abacus, Archive and Easel programs supplied with the computer. Psion will normally answer any queries within 48 hours.

Free updates

QLUB members will also receive one free update of each of the four QL Programs – incorporating many new developments.

New QL Hardware

An industry is born

From the moment of its launch, the revolutionary QL attracted massive interest from all quarters.

In one area, the interest quickly turned to action, as high-tech hardware manufacturers realised the immense potential of the QL for vast expansion, for system development and for widespread networking. Already the list of peripherals for the QL is very exciting – and lengthening by the day!

Here, we've covered many of the latest, most important developments.

As more appear, be sure to keep in touch with QL News!

The dedicated Sinclair Vision QL monitor

Once you see the incredible graphics capabilities of the QL you may decide an ordinary TV just can't do them justice.

If that's the case, a high-resolution monitor is needed. (And if you're creating presentation-quality charts, for example, it's quite essential.)

The new Vision QL monitor is specially designed for the computer by Kaga Electronics, with full support from Sinclair Research.

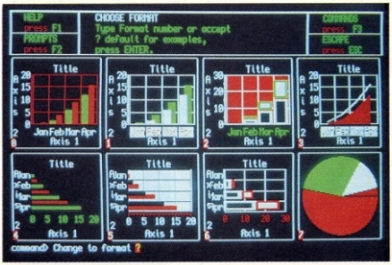
So it exploits the QL's maximum 512 x 256 pixel resolution to the full, with a pin-sharp 85 column display.

It's also specially styled to suit the QL – in looks, and in use. There's a 12" non-glare tube, and etched screen to diffuse reflections.

So the display is bright, sharp, *much* easier to look at . . . and invaluable for those late-night programming sessions!

And like the QL, the Vision monitor is designed with space in mind: it has a compact footprint of just 12½" by 15" – no more than a typical portable typewriter.

It's available from MBS Data Efficiency on 0442 60155 and selected Sinclair stockists.



The QL's superb graphics capabilities – as demonstrated by the Sinclair Vision QL monitor.

Microdrive cartridges. Another Sinclair First!

Microdrive cartridges are the QL's own unique storage media. Each stores up to 100K of information, on a cartridge no bigger than a matchbox!

Access is within seconds. And in tests, Microdrive cartridges have made over 50,000 passes without loss of data.

Over 500,000 cartridges are now being used throughout Britain. And QL Microdrives themselves are standard equipment on the new ICL One Per Desk.

Sinclair Microdrive cartridges – up to 100K of programs and data on a medium so compact you can pop it into your pocket.

Powerful hard-disk system

For the QL business user, the new Firefly QL Winchester disk will boost the QL's power in one huge leap.

Designed by Quest, it uses CP/M and offers all the benefits of Winchester technology: fast access, reliability, compact size and quiet operation.

With 7.5 Mb storage, the Quest Firefly is ideal for large databases such as stock or customer lists. And at under £1,200, it represents exceptional value for money.

The Firefly will be available very shortly from Quest on 04215 66488.

Winchester hard disk drives supplement your QL's built-in mass storage.

Interface options

The QL comes complete with two built-in RS-232C interfaces.

In addition, interfaces for Centronics printers are widely available from manufacturers such as CST, Miracle Systems and Sigma Research . . . with prices from only £35.

And that's just the beginning. For attaching scientific and laboratory instruments to the QL, CST even offer an IEEE-488 interface, which can handle up to 16 connected devices simultaneously!

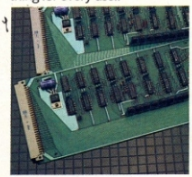
A Centronics interface slips discreetly into place.

Expansion boards for up to 4 times more memory!

Also from Quest, a simple and inexpensive way to expand the QL's RAM: with memory expansion boards.

These compact units connect to the standard QL expansion port, using the QL's internal power source or, for larger boards, an external power source.

The units range from 64K and 128K RAM boards to massively powerful 256K and 512K RAM boards, so there's something for every user.



Compact expansion boards.

Prices start at £117, and the 512K board is a very cost-effective investment at just £587.

With affordable memory like this, the QL is more than a match for any other micro under £2,000!

Where to find the QL.

The Sinclair QL is available at selected branches of Dixons, W H Smith, John Lewis Partnership, Currys, Greens in Debenhams and Ultimate, and larger branches of Boots, John Menzies and specialist computer stores nationwide.

The spec behind the spectacle

CPU – Central Processing Unit
Fast, powerful Motorola 68008 chip. A second processor, an Intel 8049, controls the keyboard, generates the sound, and acts as an RS-232C receiver.

RAM
128K. Now expandable to 640K.

ROM
48K.

Operating system
Qdos – revolutionary single-user, multi-tasking, windowing operating system.

Storage
Twin built-in QL Microdrives. Up to 100K storage each – transfer rate, up to 15K per second.

Keyboard
Full moving 65-key QWERTY, five function keys, four cursor keys.

Language
Sinclair structured SuperBASIC

Application software
QL Quill – word processor
QL Abacus – spreadsheet
QL Easel – graphics
QL Archive – database
All four packages supplied with the QL.

Interfaces
Two serial RS-232C interfaces, Microdrive expansion port (up to 6 may be added), ROM cartridge port, local area network, 2 joystick ports, RGB monitor and TV output.

Text screen
Various modes – up to 85 columns by 25 rows on monitor. On TV, up to 60 columns.

Graphics resolution
512 x 256 pixels (four colour), 256 x 256 pixels (eight colour).

Sinclair Research Ltd
Camberley, Surrey, GU15 3BR.
Tel: Camberley (0276) 686100.

sinclair

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STAYING SHARP

The Sharp MZ5600 could knock Apple's Mac and Lisa computers off their perch. Trevor Jenkins puts this new micro on the operating table and gives it a thorough examination.

First announced at last October's London Business Equipment Show the Sharp MZ5600 range has since attracted a great deal of interest — so much so that not all the options were available for review. Sharp claims they're selling too fast.

Immodesty apart, Sharp has come up with an impressive micro, and made a sensible decision in not attempting to copy the IBM PC, although there are, of course, certain similarities. Both are based on the Intel 16-bit processors, the IBM on the 8088 and the Sharp on the 8086, which means the 5600 has a 16-bit data bus compared with the eight bits of the IBM.

If the sort of work you have in mind is essentially 16-bit, the Sharp runs faster. There was a time when an 8-bit system used an 8-bit data bus, operated on 8-bit data and was easy to categorise. Now we have 16-bit systems with an 8-bit bus operating on 16-bit data, and are headed for the 32-bit system with a choice of 32-, 16- or 8-bit data buses.

First impressions

The 8086 processor may not have the best structure or instruction set available, but as it was among the first used in micros, it does have a large selection of software available for it.

Sharp has gone against the trend set by its competitors with 8086/8088-based systems in the size of memory provided as standard. Applications for the 8086 range have been memory hungry, and the manufacturers have exploited this by their entry-level systems not having quite enough memory to run the software package you need efficiently or effectively. Most of these systems start at 128K; Sharp, however, stands alone in starting you off with 256K. If you still need more memory there is an expansion board available.

In use

Program memory space is not affected by the video RAM (which is separate), although it does come out of the megabytes the 8086 is capable of addressing. The video RAM is normally 96K, but is expandable to 128K. The 96K is sufficient for monochrome display, but must be expanded if you want to exploit the colour capability.

The video RAM is accessed by both the processor and an NEC7220 graphics processor chip. The latter gives the MZ5600 series sensational graphics capability: it performs nearly all the graphics functions you might expect of a pricier microcomputer. Windowing, zoom, lines, circles and user definable characters are supported. Many sophisticated professional graphics devices are now appearing which use this chip. The demonstration system has some excellent examples of how to get the most out of this processor — multiple moving windows each with different picture elements, for instance.

Sharp has also included a programmable sound generator, supported by special statements in the Basic interpreter. The manufacturer scores over other systems here by also including a very necessary volume control, which is easy to find into the bargain.

I don't usually like such accessories but I was tempted to use it all the time with the review system.

While on the subject of noise there was excessive noise from the hard disk — not just when first switched on or when in use — but continuously. Sharp says production models will have some filtering to reduce this, but ask for a demonstration in a quiet place anyway.

Also whenever the floppy was accessed, this drive created a tremendous noise, reminiscent of an old manual typewriter. Is it safe to assume that solving the noise of the hard disk will also remedy the floppy drive problem?

The system is contained in a metal cabinet slightly smaller than an IBM PC's. Unlike many other systems, the metal box stops interference from the

electronics to surrounding equipment; it also protects the equipment in transit.

The review system came with one 600K floppy disk and a 10Mb hard disk all in the main cabinet. Apart from the keyboard and monitor, all the electronics are in this box.

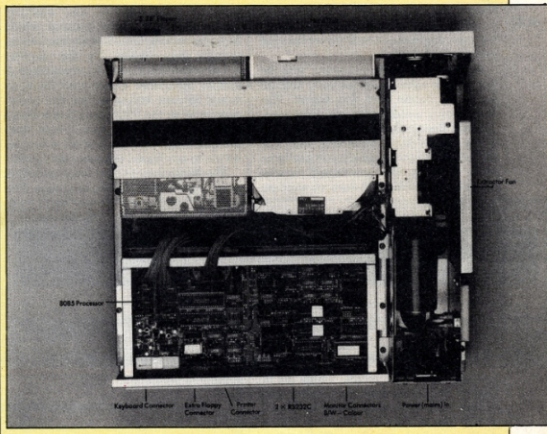
On the front of the box is a socket for the keyboard, the optional mouse plugs into the keyboard. Also on the front are the volume control and the reset switch. The latter has been recessed into the metalwork, so pushing it accidentally is impossible. A nice feature is that the on/off switch is out of the way on the side of the cabinet far away from the reset switch, and any exterior connectors which are all on the back. The power switch is also recessed.

The sockets on the back are inset making them difficult to dislodge. There are two monitor sockets, one for black and white, the other for colour; this implies it may be possible to run the two together, but as the colour monitor was not available for review, I was not able to confirm that. There is also an additional socket for the keyboard. One serious criticism of these sockets is that both RS232 connectors are not the normal 25-way sockets, nor do they conform to the newer RS432 standards, so adding a printer will need some thought. Sharp's documentation tells you how to do this, but the plug is not the normal size.

A separate Centronics printer port is also on the back of the case. A socket to connect an external floppy disk is present but this option was also unavailable for review (and ominously is not mentioned in the price list).

I would like to have seen some power supply sockets on the back, which would have added to the superiority of the system by enabling the monitor and printer to be powered without needing additional mains plugs and wires.

The quality of the monochrome monitor supplied matched that of the system. A swivel stand allows the position to be adjusted. The keyboard is modelled on the IBM PC, but has a better feel and a slightly different layout. It is thinner than IBM's, with small feet that are either up or down, rather than variable.



Plenty of function and editing keys are to be found on the keyboard.

Software

An impressive array of software was included for the review, the mainstay being CP/M-86. Sharp has made very useful additions to the utility programs and overcome some of the problems inherent in CP/M-86. Several celebrated packages came on hard disk, but without manuals. *DBase II*, *SuperCalc* and *WordStar* were supplied and the list of other software ready for the MZ5600 shows that Sharp has got its act together on this score too, unlike many others. MSDOS and CP/M-86 will be supplied free of charge with the machine.

Sharp has not forgotten the 8-bit customers, and the Basic interpreter accepts programs written for those earlier machines. Two conversion programs are provided to read an 8-bit system disk and convert the programs to the new format. This Basic is excellent, despite a few idiosyncracies.

What you should remember is that this is not Microsoft Basic (although GWBasic will be available early in 1985). So, a number of control structures are not present for the programmer. For example, there is no WHILE or REPEAT statement — only FOR/NEXT loops are allowed. A little worrying are the inconsistencies between this version and any other. The most irritating is that the PRINT statement only works on the printer. To print items on the monitor the DISP (display) statement comes into play. Then there are the strange forms of the single-line IF/THEN/ELSE statement. Lastly, the interpreter distinguishes between the cases of letters.

The capabilities of the 7220 graphics chip are covered by many statements in this Basic. Control of each separate window can be established with one statement; scrolling of any window can also be done in one command, in either up, down, left or right. The 7220's characters display can use user defined symbols, in an easier way than the BBC Micro does, the functionality is the same but more direct.

Presentation of output can be enhanced using a very powerful PRINT USING statement which allows printer control character sequences to be included in the output. On the monitor it is possible to put up a grid of various sized boxes with a Table command, which will impress anyone who uses the Sharp for producing management reports.

A number of statements are dedicated to the function keys to make full control easy. One of these is used for debugging and correcting erroneous programs.

Programming language purists may be upset to discover that some mathematical functions don't use the usual function syntax. However, there are ▶

redeeming features: a full set of floating point functions, and the ability to switch between degrees and radians for the sine and cosine functions.

More upsetting to everyone may be the licence agreement between Digital Research Japan and the buyer. The terms and conditions are ludicrous. 'Digital Research Japan make no warranty of *any* kind' runs one, and 'the entire risk as to the quality or performance is with the purchaser' warns another. So, if CP/M-86 does not work on arrival, that's just tough. Come off it, Digital Research, this won't curry any favour with your customers. In fact, I would like to refuse to sign my agreement or even to purchase CP/M-86 — perhaps that's why it comes free. DR may be trying to protect its investment, but there's protection and there's ripping people off.

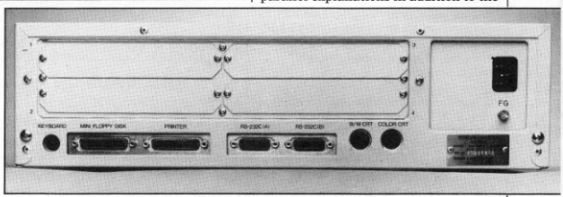
panying explanations are obscure. There is also a user's manual which includes concise details of the hardware, though data sheets for the various devices would also have been welcome. A system integrator would need them, as would anyone trying to use the sound generator or the 7220 from a non-Basic program. The Basic interpreter does provide access to them, but not everyone wants to use Basic, even one this good.

The Basic interpreter documentation is among the best for this language. The we're kept awake at night searching for the answer.

The only niggling problem with the Basic manual is that it's not in alphabetical order, but it does at least have an index of keywords.

Two quick reference cards are included in the package: first, a DR pocket manual which includes the Sharp extensions. This covers most of the contents of the DR manuals, but in very meagre detail — a deficiency best demonstrated by the error message section which explains self-explanatory errors. The section on BDOS function calls is much too cramped — it needs much more space (perhaps given up to those error messages); however, it is useful and can save time.

Basic also has a quick reference card, organised alphabetically; unfortunately, some of the notation is not explained (such as the use of input/output unit numbers). It has small examples with parallel explanations in addition to the



Volume control (top) is an unusual feature on the micro and the Sharp MZ5600 has plenty of scope for expansion (bottom).

Documentation

The usual 16-bit documentation comes in an IBM-style binder, with a box to store it in.

The manual's presentation is good, and the usefulness of the documents ranges from barely adequate to almost excellent.

Since only CP/M-86 manuals were supplied my comments are limited to those books. In my experience, it is likely that what is said about DR's offerings will also be true of Microsoft's MSDOS manuals. For the latter, I was provided with some photocopied pages of an MSDOS manual, relating to the Sharp and my comments below concerning its CP/M-86 documents would seem to be true of this manual too.

Software suppliers tend to think only in terms of quantity rather than quality of documentation, and that's true here. The impression that both Digital Research and Microsoft give is that they do not understand their audience.

The CP/M-86 documentation (a programmer, system and user guide) is as issued by DR with the necessary addendum and errata sheets. For those who have already seen these manuals don't despair, Sharp has put great effort into reproducing them. The contrast of the copies is very high overcoming the faintness of the originals.

Sharp has added a separate manual to these three to cover its additions to CP/M. Unlike DR's, this is typeset, and the examples are clearly laid out and well chosen, though some of the accombook has a small introductory section which leaves teaching the language to the many books already available; what it does cover are essential details of the implementation for those who have used another version. The manual is well laid out, with each Basic keyword on a separate page, along with the formal definition of the statement and examples of each possible format included. There are notes in explanation of the function.

What lifts this manual above the rest is that in addition to the explanations, there are helpful tips on the use of the statement with good examples, even if they are a bit laboured. There are also footnotes to answer those questions most of us have never wanted to ask until format of each keyword.

Verdict

If you want *some* compatability with an IBM but are not too concerned exactly how much, or you want to be happy in your use of a machine, relying on the documentation to tell you what you want to know again, then the Sharp MZ5600 is your machine.

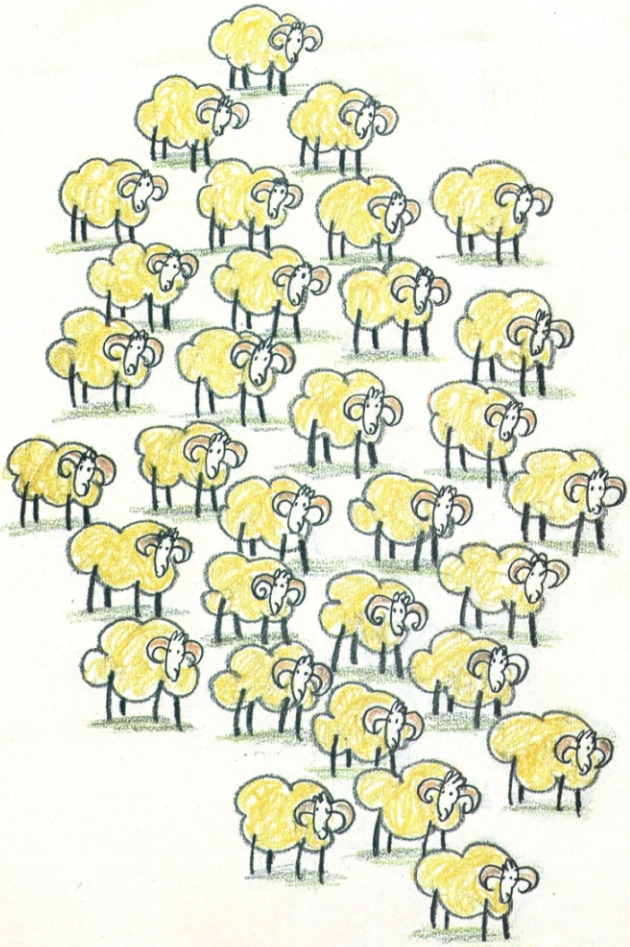
When DR's GEM package becomes available for the MZ5600, it is going to put up a good fight with Apple's Mac and Lisa machines — that NEC chip does some startlingly good graphics.

All in all, this is probably one of the best 8086-based machines at this level of the market today and deserves a lot more attention. ◩

SPECIFICATIONS

System	Sharp MZ5600 range, comprising cpu, 256K memory, single double-sided, double-density floppy drive, mono monitor, price £1595; the MZ5641 (as MZ5631, but with second floppy drive), price £1995; and the MZ5645 (as MZ5631, but with integral 10Mb hard disk) price £3495. (These prices include CP/M-86 and MSDOS as standard and one years on-site maintenance.)
Peripherals	Colour monitor, Mouse (£95) 256K memory expansion (£299), 96K video memory expansion (£230) and an 8087 Numeric processor available (price unknown).
Manufacturer	Sharp Electronics (UK), 061-205 2333

Your standard BBC Micro will have this many RAMs.



Upgrade your BBC Micro and you'll have this

And they'll be IBM PC

That's right, a massive 256 Kilobytes of Random Access Memory, plus hardware and disc compatibility with the U.K.'s number one personal computer, the IBM®PC.

Just think of the potential for your Model B. The opportunity to explore the vast range of IBM®PC compatible programming aids, languages and business software packages, which are already established as 'State of the Art' and are destined for a growth pattern previously unknown in the Industry.

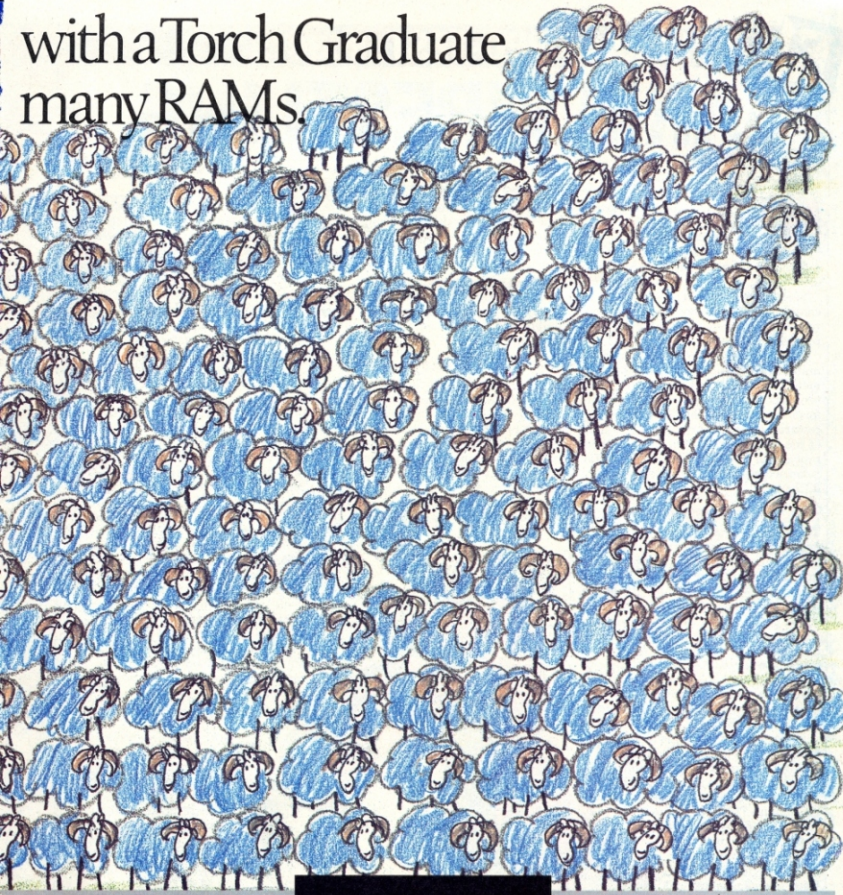
To take full advantage of this high calibre software support the Torch Graduate incorporates twin 360K floppy disc drives and two IBM®PC compatible expansion slots, thus making available options such as local area networking, ideal for business and educational applications or auto-dial/auto-answer comms modems, linking up with viewdata and electronic mail services such as Prestel and Telecom Gold.

As an added bonus, we even start you on your way with the PSION XCHANGE integrated software package comprising, word processing, financial planning, graphics and database management programs, specifically developed for the colour version IBM®PC.

BBC Model B owners, this is your day of reckoning!

Torch Computers, dedicated to the BBC Micro in more ways than one.

with a Torch Graduate many RAMs.



compatible.

Technical Specification • 8088 16-bit CPU (5Mhz) • 256K RAM • MS™-DOS operating system customised to IBM PC compatibility • Twin double sided, 5 ¼" floppy disc drives (each 360K formatted) • 2 IBM PC compatible expansion slots • Free PSION XCHANGE software (Abacus, Easel, Archive, Quill) • Software compatibility allows Lotus 1-2-3 and all popular IBM PC business programs to run without modification, subject to constraints of BBC keyboard and display • Acorn Disc interface is not required • Keyboard, text and graphics by BBC Model B Micro.

For the name of your local Torch Graduate dealer complete the reader enquiry card or ring (0223) 841000.
Torch Computers Ltd., Abberley House, Great Shelford, Cambridge CB2 5LQ.

Torch Graduate

TORCH

COMPUTERS

IBM® is the registered Trade Mark of International Business Machines. The BBC MICRO is designed, produced and distributed by Acorn Computers Limited. The Graduate is manufactured by Torch Computers under licence from Data Technologies Ltd.

ARM WRESTLING

Ralph Bancroft and Kenn Garroch engage in a trial of robotic strength and control with the Colne Armdroid and the budget Fischertechnik system.

Micro controlled robotics is a growing area of interest for many schools and for home enthusiasts. The major drawback is the cost of the robots and often the lack of software to drive them.

Fortunately, things are starting to change and a number of 'build your own' robots are becoming available at fairly reasonable prices.

Colne Robotics has been a leading manufacturer of low cost robotics equipment and a robot arm is one of its latest products. It is available either in kit form or already assembled. I took the coward's option and reviewed a sample of the latter. It turns out that this was probably a good move as we were later informed that kit assembly is pretty difficult.

Setting up

The Colne comes with an interface, operating software, a power supply and some manuals. Connecting everything up was simply a matter of plugging one lead of the interface into the robot, the other into the user port on the BBC.

The power supply comes in a weighty cast aluminium box which gives the appearance of being able to provide enough power to lift anything, although it does get very hot after an hour or so of use. With the robot powered up, the control software centre loaded, from tape, into the BBC.

Programming the Colne follows the seemingly universal process of moving the arm to a position in a sequence and then instructing the computer to remember that movement. This is continued for the complete movement cycle. Because the Colne is capable of movement through a number of axes, there are some additional commands not available on something like the Fischertechnik.

The arm is mounted on a rotating base and has joints at the elbow and wrist. The latter swivels and rotates and supports the three-fingered hand, which can open and close. All this is strung together with a veritable knot of cord and pulleys. All the cords return to a pulley set contained in the base. Each pulley has a lever on it for manual adjustment.

In use

The upshot of all this is that the program needs to be able to control the whole lot. This is done by assigning two keys to each movement (back and forth) with a number of subsidiary commands for turning the stepper motors on and off, and setting up the points which need to be remembered.

Colne Robotic's Armdroid: needs to be taken by the hand and shown what to do.

To get the robot to do anything, you have to move it to a suitable home position, defined as such with the home key. Keyboard controls are then used to move the arm to the next point. This can involve any mixture of wrist, elbow and arm movements which the computer not only seems to be able to tack together, but smoothens when it plays them back. Any number of attempts can be made to get the movement right.

I eventually got things working so that the arm would pick up the phone and, unfortunately, drop it again. The grip is not terribly good for holding telephones, perhaps because it's a little on the small side. Smaller objects, present far less of a problem. Using a large felt tip pen, it is possible to get the robot to draw lines, admittedly rather curved ones.

The accuracy is not great and a centimetre or so is lost every time the manoeuvre is repeated.

Real problems occur when attempts are made to move the arm to its extreme positions. Things get so strained that the cords tend to jump off the pulleys. Putting these back on is fiddly, to say the least, and tends to pull everything out of line. Getting going again means turning off the motors and adjusting pulleys, mainly in the wrist, until everything is realigned.

Verdict

The Colne robot arm is a good quality kit and certainly looks the part of a robot arm. If you intend building it remember that it could be a little difficult. Buying it ready-built gets around all this fuss, and the only manual labour involved will be occasionally putting the pulleys back in line.

Playing with robots is great fun. The hardest bit is thinking of some use for it besides lifting things up and putting them down again.

If you can think of some reason to justify the cost then the Colne is rather more than just a toy.

REPORT CARD: 1 TO 5

Features	●●●●○
Documentation	●●○○○
Performance	●●●●○
Overall value	●●●○○

Product Colne Armdroid 1 for BBC micro
Price £569.23 plus 3% PP (ready assembled), £534 plus 3% PP (kit form)
Availability Colne Robotics 01-8928197

For those with a lower budget, the Fischertechnik robot kit might be a more attractive option — particularly as you can use it to construct no less than six different computer controlled models.

The Fischertechnik computing kit is aimed only at those interested in tinkering around with the basic principles of robotics. By no stretch of the imagination could it be considered a precision technical instrument.

You are given the pieces to construct a 'teach-in' robot that can learn simple movements and repeat them, a plotter, a model that plays the Tower of Hanoi game, a solar cell tracking device, a graphics tablet and a sorting system.

The basic kit should be available through some leading toy shops but comes with two significant disadvantages: the manuals are in German, and there are no details on how to connect it to the leading makes of home micro used in the UK.

The package deal offered by Micro Robotics Systems is probably a better option. For £112 you get the basic kit plus interface and software to hook it up to a BBC micro.

Setting up

The kit itself comes in a box complete with all the parts to make the six different models. But the instructions on how to make them are primitive to say the least.

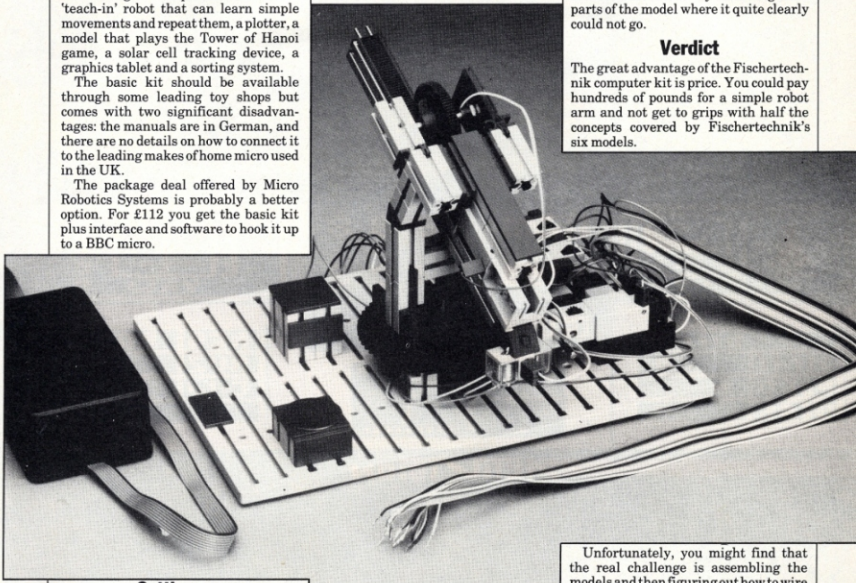
Exploded diagrams in the manual illustrate the different stages of construction and you then have guess how all the pieces fit together — not as easy as it sounds to a first-time user.

Having put the model together you then stumble across a final diagram showing the assembled model and its associated wiring. The problem is that there is no mention in the previous diagrams about the wiring and you discover that to achieve the neat result in the photograph you have to take the model apart and start all over again.

The model chosen to test drive was the teach-in robot. Having put the model together (and cheated on the wiring — see picture) it was obvious that the whole exercise was designed as an obstacle course.

If the construction details in the Fischertechnik manual were scant, the information in the Micro Robotics Systems manual was simply atrocious. All it consisted of were a couple of photocopied sheets that left more than a little to the imagination.

The Fischertechnik robot: a simple robot arm at a budget price.



It took a couple of hours' experimentation to get the interfacing correct.

The next problem, a fault in the interface box, caused one of the model's electric motors to remain on continually. The fault was cured only by opening up the box and having a good poke around until the bad connection was identified.

In use

The movements of the robot arm are completely under software control. The software is provided on cassette and allows you to rotate the arm, make it go up and operate a magnet at the tip of the arm.

In instruction mode you make it move and, using the Beeb's keyboard, mark points as it goes through its paces. The object of the exercise is to teach the arm to move to one position, pick up a metal disk and drop it in another position.

Changing modes allows you to store the sequence of moves and then tell the arm to repeat it once or several times over.

The lack of precision soon became obvious as the arm had a tendency to overshoot or undershoot the expected positions. As a result it often went into self-destruct mode by crashing into parts of the model where it quite clearly could not go.

Verdict

The great advantage of the Fischertechnik computer kit is price. You could pay hundreds of pounds for a simple robot arm and not get to grips with half the concepts covered by Fischertechnik's six models.

Unfortunately, you might find that the real challenge is assembling the models and then figuring out how to wire them into your micro.

The blame for this sorry state of affairs must rest with Micro Robotics Systems whose poor documentation and less than reliable interface and software (it crashed on more than one occasion), turns what should be a pleasurable voyage of exploration into a nightmare journey of frustration.

REPORT CARD: 1 TO 5

Features	●●●●
Documentation	●
Performance	●●
Overall value	●●●●

Product Fischertechnik computer kit with Micro Robotics Systems interface and software. **Price** £112 plus VAT. **Availability** Mail order from Miro Robotics Systems Ltd, 500 Chesham House, 150 Regent Street, London W1R 5FA.

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SOFTWARE PRE-VIEW

We check out the latest contenders on the software market, and cast an eye to the future. Don't forget, if you want your company's package to be included on this page, send your latest releases to Bryan Skinner, *PCN*, 62 Oxford Street, London W1A 2HG, along with prices and 'phone numbers.

AMSTRAD

Anirog's *Survivor* is in the best traditions of arcade/maze games, with its smooth action and need for strategy and concentration. The graphics and sound are neat, too. *Centre Court*, however, shows only too well just how variable Amstrad software, sadly, still is. The game tries to reproduce Psion's *Match Point*, but with little success.

Centre Court	**£8.95**	**Amsoft 0277-230222**
Detective	**£8.95**	**Amsoft 0277-230222**
Survivor	**£7.95**	**Anirog 0322-92513**

BBC

Apple Pie's scene-setting promises more than it delivers. Fast and difficult, with nicely done graphics, the game concept falls short of original. original.

Identify Europe, another educational program from Kosmos, aims to teach the countries, capitals and seas of Europe. For all that it's nicely packaged, there's no documentation.

Identify Europe	**£7.95**	**Kosmos 05255-3942**
Apple Pie	**£6.95**	**Visions 01-748 7473**

COMMODORE 64

The good news is that US Gold continues to bring us the best of US software, providing stiff competition for CBS and Ariolasoft. Well the even better news is that there is more to the cassette version of *Stellar 7* than the disk, and the superb wire frame images and gripping action still give hours of nail-biting enjoyment for games addicts.

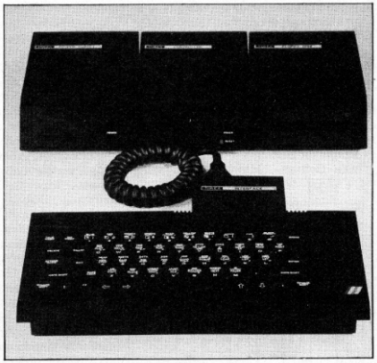
Stellar 7	**£9.95**	**US Gold 021-359 3020**
Front Line	**£7.00**	**Interceptor Micros 07356-71145**
Bigtop Barney	**£7.00**	**Interceptor Micros 07356-71145**
The Caverns of Sillahc	**£7.00**	**Interceptor Micros 07356-71145**

ORIC

Good news for Oric 1 and Atmos owners is that software houses are still interested, the most notable proof being Orpheus (due to Tansoft connections) and IJK. Oric programmers have a wacky sense of humour, typified by IJK's *Don't Press the Letter Q* in which you play various fairly decent and amusing maze/platform games.

Zebbie	**£8.50**	**IJK 0253-55282**
Don't Press Q	**£8.50**	**IJK 0253-55282**

WIN A SPECTRUM DISK DRIVE



A happy new year to Spectrum owners from *PCN* and Spectrum dealer Micro Interface. Together we're offering three superb Timex disk systems worth £300 each. They're fast, easy to use and store 160K on each 3in disk — just the thing for yawning cassette users.

In addition, we'll give away 24 keyboard overlays to the runners-up.

All you have to do is complete the sentence on the right in the funniest or most entertaining (and printable) way. Entries must be received by Friday, February 1. The editor's decision is final and no correspondence will be entered into.

My Spectrum needs a Timex disk drive because .....

.....

.....

Name.....Telephone.....

Address.....

.....

Send to: Spectrum Disk Competition, *Personal Computer News*, 62 Oxford Street, London W1A 2HG.

TWICE KNIGHTLY

***White Knight 1.2* sets new standards in computer chess games.**

White Knight Mk 12, for the BBC Model B, is Martin Bryant's attempt to improve on his excellent Mk 11 version, which incidentally, won the home computer section in the 1983 European Micro-computer Championships.

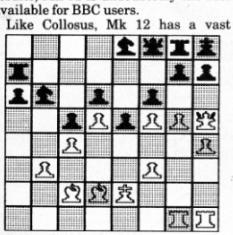
On the face of it, Mk 12 is both more powerful and includes enough extra features to justify a new version. This review was carried out on a preproduction version, complete with Bryant's own manual, though the finished program should now be in the shops.

Bryant has tested Mk 12 against a variety of other programs, including the Mk 11 version (which the Mk 12 beat 13-3).

The list is impressive, but Bryant doesn't include any mention of how Mk 12 performs against his own excellent program, Collosus, for the Commodore 64. In many ways, Mk 12 looks and feels like a direct translation of Collosus — a later and stronger program than the Mk 11 — though Bryant reckons that in the development from Collosus to Mk 12, he has achieved substantial improvements in the program's algorithims.

But the real question is which is the best program, and from what I have seen of this one, coupled with Bryant's results, Mk 12 is undoubtedly the best available for BBC users.

Like Collosus, Mk 12 has a vast



Borisenko vs Nahimouskia, 1969.

number of playing levels. Although there are only four playing modes, Mode four allows the user to specify an average elapsed time per move in any combination of hours, minutes and seconds. The program defaults to ten seconds a move when you first select Mode four, and it provides an enjoyable game at that level.

Openings

I wasn't particularly impressed with the strength or quality of the openings book, although the limited RAM on the BBC may be the excuse for this. But as Grandmaster John Nunn's annotations demonstrate, Mk 12's tactical capabilities are good enough to give casual players a thrashing at the higher serious levels.

One improvement over the earlier version is that Mk 12 knows about 'underpromoting' — the technical term to describe the deliberate choice to promote a pawn which has reached the eighth rank to something other than a Queen.

This is not the sort of facility you'll often care about, since it is natural to choose the Queen. But there are rare instances in a game when checkmate can be elegantly and instantly achieved by selecting a Knight instead of a Queen, and there is also the fact that a chess program which can't underpromote can't really be said to play all the legal moves.

One new feature that most users will not like is Bryant's inclusion of a routine to prevent the program being copied from cassette to disk. Mk 11 was not a protected program, and it could be saved to disk.

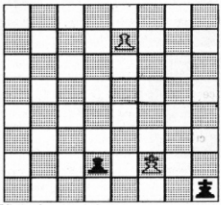
It is understandable for a programmer to want to prevent illicit copying of his software, but the advantages of disk over cassette are so great that to be forced to hang about for five minutes waiting for a cassette tape to load is extremely irritating. BBC Software has plans, apparently, for a disk-based version, but that will not be available for a while.

Other additional features include the ability to save any position or game to tape (though if the saving process is flawed for any reason, the Beeb loses its memory of the game — so you need to write down the game score before saving), user defined board colours, more information on the screen, and the fact that the program now continues to analyse the position on the opponent's turn to move.

The screen display is good, and instant replay facilities are available at any point in the game. The speed of the replay is user driven, since you return to the beginning of the game by pressing Control N for new game, then procede move by move by pressing F (forward). Alternatively, you can step back for a maximum of 128 full moves.

One interesting feature is Bryant's way of handling user input. Wherever the program requires a number from the user (*ie* for colour changes, time settings, or playing levels) the program displays a default number which is decreased or increased by pressing the appropriate cursor arrow key.

Moves on the board are made by either using the cursor keys to position the cursor over the chosen piece and entering, then indicating the destination square and entering, or (with the Beeb in lower case mode) by entering the appropriate algebraic notation.



White to play, mate in four moves.

Combinations of the two methods are also possible (*ie* when you type b the cursor shoots to the b rank — if you key in B instead, it moves the board position and game score back a move).

Verdict

White Knight Mk 12 is weaker than the present generation of dedicated chess computers, like the Super Constellation. But it is strong enough to beat most casual players and good enough to give those outside of the professionals an enjoyable game. **Tony Harrington**

PCN extends its congratulations to Grandmaster John Nunn for his recent outstanding performance in the 88-nation chess Olympics at Salonika. In the Olympic's 57 year history, Nunn's 10 points from a total of 11 games is the best individual score since the great Alekhine won 9 out of 9 in 1930. Nunn's score helped the UK team to its first ever silver medal, four points behind the Russians.

Pro's view

How good is White Knight Mk 12? John Nunn played it off against the Mk 11 version to find out.

White is to play in this position from a game Borisenko-Nahimovskia played in the USSR in 1969. Borisenko found a

beautiful forced mate in four by **1** Qh5×h7+! Kh8×h7 **2** g5-g6+ Kh7-h8 **3** Rg1-g5! (threat **4** Rg5-h5 mate) f6×g5 **4** h4×g5 mate.

I fed the position into the Mk 12 and at first it favoured **1** g5-g6, a weak move allowing Black to block the kingside by **1**...h7-h6, but after 2 hours 38 minutes it found **1** Qh5×h7+, and played the rest of the mating line without difficulty. It is rather a long time, but ask yourself whether or not you would have found the winning line.

The second test was more impressive. Most chess programs have a problem-solving mode, designed to solve the puzzles which are often found in newspaper columns where White has to mate in a fixed number of moves.

This is much faster than the normal mode, because the machine is only looking for a mate and can disregard any other type of advantage. In problem-solving mode the Mk 12 solved the first diagram in just under three minutes, a 50-fold increase in speed.

Finally, a problem composed by A Werle in 1945. How does White (to play) force mate in four moves? the Mk 11 erroneously concluded that **1** e7-e8=Q does the trick, because it didn't consider the cunning defence **1**...d2-d1=N+! **2** Kf2-g3 (to keep Black's King bottled up in the corner) Nd1-e3. Then **3** Qe8×e3 is only stalemate, while otherwise White is unable to force mate in two more moves.

On the other hand, eight seconds was enough for the Mk 12 to find the correct solution **1** e7-e8=R!. The threat is **2** Re8-h8 mate, so Black still has to play **1**...d2-d1=N+ **2** Kf2-g3 Nd1-e3 (or else White mates by Re8-e1), but now White can simply continue **3** Re8×e3 Kh1-g1 **4** Re3-e1 mate. The point is that with the rook instead of the Queen on e3, the square g1 is not covered and Black isn't stalemated. **John Nunn**

Lucky breaks

As everyone knows, chess is a game of pure skill. Luck simply does not enter into it. Or does it?

I remember playing a game in the final round of the Middlesex under 18 championship, more than two decades ago, when a win would have secured the county title for me. After pondering an intricate position for many minutes, I failed to notice that I could give checkmate, and instead played a different move which only drew. Had my opponent played that phase of the game better than I had done, or was he lucky?

Luck can also play a decisive effect in a computer game. Perhaps the most dramatic example of a lucky break in computer chess was seen in this year's World Microcomputer Championships in Glasgow.

Psion Chess, in a hopelessly lost position, won the game on time. Why? The opposing machine, Fidelity's Elegance, was running with EPROMS that had been programmed shortly before the tournament. Improvements — a one byte change — to the endgame code had been telephoned to the Fidelity factory in Miami.

Somehow the two hex letters needed for the change had been received over the telephone line back to front, with the result that the EPROMs contained one wrong instruction. The program crashed frequently, once the endgame had been reached. It was these repeated crashes, in a winning position, that cost Fidelity the game, and the tournament. Was Psion Chess lucky?

The position here arose in the 1984 North American Championships in San Fransisco. White was the Chaos program which has long been one of the contenders for top honours in the event. Black was Phoenix, an up and coming Canadian program. Chaos had earlier made an unsound sacrifice, and was now faced with an ending in which Black had an extra piece.

A respectable human player would have resigned White's position by now, but computer programs are not yet 'respectable' or respectful.

The game continued:

37 . . . Kb6xc7?

Black should first push the a-pawn to a safe square, and only then go after the c7 pawn. That way Black would eventually be able to create a passed a-pawn (after capturing on a3).

38 Kf5-g6 Bg7-f8
39 Bc3xa5+!

The correct pawn. If White captured on e5, Black would hang on to the a-pawn and win.

39 . . . Kc7-c6
40 Ba5-b4!

A good swindling try.

40 . . . Bf8xb4??

Black knows that when you are materially ahead you should try to trade off pieces. What Phoenix fails to appreciate is the potential strength of Whites King side pawns.

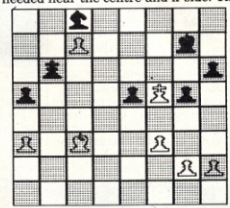
In the initial position, prior to Blacks 37th move, I made a $5 bet with one of the Chaos programmers that his program would not lose. Now I offered to bet him $10 that his program would win the game! Being a piece down, he accepted my bet.

41 a3xb4 Nc8-e7+
42 Kg6xh6 g5-g4
43 Kh6-g5!

Naturally not **43** f3xg4?? e5-e4, and e-pawn soon becomes a Queen.

43 . . . g4xf3
44 g2xf3 Kc6-b5??

The wrong way. Black's King is needed near the centre and k-side. The



Black to move, move 37.

knight should be used to stop the b-pawn, and Black could then draw.

Now Phoenix can see that **45**... Ne7-c6 4b h2-h4, gives White an unstoppable h-pawn, but the text move serves him no better in the long run.

45 Kg5-f6 Ne7-d5+
46 Kf6xe5 Ndxb4
47 h2-h4 Nb4-d3+
48 Ke5-f5 Nd3-c5
49 f3-f4 Kb5-c6
50 h4-h5 Nc5-d7
51 h5-h6 Nd7-f8
52 Kf5-f6 Kc6-d7
53 Kf6-f7 Nf8-h7
54 Kf7-g7 Kd7-e7
55 Kg7xh7 Ke7-f7
56 f4-f5 Kf7-f6
57 Kh7-g8 Resigns

Who was lucky? I won the bet, but that is skill — knowing the limitations of computer programs. Chaos won the game, but that is because it played the final stage better than Phoenix. Or should we say that because Phoenix threw away a winning position, Black was unlucky? In which case White must have been lucky. ***David Levy***

Table of results

Program	Publisher	Micro	Results
White Knight (11)	**BBC Publications**	**BBC**	**13-3**
Cyrus IS Chess	**Sinclair**	**Spectrum**	**13-3**
Superchess 3.0	**CP Software**	**Spectrum**	**13-3**
Grandmaster	**Audiogenic**	**CBM 64**	**14-2**
Chess	**Acornsoft**	**BBC**	**16-0**
Chess	**Bug-Byte**	**BBC**	**16-0**
Chess	**Computer Concepts**	**BBC**	**16-0**
Chess	**Program Power**	**BBC**	**16-0**
Chess	**Acornsoft**	**Electron**	**16-0**
Chess	**Program Power**	**Electron**	**16-0**
Spectrum Chess II	**Artic**	**Spectrum**	**16-0**
Chess	**Psion**	**Spectrum**	**16-0**
Master Chess	**Mikro-Gen**	**Spectrum**	**16-0**
Sargon II	**Hayden**	**Apple II**	**16-0**
Chess 7.0	**Odesta**	**Apple II**	**16-0**
ZX Chess	**Artic**	**ZX81**	**16-0**

White Knight Mk 12 compares favourably with its opponents.

GAMEPLAY

COMMODORE 64

GANDALF

The plot in *Gandalf* is fairly simple: you play the Gandalf of the title, and your castle is under attack from lizard-men who will enter and steal your apprentice, your task is to get him back and amass points by killing the reptilians.

In the first screen Gandalf stands on battlements above the courtyard in the foreground. To the left is his apprentice, stirring a magic potion. A forest stretches away into the distance, and it's from here that the lizard men approach. The joystick controls Gandalf's spell, pressing fire blows up a lizard with a neat little nuclear mushroom.

Casting spells drains Gandalf's strength (his colour changes to indicate this), but energy can be gained by moving Gandalf up to one of the towers at left and right: there's a magic

star in the sky which zaps Gandalf back to life in a jiffy, but only when it's free of clouds.

The lizard men move in from the wings and look like dinosaurs. Once they reach mid-screen they turn and march toward the portcullis. Each one you blast turns to a gold coin which shimmers on the forest floor. After a time the portcullis rises and you should let a lizard man in to take the apprentice. Then you can follow the beast out of the castle to screen two.

Things are pretty hairy outside. The reptiles have dragon-like tendencies and will give you a dose of flame if you let them get too close. The plan here is to avoid them, blasting as many as possible, collect the gold coins and rescue your apprentice. From time to time a gold ostrich flies past and nicks one of the coins. To rescue your apprentice you must set a trap in the path of the abductor, but you can't defend yourself once a trap has been set.

Once you've vanquished enough lizards the gold you've collected jingles into your coffers and the action speeds up, but lose your three apprentices and you're doomed.

Gandalf is a curious game, there's not an awful lot to it and it would be quite easy to master fairly quickly. It has a healthy proportion of that rare quality — playability, partly due to the neat graphics and partly the fairly original plot. It deserves a look, but what a pity there are only two screens — and where's the 'realistic sound' advertised on the inlay? All in all, fair fun in a limited format. **Bryan Skinner**

Rating 7/10
Price £9.95
Publisher Tymac 021-643 9524

BBC

THE HORSE LORD

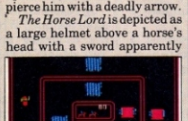
There's a trend in the computer games business to base all sorts of games on books 'of the same name'. This offering from Century is either loosely drawn from the novel, or the book is one of the dullest fantasy novels to hit the streets in recent times.

The game is well packaged and the cassette includes numerous protection devices. The most ingenious is a rewrite of the cassette operating system to produce a loading sequence, completely devoid of the comforting clicks of the cassette relay and on-screen block counter. There is also something supposed to prevent copying. But it's a shame the program isn't worth all this effort.

You take the part of the Horse Lord, a latter-day knight bent on the delivery of a message to a distant castle. In your path are footsoldiers, moats and — for variety guest what? — footsoldiers and moats together. The full path is depicted in the first screen and shows your route as a sort of square spiral to the castle in the centre.

Your old 'oss shuffles along to the first obstacle, which you combat on a second screen. If it's a moat, you have to jump it, if it's a soldier you have to cut him up with your trusty blade or pierce him with a deadly arrow.

The Horse Lord is depicted as a large helmet above a horse's head with a sword apparently



protruding from its mouth. The moat is a horizontal strip of blue across the screen, and jumping it means taking a run and pressing Return at the appropriate point. If you get it wrong it's back to the start.

The soldiers, which you meet one at a time, are also helmets wielding swords. By getting close and wapping the Return key, you can usually inflict enough damage to beat them.

The whole procedure is timed by a small band slowly decreasing across the bottom of the screen. It runs out much too fast and provides the main exit from the game. The closing image is that of a grotesque head with blood gushing from it — not for the squeemish. **Simon Williams**

Rating 4/10
Price £7.95
Publisher Century 01-434 4241

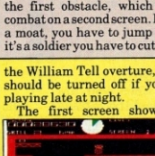
BBC

LEDGEMAN

Ledgeman seems at first sight to be a rather elementary platform game. In fact it's the most varied and compulsive platform game I've ever played on the BBC micro.

The loading screen scrolls the brief instructions and the controls (not redefinable) across a teletext display, and once loaded offers controls for music and sound effects and the selection of one of three levels of difficulty. The music is a suitably manic rendition of part of the William Tell overture, and should be turned off if you're playing late at night.

The first screen shows a



number of ledges and ladders, interspersed with large, multi-coloured Hydra and pulsating rectangles. Avoid the Hydra and take all the rectangles to move on. The second instalment has lots of ledges, but nothing to stop you grabbing the goodies — until the clock, which limits the time on each screen, reaches quarter past. Then fireballs drop from the roof, destroying platform sections and you if you get in the way. If you don't move fast on this screen you'll be stranded.

The third screen has a number of wheels rolling about the place, *Donkey Kong* style. These have to be avoided or jumped over. On screen four you have to board moving ledges like passing trains.

Screen five invokes the falling fireballs once again and a number of conveyors as well. Screen six has a spiral of ledges and ladders which seem simple until an explosion in the centre sends all kinds of debris bouncing about the place. The last screen is almost entirely conveyors with Hydra. After seven screens you return to the beginning and the skill level is increased. An excellent game with a lot of variety. **Simon Williams**

Rating 9/10
Price £7.95 **Publisher** Software Projects 051-428 7990

SPECTRUM

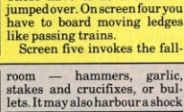
VAMPIRE KILLER

One shouldn't expect too much from pocket-money priced games — but as a cheap game, *Vampire Killer* has its good points.

You must try to ascend to the twelfth floor of a building to where Dracula is asleep behind a door. The only way you can progress between floors is by using the lifts, but unfortunately these have gone a little haywire: you might find yourself going down when you had hoped to go up.

The screen shows a split-level, side-on view of two floors with your little man in position. One floor looks exactly like another with its two green doors and one pink lift shaft. There may be a spider or bat blocking your way, but they can be shot if you have a bullet.

Any door may be opened and entered, the screen changing to show you the room. There may be one or more objects in the room — hammers, garlic, stakes and crucifixes, or bullets. It may also harbour a shock



(such as a skeleton or spider) — you can only survive a few of these scares. If the room turns out to be an air shaft you'll tumble all the way back down to level one.

Because all the floors and rooms are very similar, the game gets rather boring after a few plays. It's all based on a random set-up, and is not entirely bug-free. **Bob Chappell**

Rating 4/10
Price £1.99
Publisher Scorpio Gamesworld 061-834 2292

GAMEPLAY

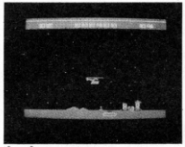
BBC

AIRLIFT

Ever since the advent of the helicopter version of *Scramble* there seems to have been an unspoken competition to design the most plausible chopper sprites for an arcade game. *Airlift* must get marks for best yet on the Beeb. It's well-proportioned and has a convincingly animated rotor as well as a rotating tail-fan. There's also a nifty little autogyro that 007 would be proud of. That said, there isn't much else to recommend this game.

The plot revolves around the rescue of hostages from a series of bombed houses and their transport to the safety of a Red Cross hostel.

In a rather defeatist manner,



the sleeve notes encourage you to wait until each house is destroyed by passing tanks before you try rescuing the hostages. In fact you get few points if you destroy the tanks before they shoot.

When you land to pick up the hostages, well animated minute figures, you are (of course) fair game for any marauding tank. Once in the air, however, you're comparatively safe and as long as you can make a reasonably soft landing back at the hostel your hostages obligingly disembark.

Your next sortie will be a bit further away, but since your fuel is unlimited, time is the only difference.

After about six rescues an autogyro appears. This will blow you out of the sky, given the chance. It's not too hard to avoid, but a Killer Satellite adds its weight to the argument in the later stages.

Sadly, there just isn't enough going on to make *Airlift* as addictive as it ought to be. Control of the helicopter is hit-and-miss, and much of your time is spent positioning the chopper to land in the right place. This may all be part of the fun for some, but for me it adds to the frustration. **Simon Williams**

Rating 6/10
Price £7.95
Publisher Superior Software
0532-459452

COMMODORE 64

AFRICAN SAFARI

African Safari, according to the cassette inlay, 'abolishes the distinction between arcade and adventure.' I was under the impression that this had been done and not by software such as this, which is essentially an adventure with graphics, along the lines of (but nowhere near as good as) Melbourne House's *Zim Sala Bim*.

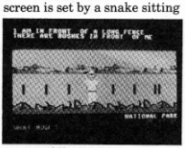
Here you're Dr Livingstone, seeking the long lost Kenyan Diamond, the character being in the centre of a scrolling graphics display. By a curious choice of commands you need a joystick to move him east and west, but have to type GO NORTH or GO SOUTH for those directions.

Above the display is a description of your surroundings, and LOOK will have the Doctor gazing around and reporting on what he can see. Beneath is stated the directions in which you can move, the WHAT NOW? prompt, and a clock (you have only an hour to complete the adventure, with no SAVE or PAUSE facility.)

Initially you can only head east and west, and east finds a peanut plant with peanuts attached. GET PEANUTS? I've got a bad back,' reports the Doctor (some Doctor!), a reply that becomes infuriatingly common, as at the next location where there's a fire and a tin can.

Further along are two monkeys, one strong and one weak, the weak one having the advantage of a gun. You must choose which of the monkeys to take.

The eastern limit of the first screen is set by a snake sitting



on a paddle, and when you've walked to the western limit you can GO SOUTH to the Zambesi River, and another set of east-west locations for your character to walk maddeningly slowly along. Here you find a boat, so now you're up to the Zambesi without a paddle. How to deal with the snake? Keep exploring, and use your monkey.

More difficult is how to deal with the strange responses. Type LOOK near the boat and you're told: 'There is nothing special. I can see a boat here.' GET BOAT. 'I can't see a boat.'

African Safari is ruined further by being so slow to play. If this abolishes the distinction between adventure and arcade, then give me one or the other every time. **Mike Gerrard**

Rating 4/10
Price £11.95
Publishers Interdisc
01-969 9414

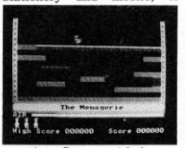
AMSTRAD

MANIC MINER

The game which really started the plethora of platform games *Manic Miner* is available for the Spectrum, 64, BBC, MSX, and now the Amstrad.

It all starts with miner Willy at the bottom of a very deep mine (some 20 screens deep). How he got there is neither explained nor relevant, but with your aid he will do his best to escape by collecting the flashing treasures, and entering a portal which will take him to the next level.

Naturally there are a number of different obstacles, both stationary and mobile, to



negotiate. Contact with these is fatal, and Willy only has three lives. Each screen is given a title, and these, together with a number of the characters, form a series of 'in' jokes among members of the arcade programming fraternity. These are beginning to fade with time, but the graphics are still witty and everything moves very smoothly.

The game remains none too easy either, and I've still to get past the fifth screen consistently. The sound effects are average, but at least you can turn the incessant 'Hall of the Mountain King' off. The demonstration mode offers tantalising glimpses of all 20 screens, but these are too short to allow you to develop a useful strategy.

I'm surprised the programmers who converted *Manic Miner* didn't do more with the Amstrad's graphic screens. The game runs in Mode 1, so only four colours are available, but surely more detail could have been put into each character. Perhaps it's sacrilegious to want changes to the original masterpiece, but it seems a pity not to make the most of the graphics potential of the host machine. **Simon Williams**

Rating 7/10
Price £8.95
Publisher Amsoft
0277-230222

COMMODORE 64

KONG STRIKES BACK

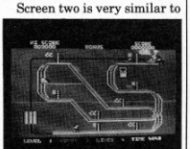
Ol' hairy is back again, still with a damsel in distress in tow. This time Kong has sought refuge in a fun fair.

The first screen shows a Roller Coaster at the top of which Kong has perched his yelling captive. What you have to do is guide your man around the track until the Pinnacle is reached. Kong releases four cars down the coaster — if one hits you, you go bouncing around the screen, finally coming to rest back at the start.

There are two ways of dealing with the runaway cars. You can release a bomb in their path, but as this only blows up the lead car, you might not have time to fire another before the next car arrives. A simpler method is to shin up one of several ladders, and let the cars pass over or below you.

Once at the top, you have to move right past the damsel to make Kong reappear otherwise nothing will happen and you won't move on to the next of the four screens.

Screen two is very similar to



the first. It has a different track layout, and there are some bouncing balls, but it's still the same mixture as before. The remaining screens promise waltzers, horses, and springs.

The background music is great and the animation is impressively smooth. The drawback is that the first two screens are too similar, and the fact that there's only four screens means that the challenge is very limited. **Bob Chappell**

Rating 7/10
Price £7.95
Publisher Ocean
061-832 6633

SOFTWARE PRO-TEST: BBC

HEAVENS ABOVE

Astronomy software can present the subject of star-gazing in a unique way. Colin Cohen loads up and looks to the stars.

One of the good things about micros is that they make some tasks easier, and these three programs go one better. Instead of standing out in the cold night air, you can now go star-gazing from the comfort of your armchair. No longer do you need a torch to read your astronomical handbook, and you can view the night sky from anywhere on Earth and even travel back in time.

Several astronomy programs have been released recently, here we look at three for the BBC: *Star Gazer*, *Astronomy* and *Star Seeker*.

Features

I began using *Star Gazer*, then came across *Astronomy* and realised the two should have been integrated. The first only deals with the stars, the second with planets and seasons. Then Mirrorsoft released *Star Seeker* which has all the features of the other two.

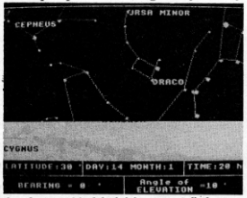
But, before you rush off to buy it there are some differences in the way the programs approach the subject which are worth bearing in mind. For example, *Star Seeker* and *Star Gazer* suffer from slow screen updates if you change the time or your viewpoint. They're so slow I forgot what the old screen looked like before the new one had been drawn.

Documentation

Perhaps it's the subject matter, but for the first time in a review of this kind I can say that all the documentation is very good—the text is clear and well-written. *Star Seeker* comes with screen dumps and while *Star Gazer*'s manual is execrably printed there is a useful colour chart and diagrams explaining the Celestial Poles. All three programs are available on cassette or disk.

In use

Star Gazer deals with the 31 brightest constellations, the criterion for selection is simply if they can be seen with the unaided eye on a clear night. You can call up a plot of the night sky in any direction, then move that window on the sky around the star map.

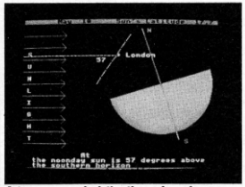


Star Gazer — 31 of the brightest constellations.

Pressing 'p' draws in the lines linking the stars in each constellation and displays their names and those of the 61 brightest stars. The Study Suites allow you to pick a constellation, or to guess which constellation is being shown. A short explanatory text can be produced under each image.

Astronomy is a slightly misleading title because it only deals with the solar system, but it complements *Star Gazer* well and makes extensive use of the Beeb's colour graphics.

The phases of the moon are demonstrated with an orbiting screen and there's an inset to show what the moon looks like at any time. In Quiz Mode you can stop the orbit and guess what the moon looks like at that stage.

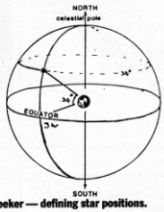


Astronomy — calculating the sun's angles.

Partial and total eclipses can be generated, and the package carries dire warnings about looking at the Sun. Most complex are the seasons, and there's a good try at showing the effect of the Earth's tilted axis on the seasons from Aukland to Zanzibar, but due to screen limitations it's 'not to scale'.

The planetary movements are given in another section. You can select from one to all nine planets, but for this you really will need a colour monitor to do the program justice. There are no aliens, but the problems of landing a rocket on any of the planets and using more than a dozen keys to cope with the different effects of gravity and atmosphere on each planet are not easy to master. I found it both difficult and slow and was soon lost in hyper-space. Note that the program will not run on the early OS 0.1 BBC machines, though these can be updated for £5 to £10.

Star Seeker covers 53 constellations, 308 stars, the nine planets, the sun and the moon, but makes little use of colour. There's a section on Halley's comet on one of its 76-year round trips to the third stone from the sun. You can vary the scale of the display, and indeed unless you do I fear Earth will be wiped out by the comet in 1986.



Star Seeker — defining star positions.

As well as plotting sky views (the information overlays are less complete than those of *Star Gazer*), you can calculate such things as times of sunrise or the moon's phase on any date. Some displays are text-only, information that would perhaps be more at home in the manual.

Star Seeker includes a driver for Epsons or compatible printers which you can use for screen dumps at many points in the program. BBC Publications say that there isn't room in *Astronomy* for a printer-driver, but the manual describes how a screen can be saved to disk and then dumped to a printer.

Verdict

If you want to use these programs to teach astronomy, you'll have to bear in mind what the BBC's blurb says, they'll all need 'an active partnership between parent and child or teacher and pupil'.

All three programs are up against the 32K limitations of the BBC Micro, though *Star Seeker* is also available for the 48K Spectrum and Commodore 64. But for once the subject matter is such that the subject can be shown and explained in a way quite impossible for any book.

They are all programs to which you can return again and again, for education or for the sheer pleasure of looking at the stars without clouds, buildings, light-glare or driving rain. For my money, *Astronomy* has the edge.

Name Star Gazer **Price** cassette £9.95, disk £11.95 **Distributor** Small School Software, 14 Saltmarsh Lane, Hayling Island, Hampshire.

Name Astronomy **Price** cassette £9.20, disk £13.80 **Distributor** BBC Publications, 01-580 5577.

Name Star Seeker, **Price** cassette £9.95, disk £12.95 **Distributor** Mirrorsoft (in conjunction with the London Planetarium), 01-822 3800.

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Acorn

BBC B including DF5, leads + manuals £400 or swap with CBM 64 + 1541 disk drive. Also PC World back issues £1 each vgc. Buyer collects. Tel: 01-802 8724 (North London).

BBC Model B 32K O/S 1-2, tape recorder, modem, joystick, large range of software, ROMS, wordwise, BEEB Calc, Graphics, Speech Synthesiser, Good condition, £500 ono. Tel: 01-303 5459 after 7.30pm.

BBC, B + DFS + Opus 200K disk + RX80 + cassette + joystick + Elite + games. Cost £1,200, sell £750. Tel: 0272 498 after 6pm.

Wanted BBC Micro B computer system. Details (Norfolk) 037976/578.

BBC Model B 1.2OS including Acorn speech chips £250 Pace Nightingal + Commstar chip £100 some software. Tel: 0945 587152.

Acorn disk drive 5.25in, 40 track, 100K. Cables + utility disk, offers? East Sussex. Tel: 0435 882540 (eves). Ask for David.

Wanted Acorn electron in exchange for Japanese biological four turret microscope with rising and measuring stage. Up to 400X. Tel: 061-962 4348 after 6pm.

Acorn Electron four weeks old plus £60 orginal software. Swap for CBM 64 or sell for £160. Tel: 051-722 5962 between 6pm and 7pm.

BBC B Merlin Scribe (V1.3) ROM wordprocessor. Disk-based system, with utilities disk and manual. Only: £40. Tel: 01-659 1303 (eves).

BBC home/business software, Spellcheck (Beebugsoft), Wordwise Spelling Checker, for BBC Model B. Only £9 (40 track disk). Genuine home accounts (cassette) £5. Tel: 01-659 1303 (eves).

BBC B plus 6502 processor, sideways ROM board, Wordwise, Graphics ROMS, joysticks, 1.2OS All Basics. Worth £800 — offers? Neil Washbrook, 24A Llanover Road, Wembley Middx.

BBC software many popular original titles (includings Acornsoft) less than half price. Also many computer magazines and Basic books. Ideal for beginners. Tel: Cambs 240638.

Easycript 8/9" disk and manual £80. BBC Basic extension cartridge allows use of procedures etc.£25. Both for C64. Tel: 01-594 1802.

Amstrad

Amstrad CPC464 software. Adventure Quest, Roland In Caves. Basic tutorial. Master Chess, and others £5 each. Tel: Reading 332417.

Amstrad plus colour monitor wanted for CBM 64, 2 joysticks, cassette, £80 games software, books. Total value £430. Local (if possible). D. Foyston, 79 Bewholme Grove, Marfleet Lane, Hull, N. Humberside.

Amstrad DMP-1 dot matrix printer, two months old, original box £150 ono. Tel: 01-502 2681.

Amstrad CPC 64+ colour monitor plus disk drive, joystick, Devpac, Amsword, games, books (Concise Firmware, Concise Basic), printer cable. £400. Tel: 01-868 9517 after 8.30pm.

Amstrad software to sell or swap, Harrier Attack, Codename Mat, Colossal Adventure. Tel: 01-672 2509 after 6pm.

Amsoft, sell of exchange, originals as new, crazy Golf, Admiral Grafspee, Codename Mat and Tasword. Also Commodore 64 progs sell or exchange for Amsoft progs. Tel: Bedworth 316599.

Amstrad CPC 464 colour complete with joysticks, games, magazines. Excellent condition. £295. Tel: Bradford (0274) 881896.

Amstrad games for sale. Elector Freddy, Oh Mummy, Codename Mat, Hunchback, sell £4 each of swap. Steve Rae, 190 North Gower Street, London NW1.

Amstrad colour computer, colour modulator, software etc £210 ono or swap for CBM 64, C2N, joysticks, software etc. Tel: Lea Valley 718606 (N. London).

Amstrad penfriend wanted to swap information, tips, and swap/borrow games. I own many titles. Alan Wright, (age 16), 54 Hawkhill Road, Alloa, Clacks, Scotland.

Atari

Atari VCS plus 48 cartridges. Decathlon, Pole Position, Star Raiders, Defender plus many more. worth approx. £1,200, sell for £450 or swap for CBM SX64. Tel: 01-673 5819.

Atari Software from £4, Dig Dug, Jet Boot Jack, Star Raiders, Space Invaders, Paint, Qix, etc, originals with instructions. All new. Tel: 021-747 5368.

Atari Printer as new, £60ono or swap for Atari hardware/software. Tel: Basildon (0268) 284771.

Atari software disk Reforger 88, Flight Simulator II, Field of Fire. £30 each ono. Tel: after 6pm 01-941 6163.

Atari software sell or swap also disk drive wanted. Tel: 0904 791067.

Atari 400/800/XL games, Donkey Kong, Buck Rogers, Pole Position, Star Raiders, Galaxian and others. £5. Tel: 0709 72868.

Atari 800 wanted. Must be in good condition. Must have leads and manuals. Tel: Harlow 443837 after 6pm.

Atari magazines, back issues of Antic, Analog, Atari Connection, Electronic Games wanted. Single issues of whole collections bought. Cash waiting. Tel: 01-341 0464 (eves).

Atari joysticks: Le Stick £8 (£25 new), Suncom Starfighter £5, including postage. Suitable for all Ataris (including YCS). All as new. Tel: 01-341 0464 (eves).

Atari software sale: Gorf ROM. £8, Airstrike, Bug Attack Disks £4 each, Ghost Hunter (Pacman-type), Canyon Climber cassettes £3 each, originals. Tel: 01-341 0464 (eves).

Wanted Atari books mags and manuals. Will also swap programs on disk. Or buy unusual hardware for same. Tel: 01-478 5936 eves or weekends.

Atari 1020 colour printer, hardly used. £50. Tel: Slough 74901.

Commodore

32K Pet (Basic 2 AMD 4) £300. Epson printer MX100 £200 MX80 £180. Koala pad (C64) £40. Tel: Tunbridge Wells 0892 26016.

Commodore 64 with data recorder and crackshot joystick and over £100 worth of software and guarantee extended. Sell for £310 ono. Tel: 061-881-1144.

CBM 64 originals for sale: Acos + £3; Cuddly Cuburt £2. More!! Also wanted: Operation Whirlwind; Realm Impossibility; Cluedo; Monopoly. Tel: Waterlooville 266855 (after 6pm).

CBM 64 originals for sale: Pharaoh's Curse (Synapse) £5; Flightpath 737 £4; Soccer Cartridge £5; Protector II £5. Might swap. Tel: Waterlooville 266855 (after 6pm).

Wanted VIC 20 super expander. Will pay around £13, offers in Norfolk/Thetford area only. Tel: Mundford 8192 (after 4pm).

Commodore 1525 printer. 30 CPS. Excellent condition. One year old. Cost £230. Sell £160 ono. Tel: Kaz 01-444 5499.

Enormous quantities of CBM64 and Vic 20 software (originals). For large graded lists please send SAE to: John Keogh, 303 Highwood Ave., Finchley, London N12 8QP.

VIC 20 S/W, over £100 new. Sell £1 each or all for £20. Tel: 0506 630975 (Gary after 6pm only).

C.B.M. software swap. Tel: Oundle 72332 or list to 44 Bellamy Rd., Dundle, Peterborough. Have big list. After 5pm, disks preferred.

CBM-64 disk-based software for swap. Titles include Summer Games and Hesgames. Tel: 0282 33993 or write to Geoff, 50 Moseley Rd., Burnley, Lancs BB1 2RF.

Commodore 64 educational software wanted urgently for my children. Ages 3-9. Tel: Peterborough 0733 61685.

CBM 64 software to swap. Games like Bruce Lee, Strip Poker, H.E.R.O, American Football, Zaxxon, Pitfall, Beach-Head, Suicide Express and much more. Tel: 0706 229875.

Commodore 64 Simons Basic cartridge £30, also Codewriter. Program Generator £40. Both brand new. Tel: 01-207 1604 (after 6.30).

CBM 64 software for swapping over 160 from Holland, Germany, US, GB and Australia. Write to: Helen Reynolds, 55 Leam Crescent, Solihull, West Midlands B92 8PB.

Commodore 64 software. I have over 500 programs to sell on disk or tape. Tel: 021440 2124 (Amier).

CBM 64 software to swap (cassette only). Send list to: Hans Persson, Hyacintvagen 9 S-590, 62 Linghem, Sweden.

Commodore printer/plotter model 1520 for CBM/Vic. Original box and packing. Immaculate condition, as new. Bargain! £40 ono including leads and paper. Tel: 0244 675717.

Vic 20 16K, Data Recorder £25. £130 software £69. 16K, £20. Programmers Aid, £22. Introduction Basic I, £8. Quickshot 1 £7. Books £2.50 each. Whole lot £179. Tel: 021 4540284.

CBM64 plus 1541 disk drive plus easy script plus games, all fully boxed with manuals. Will sell £360. No offers please. Tel: 061-656 5937.

Pet 32K old ROM, small keyboard with cassette with software and manuals. £150 ono. Tel: 01-794 1984 (after 5.30pm. Ask for Chartpak.

Commodore 64 cassettes: Scope 64 £12. Mutant Monty £5; Combat Lynx £6. Tel: 045 275 494. Also Commodore 64 cassettes/disks £1 off.

CBM 64 plus £110 software, only £190 ono. Tel: 0827 53006 (after 4pm — Steve). Also Atari games to swap or sell.

CBM 64 s/w on cassette or disk. Over 130 titles, send list to Neil Reynolds, 55 Leam Crescent, Solihull, West Midlands B92 8PB.

CBM 64 Easyscript, O' Level Geography, Revelation, The Pyramids, Cosmic Cruiser, Flight Path 737, £35 the lot. Write: B. Miller, 31 Greenway Road, Widnes, Cheshire WA8 6HE.

CBM 64 software to swap. Games like Strip Poker, Bruce Lee, H.E.R.O., Tapper, Star Wars, DC, Quest For Tires. Tel: Rossendale 229875 (ask for Stephen).

Vic 20 + C2N + B + W TV + J/S + 32K RAM pack + 3K RAM pack. Also hundreds of pounds of S/W + books. Price £180 ono. Tel: Newbury 40821.

Vic 20 C2N cassette deck 16 & 8K expansion. Also 3K Super Expander. Quickshot II joystick, books, magazines, over £150 software eg Pharohs Curse. Tel: 0422 71862.

Commodore 64 + disk drive wanted, swap BBC/B with Acorn speech chips, Acorn Synapse 5; Flightpath 737 £4; Soccer Cartridge £5; Protector II £5. Might swap. Tel: Waterlooville 266855 (after 6pm).

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CBM 64 software to swap. Cassette only. 50 new titles in my collection. Tel: 0702 72238 after 6.30pm. Also Modem wanted, will pay £50.

Vic 20, 16K RAM, Basic intro, cassette unit, joystick, about 200 programs, books, mags, fully boxed and perfect, sell £100 or swap Spectrum with similar accessories. Tel: (Barnes) 01-748 8325 after 7pm.

C64 software wanted, all strategic simulations, war games, or any other war simulation programs. Steve, Mossley, Orient Drive, Liverpool 25. Tel: 051-428 5101.

C64 printer, cassette deck, joystick, over £50 software, over 60 listings, Introduction to Basic (part one): cost £230; sell £110. Tel: Telford 611582.

Commodore 64/Spectrum software Interchange. Send your Commodore list for my Spectrum's. 54 Park House, 314 Seven Sisters Rd., London N4 2LS.

Wanted: Commodore 64 Select 1. Write 54 Park House, 314 Seven Sisters Rd., London N4 2LS.

CBM 64 Easyscript 'O' Level Geography Pyramid £25. Also 48K Spectrum with £100 worth of software, swap for a CBM printer or disk drive. Tel: 051-423 5493 after 6pm.

CBM 64 software wanted. I have about 1,000 programs. Swap only on disk. You must have at least 800 programs. Send lists to: Thomas Lund-Hansen, Baekskov 3, 5290 Marslev, Denmark.

CBM 64 Superbase 64, as new, plus backup copy, cost £90, sell £45. Multiplan 64, as new, plus backup copy, cost £99, sell £50. Tel: 01-690 3820. Can deliver.

C64 Easy File (disk based) for sale — excellent condition, manual + originial packing. Only three months old, £50 new, only £22!! Tel: 0474 67326.

Vic 20 peripherals wanted, RAM pack, joystick, games, educational progs. Tel: 0436 810402 before Feb '85.

Vizawrite/Easyspell £50 the practicalc £29.95, Chartpak £19.95, Busicalc £12.50, (all disks) Tripler C64, Printer interface £39.95. Tel: Petersfield 68597

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Commodore 64 software to swap. Titles include Strip Poker and Inter Soccer. Write to Geoff Lord, 50 Moseley Road, Burnley, Lancs BB11 2RF or tel: 0282 33993.

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Others

Wanted PCN issues 1 to 67. Will have to deliver, can't collect. Will pay up to £15. Tel: Norwich (0603) 808232.

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QUIT

It was business as usual at the *Which Computer?* Show last week. Oric wasn't there, Sinclair found that the show was just too early for it to show off the matching accessories for the QL, and Commodore displayed its new PC but wouldn't say what was in it.

Acorn, on the verge of delivering its first real business systems, also stayed away and for home micro fans the only remaining point of interest was the occasional MSX machine that sat shyly on the stands of a couple of Japanese manufacturers.

But there's many a slip ... one of the joys of these events is that companies have to make an effort to stand out from the crowd. This tempts them into the kind of folly that under normal circumstances they'd run a mile from.

There was Tandy, which succeeded in distracting attention from its Model 1000, 4P, 2000 and the rest almost completely by arranging to have an acrobat (Gina, pictured above) perform from a hoop above its stand. Gina was hoisted towards the rafters by earth-bound assistants whose ropes effectively closed off areas of the Tandy stand.

Commodore left its elephant

at home and Microvitec has apparently found a home for its famous tiger cubs, but with a touch of humour the company demonstrated a caged monitor with a growling tiger on the screen. The advantage of this is that the monitor doesn't need regular attention with water and red meat.

Brother hit problems of a different kind. To launch its TC600 printer/comms terminal Brother thought it would be a smart idea to take the London-based press up to the show by train while simultaneously communicating with another terminal at the National Exhibition Centre in Birmingham.

When first approached British Rail was keen on the idea, and swore it could be done, but after four months BR changed its mind. The comms facilities available were send only, and Brother was therefore reduced to booking a room at Birmingham International to give the demo once the train had arrived.

Still, it wasn't all bad news. The Brother Express was well patronised, to the extent that there wasn't a single free seat in the restaurant car. Unfortunately, whoever had done the counting had forgotten to include the Brother people, who were forced to stand for the duration of the journey.

FALL GUYS — Subtlety isn't the first thing you'd think of in connection with US advertising, but this Commodore promotion beats about the bush even less than most. It's how Commodore is advertising its new C128 in the US, and as you can see it gets right to the point. No messing about with elephants over there.

SYNTAX ERRORS

In issue 94 the first line of the first part of the Bruce saga was short of a letter or two. It should read: FOR W = 1 TO 10

Some owners of issue 3 Spectrums may be having trouble with the listing of The Castle in issue 94. The problem lies with the IN values in lines 1100-1200.

In 1100 change 254 to 190. In 1110 change 253 to 189, and in 1200 change 254 to 190.

Sandwiched between Arendarvon Castle and Heathrow ATC on our Software Preview page last week was Technician Ted, which we wrongly ascribed to New Generation. In fact Ted is a creation of Hewson Consultants — our apologies to him for casting doubt on his parentage.

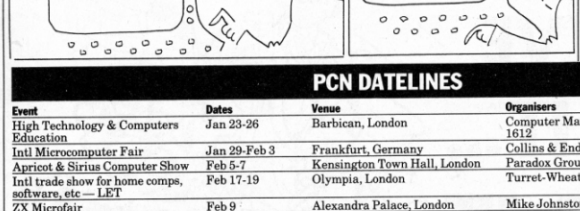
NEXT WEEK

Aladdin's Cave
We present an original game from Tony Crowther, the author of Potty Pigeon, Suicide Express and many others. We'll publish a complete machine-code listing over the next few weeks.

Spectrum palette
Part one of a screen-art routine to put some colour back into your Spectrum's cheeks.

Two Brothers
Hard copy comparisons in the Pro-Test of two versatile units from the Japanese company with the family name.

QL turntable
We give a spin to CST's disk drives just released for the Sinclair QL — is this the end for Microdrive?



PCN DATELINES

Event	Dates	Venue	Organisers
High Technology & Computers Education	Jan 23-26	Barbican, London	Computer Marketplace Exhibitions, 01-930 1612
Intl Microcomputer Fair	Jan 29-Feb 3	Frankfurt, Germany	Collins & Endres, 01-734 0543
Apricot & Sirius Computer Show	Feb 5-7	Kensington Town Hall, London	Paradox Group, 01-241 2354
Intl trade show for home comps, software, etc — LET	Feb 17-19	Olympia, London	Turret-Wheatland, 0923-777000
ZX Microfair	Feb 9	Alexandra Palace, London	Mike Johnston, 01-801 9172
Intl Computer Graphics User	Feb 19-21	Barbican, London	Mountbuild, 01-486 1951 Show and Conference.
MEXCOM	Feb 25-28	Mexico City, Mexico	AESI Ltd, 01-379 7628
PC Trade Show	Feb 26-28	Barbican, London	EMAP Intl. Exhibitions, 01-837 3699
Computer Conference and Exhibition — INTERFACE	March 4-7	Atlanta, USA	Interface Group, 300 First Avenue, Needham, Mass 02194
DEXPO Europe, 1985	March 6-8	Olympia 2, London	CGP 01-582 9256
Comp Conf and Exhbn — COMDEX/WINTER	March 21-24	Anaheim, USA	Interface Group 300 First Ave, Needham, MA 02194

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