

A & B

£1.25

COMPUTING

FOR USERS OF THE BBC MICRO AND ELECTRON

Take Control:

Interfacing Techniques for User Port, RS423 and IEEE

Developing 6502 Ideas with Acorn's Own System

Plus:

Desk Top Aids for Businessmen, Homing-In on Domestic Databases, Swopping Keys for Joysticks, and the Game of Life.



REVIEWS of Osprey, 3D Grand Prix, The Music System, Watch Your Weight and Eric the Viking!



Acornsoft announce tidings of great joy for both BBC Micro and Electron owners: eight brand new programs for Christmas.

Each one makes an ideal stocking filler.

They're all available at your local Acorn stockist. (To find out where that is, simply call 01-200 0200.) Or you can send off for our

catalogue and order through the post by writing to Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL. Tel: 0933 79300.

Alternatively, however, you could always take a chance and drop a line to Father Christmas.

ACORNSOFT
Software for the BBC Micro and Electron.

9.00 Firebug

A fast moving arcade-type game in which you are a fireman, trying to rescue some oil drums and take them to the safety of a water tank. Your opponent is the firebug who runs around lighting fires which move slowly towards the drums and fire extinguishers, destroying them if contact is made.

10.00 Maze

A gripping graphics game where you enter a top secret installation with the aim of stealing secrets from a rival company. The security system, however, has many levels each consisting of a maze of corridors patrolled by armed robot guards. Complete with full colour 3-D graphics, sound effects and a high score table.

12.00 Elite

A superb 3-dimensional graphics game that's light years ahead of any other. You are a space trader who roams the universe, making your living from buying and selling cargo in your Cobra space craft. On your travels, you will encounter aggressors who are eager to put an end to your dealings. Be warned, only the fittest will survive.

1.00 Crazy Tracer

A crazy adventure in which you guide a paint roller round the edge of a maze of rectangles, while avoiding the monsters which are trying to stop you by crushing the roller. Beware - as the game progresses, so the number of monsters chasing you will increase.

3.00 Go

'Go' is a board game for two players which originated in China 3000 years ago and is now more popular than Chess in the Far East. It requires strategic insight, intuition and a strong, calculating mind. If you wish, you can also challenge the computer at differing degrees of difficulty. A velly good game indeed.

4.00 Watch Your Weight

At last, a weight-loss program designed especially for you. With it, your computer becomes an expert wholly conversant with and sympathetic to your needs, and will help you choose an appropriate and individual weight-loss plan. The program also includes a calorie counter and a series of apposite menu suggestions to help stimulate your imagination when you just can't think what to eat.

5.00 The Complete Cocktail Maker

With everything from a Black Russian to a Betsy Ross, this program contains data sufficient to concoct a staggering 320 different cocktails.

6.00 Paul Daniels' Magic Show

Stun and amaze your friends with your astounding feats of magic. This program contains ten tricks to be performed by or with your BBC Micro/Electron. Hurry though - it's bound to disappear fast.

Cover: Pilot One's Computer Controlled Crane



Volume Two Number

Group Editor: Elspeth Joiner
Acting Editor: Mark Webb
Editorial Assistant: Ione Holmes
Software Assistant: Simon Rockman
Advertising Manager: Barry Bingham
Sales Executive: Jonathan McGarry
Chief Executive: TJ Connell

News 6

More of the latest add-ons, software releases and information to help you get the most from your computer.

Mailsort 13

Your comments, complaints, ideas and opinions. Keep them coming.

Dynamic Duo 16

An in-depth look at the facilities offered by Acorn's spreadsheet, ViewSheet, in combination with the Raven-20 board.

Disc Menu 22

Create a menu of all your files on disc.

Laser Cycles 28

A race against time. Vapourise the enemy before your cycle disintegrates.

Random Access 34

Dave Carlos provides the answers to some of the questions he's often asked about discs and drives.

A&B Computing is constantly on the look-out for well-written articles and programs for publication. If you feel that your efforts meet our standards, please feel free to submit your work to us for consideration for publication.

All submitted material should be printed or typed, double spaced. Any programs submitted should be listed (55 character width emphasised if possible). A cassette of the program alone will not be considered. All programs must come complete with a full explanation of the operation, and where relevant, the structure. We also require the program in machine readable form (cassette, 40 track 5 1/4", or 3" disc) plus any suitable screen photographs, printer dumps and so on.

All submissions will be acknowledged and the copyright in such works which will pass to Argus Specialist Publications Limited will be paid for at competitive rates. All work for consideration should be sent to the Editor at our Golden Square address.

Accountant 36

How good is Acorn's book-keeping program?

Life 40

An intriguing puzzle for the Beeb and Electron that will fascinate you for hours.

Sorting On Index 45

Silversoft's disc-based database.

CRTC Under Control 48

Direct Programming of the 6845 graphics chip. Apologies for the wait but it's well worth it! GOTO 48.

Developing Ideas On 6502 55

A detailed look at Acornsoft's 6502 development system.

ROM Report 63

Watford Electronics' ROM Manager reviewed.

Buggy Briefing 65

The Economatics Buggy becomes more versatile with a Penkit.

Questions and Answers 68

Bruce Smith solves your computer problems.

ROM Report 70

An analysis of the DUMPOUT 3 ROM from Watford Electronics.

Solo Pilot 72

Pilot One's interface for the BBC teaches digital control.

Bouncer 74

The second part of our series creates the sprites for this arcade game.

A&B

One January 1985

Published by Argus Specialist Publications Ltd., Number One, Golden Square, London W1R 3AB. Tel: 01 437 0626.

All work for consideration should be sent to the Editor of A&B Computing at our Golden Square address.



Edsoft 80
Educational programs for students of all ages.

Create Your Own Adventure World 90
Melvyn Wright's article concludes by explaining the importance of the story itself in a successful adventure game.



Software Reviews 92
All the latest programs for the BBC and Electron.

Down To Business 104
The Miracle WS2000, Pace Nightingale and Prism 1000 modems compared as executive aids.

IEEE Experiment 108
Acorn's IEEE-488 interface is put through its paces.

Software Listings 112
A guide to the multitude of programs available for your computer.

A&B Computing is published monthly on the first Friday of the month preceding cover date. Distributed by: SM Distribution Ltd, 16-18 Trinity Gardens, London SW9 8DX. Telephone: 01-274 8611. Printed in the UK by Garnett Print, Rotherham and London

The contents of this publication including all articles, designs, plans, drawings and programs and all copyright and other intellectual property rights therein belong to Argus Specialist Publications Ltd. All rights conferred by the Law of Copyright and other intellectual property rights and by virtue of international copyright conventions are specifically reserved to Argus Specialist Publications Ltd. Any reproduction requires the prior written consent of Argus Specialist Publications Ltd.

© Argus Specialist Publications Ltd 1984
Printed in the U.K. by Garnett Print, Rotherham and London.

News Me

CREATIVE COMPUTER

Have you ever doubted the wisdom of the old computing chestnut "You get out only what you put in"? Have you been struck by the thought that the computer has come up with something original?

The Creative Computer, written by artificial intelligence guru Donald Michie and writer Rory Johnstone, will convince you that computers can now truly create new knowledge.

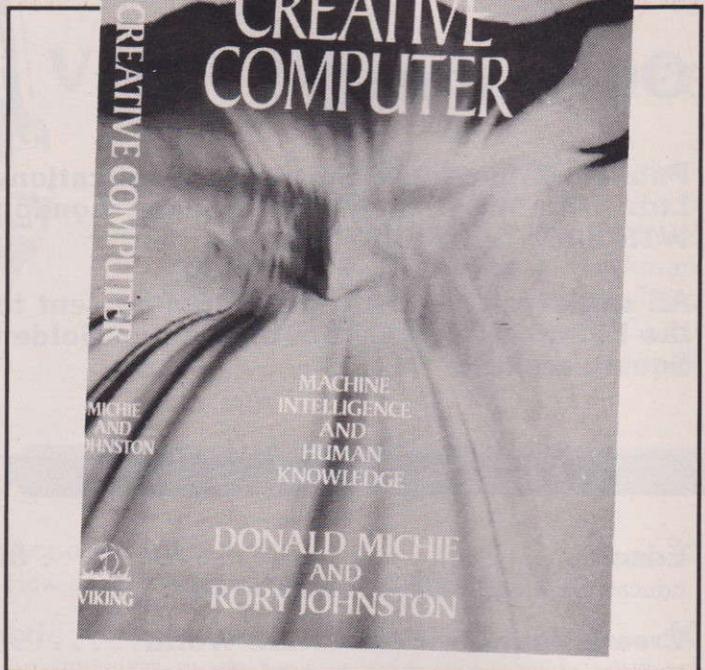
Rule based expert systems are already coming up with answers to problems in fields as diverse as mining and the treatment of heart disease.

This blend of informed comment and interesting example from real life applications should fascinate any one who is interested in where computer technology is taking us.

Artificial Intelligence is presented as the answer to the problem of the "human window", the meaningful interface between man and machine. There are plenty of worrying examples of this window, in its current form, breaking down. The three mile island disaster was exacerbated by a user unfriendly computer.

The Creative Computer, published by Viking, is also an appeal to all of us to sit up and take note of the advances in AI made here in Britain and not to allow them to go to waste through lack of understanding, and consequently, funding.

The book is "eminently readable" and understandable, contains a very good glossary of terms and bibliography. A highly recommended read. In the new year **A&B** will be looking into the basis of artificial intelligence at microcomputer level and drawing the conclusion that it's one thing the humble BBC isn't quite capable of!



ELTIME IMAGES

A high resolution video frame store which connects directly to the BBC has been launched by Eltime. The store, called IMAGE III, allows the user to capture and display pictures in real time from

any 626/525 line video source. Once captured in the frame memory, the computer can access every pixel in the stored image for processing or manipulation. The store can be partitioned to hold multiple pictures allowing the computer to compare two or more pictures captured from the

same or different video sources.

IMAGE III turns the BBC into a low cost image processing system and opens up a wide range of possibilities such as robotic vision, medical imaging, factory inspection etc. The store can also be used in applications where picture data is arriving

slowly eg weather satellite transmission and ultrasonic imaging, enabling the user to have a steady display without the need for long persistence display devices.

Software is supplied which details how to configure the store for different resolutions, capture pictures and read or write to individuals pixels. This allows those without hardware experience to plug the interface card into their computer and immediately start to develop their own image processing software.

IMAGE III is priced at under £2000 and is available from Eltime Ltd, Unit D29, Maldon Ind. Est., Fullbridge, Maldon, Essex CM9 7LP.



ACORN VIDEO

Acorn has launched a new subsidiary company, Acorn Video Ltd, to develop the interactive videodisc market. The first of a new range of products, called the Acorn Interactive System, links the BBC to a laser-optical videodisc player. It took two years to perfect and Acorn hope it will revolutionise computer-aided training in industry and education.

NEWS NEWS

Interactive videodisc is the ideal tool for computer-aided training. The videodisc provides a huge random-access video picture store, from which stills and motion sequence can be retrieved instantaneously on command from a teaching program, which can also generate explanatory text and graphics overlaid on the video image.

CAT programs are stored on and retrieved from floppy discs through a dual drive connected to the BBC. Every item of CAT material consists of a floppy disc holding the controlling computer program and a laserdisc on which the video images are stored.

Two version of the Interactive System will be produced — an authoring system for organisations to develop computer-aided training materials, and an end-user system. Systems will cost from £3000 to £4000 according to specification.

WARLOCK ON THE CHRISTMAS WARPATH

A new BBC software house, Warlock, has just released its first batch of games onto the Christmas market. The first four include strategy and arcade games and a further release will also take them into the realms of adventure as well as adding more "advanced" arcade games.

The flagship of the Warlock range is Galactic Patrol. Five levels of difficulty, each encompassing five different types of screen mean a challenging game for all. As commander of a starfighter, you have to fight off an alien invasion while the earth colonists board their transporter. Later you will have to protect the damaged transporter in deep space, dock with it and finally land to disembark the colonists.

Warlock are proud of their 100% machine code creation which utilises keyboard or joystick control and retails, like their other games, at £6.99. You can get in touch with Warlock at 66 Upper Richmond Road, Putney SW15. Tel. 01-870 3182.

DDOS READS ACORNSOFT

As we reported in our December review of the Opus double density operating system, Opus were having discussions with Acornsoft to solve the problem of DDOS not being able to read their protected software. We can now report that their discussions have come to a satisfactory conclusion.

Opus were asked to include a further OSWORD &7F call to the DDOS eeprom, which would ensure that DDOS could load and run Acornsoft discs incorporating their new protection. We have received a sample disc from Acornsoft which booted on DDOS with no problem.

Only new production runs of Acornsoft discs will have this protection, so you should take care when buying software to make sure it is new stock, although some of the older protections can also be read by DDOS.

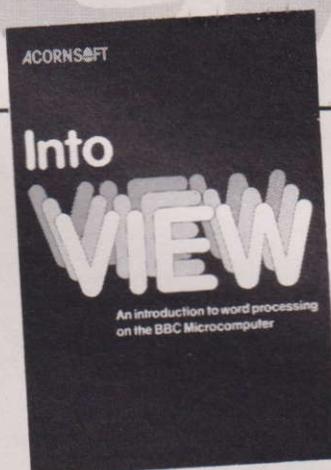
Opus will exchange old DDOS eeproms for the latest version (No 3.15) free of charge. They can be contacted on 01-701 8668.

WIDER VIEW

View, Acornsoft's word processor for the BBC, has sold over 16,000 copies worldwide since 1982 and this year won the British Microcomputing Award for home software.

A new selection of products relating to View has recently been released. These View add-ons increase its versatility by extending its power and adding related products that comprise a comprehensive set of professional worktools.

View sheet is a ROM-based spreadsheet package designed for all types of business and financial calculations. The spreadsheet has a 255 by 255 grid with facilities such as windowing, flexible formatting of values and the replacement of row and column numbers with more readable text headings. It also allows multiple spreadsheets stored on disc to be linked together, so models larger



than the computer's memory can be easily created. The package comes complete with user guide and function key strip and costs £59.80.

ViewIndex is an automatic index generator. It creates an alphabetical page- or section-numbered index of references. All the writer does is mark relevant words or phrases in the text and the computer does the rest. ViewIndex is available on disc and sells for £14.95.

Printer Driver Generator extends View so that it can control the special facilities of virtually any type of printer. It builds an interface for a printer through a simple questionnaire. The driver is then stored and automatically called up by View whenever a document is output to the corresponding printer. It retails at £9.95 on cassette and £11.50 on disc.

Hi-View is a new version of View to enable 6502 Second Processor users to take advantage of the extra large memory — 47K of text — this add-on offers. It costs £59.80 with user guide and function key strip.

WIN A BEEB WITH WASTEFUEL

An opportunity to win a BBC Model B is being offered by British Gas through their Wastefuel comic, available free from gas showrooms and a number of children's magazines.

The sixth edition of the comic gives advice on simple gas safety as well as saving energy. By using their skill to answer

questions on energy conservation, children have the chance of winning a computer as first prize in each of the 12 British Gas Regions, with pocket calculators as second prizes and a puzzle game for runners-up.

The competition is open to children under 17 but you'll have to hurry because the closing date is 14 December.

IMPROVED EPIC

If you've bought Castle Frankenstein, Quest for the Holy Grail or Kingdom of Klein by Epic Software and are finding the adventure impossible to solve, don't despair — help is at hand. You can now obtain an improved version for free.

The new versions contain many more clues and have a greater range of error messages than the originals. The amount of text has been greatly increased, with an average of 31,000 characters in the BBC versions and 25,000 in the Electron.

To check which version you have, simply load the first small BASIC program and list it. If the first line contains no number then it is an early version, and you will be able to get a free replacement. The new BBC versions play a five minute overture during loading.

Replacements are available to anyone who returns the original plus 50p post and packing to Epic Software, 10 Gladstone Street, Kibworth Beauchamp, Leicester LE8 0HL.

LATE NIGHT LINE

By now most nocturnal Micronet 800 users will have dialed into Chatline, Micronet's new service which allows members to "converse" by sending short messages on the computer.

These messages are quickly and automatically published and displayed in sequence, which is on view to a potential 11,000 people each weekday evening from 8.00 pm to midnight. There are 100 pages in the sequence

CONTINUED OVER

Mirrorsoft Me



GARLANDS FOR GARLAND

A competition held by BBC Television in conjunction with English Estates to find the best new business talent in the South West resulted in success and a £20,000 prize for educational software house Garland Computing.

The company was founded just over two years ago and specialises in publishing educational programs for the BBC and Electron, mainly for secondary schools and higher education. In two years they have released over 50 titles, covering biology, chemistry, physics, maths, geography and music.

Recently they have been able to reduce the price of their software due to economies brought about by the increased sales of programs on disc, and also offer a free replacement service for customers who buy cassette software and then upgrade to disc.

Garland has just signed agreements for distribution of their programs in Australia and New Zealand and are negotiating translation rights in several European countries where the BBC is sold.

with one message on each page. When 100 messages have been published, subsequent messages replace the older ones in a cyclical manner.

It can take as little as 29 seconds for your message to appear once you have sent it. Minutes later you will see the replies of anyone out there who wishes to comment! Messages cost 2p to send but are free to read.

MIRRORSOFT DISCOVERY

Mirrorsoft, the software publishing company of the Mirror Group Newspapers, has published a suite of five programs under its new "Home Discovery Series" banner. These programs, which will run on both the BBC and Electron, extend Mirrorsoft's titles from the games and education market into the realms of practical home computing.

The programs are: **The Joffe Plan**, a no-diet weight control system; **Know Your Own Personality**, a character analyser; **Know Your Own Psi-Q**, designed to assess psychic ability; **Mastermind** and **Quizmaster**, based on the TV series and finally **Star Seeker** and **Solar System**, developed in conjunction with the London

Planetarium.

The programs retail at £9.95 for cassette version and £12.95 for disc.

MICRO MENDERS

Is your computer out of warranty? Fortunately it's unlikely that it will break down, but if it does you're going to be faced with a hefty bill. Now there's an alternative. A new organisation, the Micro Repair Club, has been set up to provide a repair-guarantee package which ensures that if your computer goes wrong it will be repaired at no cost to the user.

The Micro Repair Club takes over from where the manufacturer's guarantee leaves off. You can join for one to four years but your computer must be in good working order when you do so. A one year membership costs £24.95 with an annual renewal of £14.95. Two years costs £24.95, three £35.95 and four £57.95 including VAT.

The Club's service is underwritten by the Domestic and General Insurance Company and the actual repair work is carried out by Computeraid Services, a division of Thorn EMI. If the repair costs exceed the market value of the machine you will either receive a new computer or the full purchase price, provided

the equipment is not more than five years old.

Membership can be transferred to another person if you are selling your computer to them, or to another computer if you purchase a new one. However, only one computer is covered by each membership.

For further details and an application form, contact Simon Jamison, The Micro Repair Club, Swan Court, Mansel Road, Wimbledon, London SW19 4AA (tel 01-946 777).





MIRACLE APPROVED

The Popular Modem WS2000 from Miracle Technology Ltd has now received BABT approval for use with standard telephones and selected PABX systems. Therefore it can be used with telecommunications systems run by British Telecom, to gain instant access to the world of information technology.

Now the WS2000 can link almost any computer or data terminal with any other, anywhere in the world, for high speed transfer of data and full two-way telex facilities. Prestel, Micronet, Telecom Gold and many other private bulletin boards are instantly accessible, plus high speed user-user and terminal-mainframe links.

The Modem WS2000 costs less than £150 and is available from most computer dealers.

DATA FOR STARBASE

If you've been put off from buying StarBASE, the ROM Database from GCC (Cambridge) Ltd because it sounded more like an arcade game than an item of professional software you need worry no longer. You can now include it in your collection with pride because it's been renamed STARdataBASE. Now it sounds like something from Star Trek...

The program has been enhanced with a mail merge facility to complement its facilities for producing user-designed print formats and extended to integrate with two popular word process-

ing packages for the BBC — VIEW AND WORDWISE.

A further addition to the package is the program's ability to perform all calculations that are possible on the BBC on data held in the file. This makes it possible to produce complex invoice-type documents with calculations being performed on data from the data-file while they are printed.

Existing Star BASE owners can obtain this update and the new manual that covers it by returning their original Utilities disc and manual with £1 postage to GCC (Cambridge) Ltd, 66 High Street, Sawston, Cambridge CB2 4BG.

SAVE "GAMES"

In an attempt to encourage young people to start saving with them, the Leeds Permanent Building Society has installed two BBC computers in their Luton branch. The computers, supplied by Broadway Electronics, have been programmed to run special building society games software.

There are three games to choose from — Saving Stick for age 12 and under, Tile Teaser for age 13 to 15 and Money Maker for age 17 to 18. If the player is successful the computer automatically prints out a £1 voucher to open a savings account.

Broadway are also offering a discount to young savers who want to purchase an Acorn computer. If they use a Leeds cheque, Broadway will reduce the BBC by £10 and the Electron by £5, and will provide free software.

CLUB CALL

Those of you living in Nottinghamshire might be interested in the Nottingham Microcomputer Club and especially their BBC Micro User Group.

The club has around 70 members and is looking for more, whether beginners or experts. Their interests cover training, games, competitions, hardware, education, business projects and communications.

They have lots of exciting plans for the winter months so if you'd like to join them contact the Chairman, John Day, on 0602 225660 or turn up for a meeting on the second Monday of the month between 7.30 and 9.30 pm at the Castle Gate Congregational Federation Building in central Nottingham.

ASP FIGHTS SOFTWARE PIRACY

Much has been said and written in condemnation of software piracy but few have taken a positive stand against it. ASP is among those few that have taken action to help curb the grave problem of home copying of commercial software.

ASP has already taken steps to eliminate advertisements in our magazines which relate to tape duplication for piracy purposes. While it is appreciated that individuals may take "back-up" copies of their own programs, it should be noted that it is *illegal* to copy commercially available software for other than personal use.

Software piracy is costing the software industry huge sums of money which is detrimental to the future development of the industry. It is in everybody's interests to dramatically reduce the level of software piracy primarily because firms need funds raised from software sales to plough back into research and development of new products. This means that the standard of software products can only improve.

ASP hopes our action will help combat this serious problem in order to maintain and improve the high standards of the UK software industry. We are asking you to do the same by refraining from duplicating or copying commercially available software for anything other than personal use.

MIRRORSOFT COMPETITION WINNERS

Thanks to all those who got involved in the October Mirrorsoft competition. The correct answers were: Fellow of the Royal Astronomical Society and Giotto.

The lucky winners of such Mirrorsoft programs as Hi-Bouncer, Star Seeker and Caesar the Cat are: Mr. B.P. Liston, 43 Purbeck View, Bovington, Nr. Wareham, Dorset BH20 6JQ; L.J. Walker, 15 Halesworth Road, Lewisham, London SE13 7TJ; D.P. Reed, 18 Brewers Close, Farnborough, Hampshire GU14 8NR; B.K. German, 145 Rudolph Street, Sliema, Malta; M. Perry, 19 Elmore Close, Holmes Chapel, Cheshire CW4 7HW; S. Berry, 74 Cleveland Street, Colne, Lancashire BB8 0BE; P.J. Cox, 92 Middlemuir Road, Inverurie, Aberdeenshire AB5 9RG; D. Hufton, 4 Albany Court, Ackworth Road, Pontefract, West Yorkshire WF8 3QE; N. Denton, 37 Blemheim Road, St. Johns, Worcester, Worcestershire WR2 5NQ; G. Lewis, 45 Lakeside Gardens, Merthyrtydfil, Mid Glamorgan CF48 1EN; D.M. Stocks, 21 Theodore Road, Scunthorpe, South Humberside DN15 7SG; P. Wright, 24 Church Street, Stilton, Peterborough PE7 3RE.

DO YOU ALREADY GOT DISK DRIVE(S) FOR YOUR BBC COMPUTER?

SOLIDISK HAS SOMETHING TO OFFER.

— FOR THOSE OF YOU WHO DO HAVE ALREADY, A DUAL FDC DISK FILING SYSTEM (DFDC, using the old 8271 and adding the new WD1770 FDC), ADDS DOUBLE DENSITY AND KEEPS TOTAL COMPATIBILITY (See opposite page).

— FOR THOSE WHO HAVEN'T, A DUAL DENSITY DISK FILING SYSTEM (using the new WD 1770) WILL PROVE MUCH FASTER AND CHEAPER THAN THE 8271.

THE DISK DRIVE:

The disk drive (see pictures) comes from the new series VLSI ultra quiet, auto spin-up, 5.25" half height, solenoid head load, 40/80 track, single and double density MIT-SUBISHI M4853. It is fast, quiet and consumes far less power than any previous models. 2 new 64 pin surface mounted microcontrollers (from Motorola and Mitsubishi), largely reduce the area occupied by the drive electronics (see pictures), leaving so much more room for the diskette, with very low noise level and reduced friction of the media and the jacket.

SOLIDISK DUAL DENSITY DISK FILING SYSTEM.

Basic characteristics include very high operating speed, Acorn compatibility, automatic 40/80 track switching, auto-density, resident disk formatter and 100% compatibility with Solidisk Sideways RAM.

It is also the simplest ever Disk Upgrade for the BBC computer: with only 4 components: 1 ROM, 2 buffers and the FDC. (See picture 3).

Solidisk software engineers have built in to the 8192 bytes of the 1.40 ROM more facilities than any other DDFS manufacturer has managed before.

The result is a substantial cost reduction, which is passed on to you.

Solidisk engineers won't stop there.

But let's first answer some more immediate questions.

1 — SINGLE OR DOUBLE DENSITY?

You get 60% more storage in double density mode than in single density mode at no extra cost.

In single density — the usual Acorn disk format — you get 10 sectors or 2.5 k bytes of storage per track. That is what the Acorn DFS and many others can do.

In other words, you get 100k with a 40 track single sided disk drive (such as the TEAC 55A), 400k with a double sided 80 tracks disk drive (such as the one in this offer).

In double density, you get 16 sectors or 4k bytes per tracks, an increase of 60%.

With the same TEAC 55A disk drive, you get 160k instead of 100k or with the disk drive in this offer, you get 640k bytes instead of 400k.

The majority of software tested also runs FASTER in double density mode than in single density mode, especially Wordwise, View, Masterfile and Scribe and 95% + of games are also compatible with double density.

2 — INSTALLATION:

As the STL DFS consists of only 4 ICs, to be plugged into existing sockets on the BBC computer board, installation is quite simple and should not take more than a few minutes even if you are a novice. Simply instal the 4 ICs into their sockets and connect the disk drive (see picture 4).

3 — BASIC DISK SYSTEM COMMANDS AND UTILITIES:

- *ACCESS <afsp> (optional L)
- *BACKUP [source drive] <dest. drive>
- *COMPACT (optional <drive>)
- *COPY <source drive> <dest. drive> <afsp>
- *DELETE <fsp>
- *DIR <dir>
- *DRIVE (optional <drive>)
- *ENABLE
- *F40 (optional <drive>)
- *F80 (optional <drive>)
- *INFO <afsp>
- *LIB (optional <dir>)
- *LOAD <fsp> (optional <load address>)
- *RENAME <old name> <new name>
- *SAVE <fsp> <start> <end> <exec>
- *TITLE <title>
- *VERIFY (<optional <drive>)
- *WIPE <afsp>
- *BUILD <fsp>
- *DISC
- *DUMP <fsp>
- *LIST <fsp>
- *TYPE <fsp>
- *DDFS

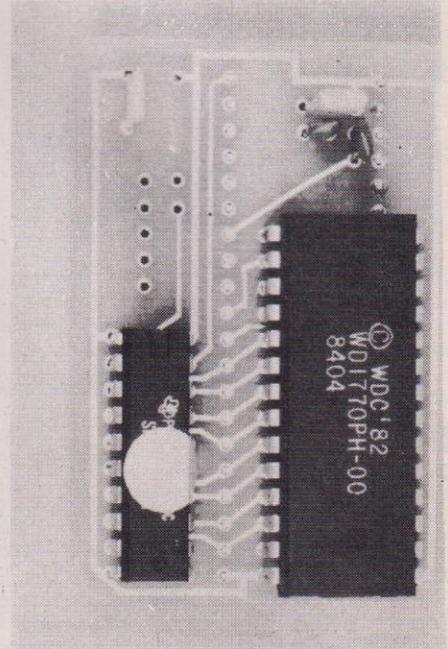
THE SPECIAL PACKAGE DEAL:

A COMPLETE 640K DISK OUTFIT AT ONLY £209.95 INCLUSIVE:

- ONE 80 TRACK DOUBLE SIDED DISK DRIVE.
- ONE DOUBLE DENSITY DISK INTERFACE.
- ALL LEADS AND MANUAL.
- WORD PROCESSOR.
- ELECTRONIC SPREADSHEET.
- SPELLING CHECKER.
- DATABASE.
- STOCK CONTROL.
- MACRO BASIC.
- FULL ONE YEAR NO QUIBBLE WARRANTY.

Optional extra:

- DFDC instead of DDFS: £10.00.



Other OS commands include LOAD, SAVE, BPUT, BGET, OSFILE, BLOCK GET, BLOCK PUT OSARGS, OSFIND, PTR, OSWORD 7F, 7D, 7E etc.

Care is taken in the disk directory presentation, showing the disk size and other useful information. Whenever a diskette is being spun, its number of tracks and density are identified. This information helps the DFS to skip alternate tracks if a 40 track disk is in use in an 80 track drive and also switch the FDC to single or double density.

The net result is exceptional response and user-friendliness.

Outstanding speed too.

As shown in the benchmark test on the opposite page.

CUT THE COST OF RUNNING YOUR MACHINE

Solidisk DDFS comes with free bundled software: (see picture 5).

- Solidisk Database — a fast, efficient and flexible disk based random access database. Ideal for prescription records, club membership etc.
- Solidisk wordprocessor.
- Solicalc electronic spreadsheet.
- Stock Control — very useful for small commerce. Features include menu driven, easy to follow operating instructions, stock items can be grouped by categories, by suppliers, by frequency of movements etc. Stock valuation report (inventory), sale price list, reorder forms can be printed automatically as requested.
- Silexicon — the most successful spelling checker with English, French and German dictionary. Self dictionary generating capability.
- Macro Basic — a BASIC program generator capable of using bits of old programs to create new programs. Simply ingenious!
- Benchmark for disk drive and disk utilities.

4 — OUTSTANDING PERFORMANCE:

The table below shows the benchmark timing for STL DDFS 1.4. The benchmark consists of disk operations such as save and load a 16k program, open and close files, BPUT, BGET strings and numbers, format and verify a disk etc., and is available upon request, otherwise listed in Solidisk DDFS User Manual.

The benchmark tests B1 to B9 are the same as used by many reviewers. The time is expressed in seconds and parts of 100th of a second. The disk drives are twin 40/80 track double sided MITSUBISHI M4853, the diskettes are Verbatim Datalife MD 557 series, 96 TPI, double density, double sided, pre-verified to ensure that the media is free of all error and mechanical defects and containing solely the benchmark program. The test is loaded into memory, the drive motors are allowed to stop completely 2 seconds between tests, 10 timing samples are taken and the mean time is calculated automatically.

For example:

100 DEFFNB1:REM Save a 16k program.

110 T% ÷ TIME

120 *SAVE A 8000 +4000

130 ÷ TIME - T%

Full listings are included in the User Manual.

This FN is called 10 times with 3 sec. interval, the mean result is printed as 'B1'.

BENCHMARK DESCRIPTION

BENCHMARK DESCRIPTION	S/D TIME	D/D TIME	
B1 Save 16k	2.62	1.43	
B2 Load 16k	2.45	1.23	
B3 Openin and close 100 times	20.70	20.16	*See note 1
B4 Openout and print 1000 numbers (255)	5.84	4.66	
B5 Openin and input 1000 numbers (255)	4.72	4.14	
B6 Openout and print 100 80 bytes strings	6.18	4.91	
B7 Openin and input 100 80 bytes strings	4.90	4.31	
B8 BPUT 100 bytes (255)	3.01	2.06	
B9 BGET 1000 bytes (255)	1.88	1.52	

Note 1: Whenever a file is to be opened, STL DDFS automatically refreshes the disk directory, thus preventing erroneous disk change. Many other DFS's do not take the same care, although yielding a much shorter time, and this could accidentally stop the program.

With Wordwise:

Load 2000 words (17811 bytes) 16.80 sec. (41.40 sec. with AC.

With Scribe:

Count 2000 words (17811 bytes) 4.20 sec. (9.80 sec. with AC .90 DFS)

With Beebug's Masterfile:

Sort records 1 to 20 in PEOPLE sample database, the database is presorted on field 2 then the program is asked to sort on field 1, the time is then taken: 56.23 sec. (127.86 sec. with AC.90 DFS).

These timings are improved even further in double density mode.

The figures speak for themselves.

STL DDFS dramatically increases the operating speed of your software, including wordprocessors like Wordwise, View, Scribe, databases like Masterfile, Starbase etc.

Solidisk engineers won't stop there.

ONE ROM TO RULE THEM ALL

Already a super mini floppy (2.4 MB) and controller for under £400, a 10MB integrated Winchester hard disk for under £600 AND AN EVEN MORE POWERFUL 16K ROM (2.0 UPGRADE) with outlined specifications below are planned for Christmas.

- Unlimited number of entries into the disk directory.
- File size and disk size can be as big as 16MB.
- Immediate recovery of accidental file deletion.
- Built-in wordprocessor in place of the classical *BUILD.
- Disk sector editor, disk search and replace, tape to disk, disk to memory below PAGE, disk duplication.
- Instant data encryption and decryption using 256 byte single key (expandable).
- Quadruple FDC drivers (8271, 8272, WD 1770, WD 2793).
- RAM Disk facilities for Solidisk Sideways RAM.

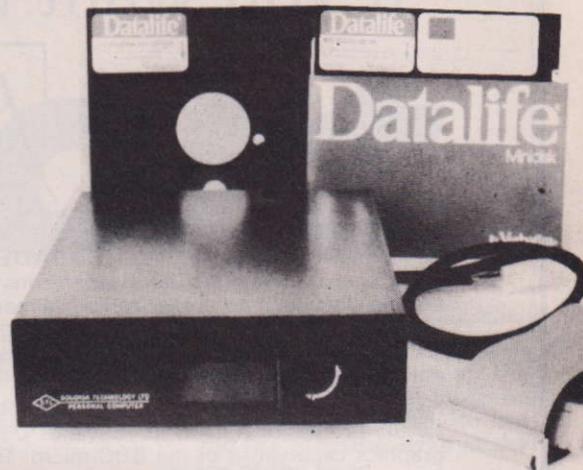
6 — SOLIDISK DFDC:

THE ONLY SYSTEM TO ADD DOUBLE DENSITY AND KEEP COMPATIBILITY.

If your BBC is already fitted with Acorn Single Density DFS, you can ADD double density to your system and KEEP the existing DFS with Solidisk DUAL FDC Filing System (DFDC).

Solidisk DFDC system overcomes the problems caused by around 5% of the games (specially those produced by Acornsoft newest releases such as Elite). These programs (directly) controls the 8271 thus requiring its presence.

Solidisk DFDC ROM controls BOTH FDC at a flick of a switch, you can choose the new FDC for speed or the old 8271 for Acornsoft game disks.



OPERATIONS	S/D TIME	D/D TIME
FORMAT 40 TRACKS:	17.74	17.74
FORMAT 80 TRACKS:	33.22	33.22
VERIFY 40 TRACKS:	9.30	9.30
VERIFY 80 TRACKS:	17.84	17.84
BACKUP 01 80 TRACKS:	37.69	37.69
BACKUP 02 80 TRACKS:	39.46	39.46
COMPACT 100K-10 FILES	22.42	18.82

7 — PRICES (including P and P and VAT)

STL DDFS (disk chip upgrade for BBC B)	£39.95
STL DFDC for those who have Acorn DFS	£49.95
640k DISK OUTFIT (complete package)	£209.95
1.3MB DISK OUTFIT (with twin drives)	£359.95
2.0 ROM Upgrade (available soon)	£10.00

To order, you can use the coupon. Access and Barclaycard holders can ring direct:

HOW TO ORDER?

You can order any item using the coupon. Prices are inclusive of VAT, post and packing. Access and Barclay card holders can place their order by phone.

Educational authorities, Acorn dealers and OEMs can obtain quantity discounts.

Name:

Address:

Credit Card Account:

Callers are requested to ring first for appointment.

Total: !

SOLIDISK TECHNOLOGY LIMITED
17 SWEYNE AVE
SOUTHEND-ON-SEA
ESSEX SS2 6JQ

SOLIDISK'S NEW TELEPHONE NUMBER: SOUTHEND (0702) 354674 (10 lines)

If you want more from your MICRO



UPGRADEing your BBC micro (model "A" or "B") is the simplest, most cost effective way of dramatically improving its capabilities. An **UPGRADE** gives you access to the world's largest library of professional software and clears the way for future expansions by adding a Z80 A second processor 64K of additional RAM, and a flexible disk drive controller to your already powerful BBC micro. An **UPGRADE**'s ability to run TRUE CP/M rather than a CP/M compatible operating system is one of the features that make an **UPGRADE** the sensible choice. Couple this with its ability to handle disk drives independently from the BBC micro and your ability to choose what disk drives to use (3½", 5¼" or even 8") and you can see why an **UPGRADE** is the only choice.

Software available to run on your **UPGRADE**ed micro seems limitless. From wordprocessing to financial analysis for the professional user, to Pascal or Cobol for the serious programmer, all still capable of using the sound and graphics capabilities of the BBC micro. The choice does not end there though. An **UPGRADE**ed micro can be further expanded by adding up to three of our option boards to the unit. There are boards available for expanding the **UPGRADE**'s RAM, for providing further serial or parallel interfaces, additional disk interfaces for 5¼" or 8" disk drives. There is even a Winchester disk controller and an IEEE 488 interface option.

So if you **do** want more from your micro - **UPGRADE** it.

SPECIFICATIONS

Processor - Z80 A running at 4MHz
Memory - 64K RAM (fully expandable)
Operating system - CP/M (Supplied on disk)
Other operating systems available - TURBO DOS
Disk drives supported - 3½", 5¼", 40 or 80 track double or single sided, single or double density. Can be shared with the BBC micro.

NOTE: An **UPGRADE** does not require the fitting of a DFS within the BBC micro.

Disk drive capacities will vary dependent on disk drives fitted (example 5¼" DD/DS gives 800K storage).

Keyboard - As BBC

Graphics - As BBC

Power requirements - 240V AC.

PRICE: £299 + VAT

UPGRADE TECHNOLOGY, 290A High Road, London NW10 2EU.
Telephone 01-451 4416. Telex 46523. Symsys G.

**DEALER ENQUIRIES
INVITED**

4MATION Educational Resources

FORMERLY 4 MAT, ONLY THE NAME HAS CHANGED!

TELE-BOOK

TELE-BOOK is not another teletext simulator but an extremely flexible menu-driven program which allows 'books' of up to 15 pages of text and graphics to be created on the BBC micro. Some of the many possibilities are: class magazines, simple animations, poetry anthologies, noticeboards, assignment/work cards, stories and records of all sorts.

TELE-BOOK has simple word-processing facilities so that text may be easily inserted or deleted and, at the end of each line, words are automatically 'wrapped round' onto the next line. All the teletext features are available so that children may enhance their writing in colours and other effects. Teletext graphics may be used on any page either to enhance text or create graphics-only displays. At any time pages may be copied or moved about within the book. TELE-BOOK is compatible with most printers. Any number of pages may be printed individually or as a single document.

TELE-BOOK is available both on tape and disc, the complete package being attractively boxed and containing a comprehensive 32 page manual, a set of 5 double-sided laminated 'help' cards, a coloured plastic key strip, a transparent plastic page-planning sheet (for use with O.H.P. pens), a set of paper page planning and 8 example 'books' (containing a total of 120 pages) which have been produced by both children and adults to illustrate how various effects are achieved and to demonstrate some possible uses in the classroom.

The disc version (containing two discs) also includes

1. DISC UTILITY - allows 'books' to be merged and facilitates some disc management operations such as compacting, titling, re-naming and locking files.
2. SEARCH - a separate database program allowing schools to store information about their software collections and to make enquiries such as "Which language programs do we have which are suitable for 7 year olds".

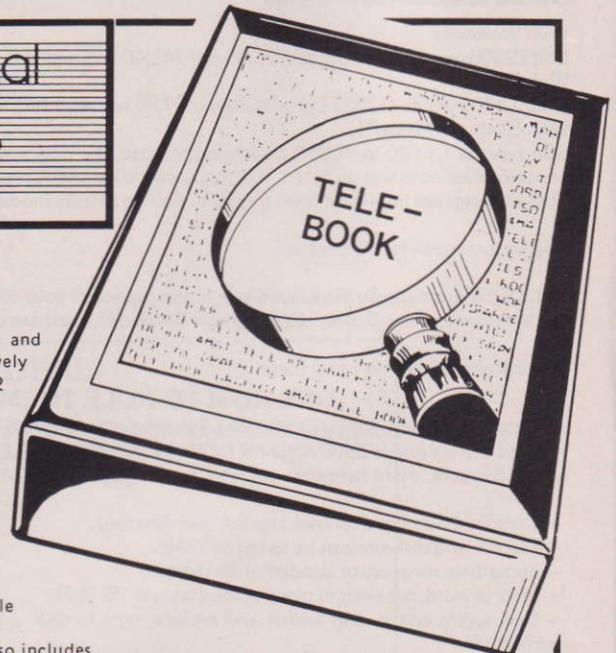
4 MATION EDUCATIONAL RESOURCES

LINDEN LEA ROCK PARK BARNSTAPLE N. DEVON EX32 9AQ TEL: (0271) 45566

£15.00 + VAT CASSETTE

£17.65 + VAT DISC VERSION

P & P INCLUSIVE



Mailsort

£5

Dear Editor

Many thanks to you and Mr. Clarke for a most useful wordprocessing program in November's issue, well worth the price of the magazine alone.

Unfortunately, he seems to have got his operating systems confused. (Question: what is the best adventure game on the BBC? Answer: the Operating System.)

Alas, the program will not work on O.S. 1.2 as the function keys do not generate their "soft key" definitions. When pressed with the Shift and/or Control keys.

*FX 226,1 and *FX 227, 1 and *FX 228,1 are required to enable this, although I've never seen this documented anywhere. Yours faithfully
Mr. K.J. Adams
Stoke-on-Trent

Many thanks Mr. Adams for putting us right. I hope this sorts out the problems some readers naturally encountered trying out TextMaster. Still once you have got it working, there is no excuse not to write to us here at Mailsort with your opinions, programming ideas and politely worded demands for what you want to see in A&B Computing.

Dear Editor

In your Random Access article in the November issue, you mentioned the problem of chaining a further program from inside one which has been relocated in memory. I had the same problems with a suite of music programs which I wanted to back up to disk, and solved it by inserting two lines before the CHAIN command; eg.

1000 PAGE = &1900
1010 * DISK
1020 CHAIN"NEXT PROG"

— crude, but effective!

For machines with Econet fitted as well as the DFS line 1000 would have to read PAGE = 1B00.

This still leaves the problem that after the last program in the suite the Beeb is expecting its

A&B readers' personal printout of programs and opinion.



next program from tape. (Putting the extra lines in the last program generates rude messages like 'Bad Program'.) One way round it in this case was to add an extra routine, as a short program CHAINED from the last, to offer a replay or end choice. This, of course, can be loaded and run at &1900 (or 1B00), thus leaving the machine ready for further disk input.

Yours sincerely,
Patrick J. Black
Barrow-in-Furness

Dear Editor

I am writing to ask if all the programs in A&B run on the Electron and if the use of Mode 7 in a program means that it will not work on anything but a BBC. You often put Electron on the top of the page but the program has Mode 7 in it.

Yours faithfully
T. Woodward
Basingstoke

Thanks for your letter Teresa. All the programs listed in A&B beneath the Electron strap (at the top of the page)

will run without problems on the Electron. Any reference to Mode 7 will default to Mode 6, and although some of the teletext control characters may appear, or double height effects will cause two lines of text to be printed, the main body of the program will run as listed.

If you wish to change references from Mode 7 to Mode 6 then go ahead. The control character (CHR\$(?)) in Mode 7 should be omitted. We do not supply an alternative listing for each set of instructions (for instance) which contains Mode 7 because such a listing for each program would result in less space for other listings. This is not an intentional bias against Electron owners but a practical step designed to make more space available for programs, many of which are developed on the BBC but which will also run on the Electron.

We test all programs on both BBC and Electron and if, for any reason including speed of performance or

tightness of memory (Pools Prediction for instance), the program is unacceptable on the Electron then we do not add the Electron strap at the top of the page.

I hope that this has cleared up any misunderstanding about the use of Mode 7 and our general selection of Electron programs. A&B welcomed the addition of the Electron this time last year and intends to continue support for it as an excellent computer in its own right. Witness Electron Adventuring in December and our hardware reviews.

Dear Editor

I am writing because I have encountered problems with two of your recent programs, Pools Prediction from October and Old English Font from November. They look like marvellous programs but I can't get them going correctly.

Yours in hope
D. Last
Cornwall

Apologies to Mr Last and all those other readers who had trouble with Pools Prediction and Old English Font. Many readers spotted the mistakes in the former: line 670 should read as follows: UNTIL tem% = high% + 1: en% = 1. On line 2980, the second statement should be test% = 0, not, as the printer has managed to produce, test% - 0 (you got that one yourselves didn't you?). Old English Font from the November issue is similarly faulty. Part of line 1450 decided to take a walk. Here it is in all its glory:

```
1450 DATA 8, 9,
80C0E0E0F0F078383-
81C1CFCFC1C1C18-
383870F0E0C080.
```

The latter part of this line appears in the magazine but without its better half. Best just to copy from the above. You now have a capital G.

CONTINUED OVER

Try these corrections for Pools Predicti on Oct A&B:

Line 670: UNTIL tem%=high%+1:en%=1
 Insert line 4045 IF choice%=5 THEN tem%=116
 Q1 and Q2 are home and away points gained. Lines 1330 and 1340 should make them = 3 for the English league:

510 tem%=tem%-1
 520 REPEAT:CLS
 524 tem%=tem%+1
 526 PROCdivis
 660 UNTIL tem%=high%
 670 en%=1

Try these alternative solutions:

```
1330 IF LEFT$(name$(homet%),2)="S."
      AND homegoal%>awaygoal% THEN
homematch%=10000:awaymatch%=1:Q1=2:Q2=0:
GOTO1360
1335 IF homegoal%>awaygoal%
      THEN homematch%=10000:
awaymatch%=1:Q1=3:Q2=0:GOTO 1360
1340 IF LEFT$(name$(awayt%),2)="S."
      AND awaygoal%>homegoal% THEN
homematch% =1:awaymatch%=10000:Q1=0:Q2=2
:GOTO 1360
1345 IF awaygoal%>homegoal% THE
N homematch%=1:awaymatch%=10000:
Q1=0:Q2=3:GOTO 1360
```

```
4030 IF choice%<3 THEN tem%=choice%*22+1
:ENDPROC
4035 IF choice%<5 THEN tem%=choice%*24-3
:ENDPROC
4040 IF choice%=5 THEN tem%=choice%*20+3
:ENDPROC
```

Special thanks to Frank Pitt and Kenneth Sherwood for their help. We have already had some winners (but no fortune s), so good luck!

Dear Editor
 I am pleased that your readers have shown an interest in BASUTILS.

I apologise for the error in line 770. This error did not show up in my tests because

IF T% = E% GOTO 790 ELSE

is superfluous and should have been deleted. At this stage in the program T% cannot equal E%. Hence the program works correctly with GOTO790, although line 790 does not exist.

Similarly, T% = P%: at the start of line 740 may be deleted. T% is set in the line above.

I also made some errors in describing the user defined keys in column 4 of the text. From the program listing it is clear that CTRL/f2 sets MODE 7. CTRL/f3 selects the Hobbit (now Ultradrive), CTRL/f4 selects the cassette recorder and CTRL/f5 catalogues the file system.

In view of my experience with the program since submitting it for publication, I would like to suggest some further im-

provements.

To avoid damaging programs by pressing ESCAPE whilst BASUTILS (especially REPLACE) is running, I have disabled ESCAPE. I have also improved the handling of the BREAK key. These are achieved by altering lines 20, 40, 200 and

300 as shown in the listing below (the changes are underlined> and inserting lines 25, 45, 70 and 80. Pressing BREAK by accident simply resets BASUTILS and returns to the program being edited CTRL/BREAK may be overcome by using OLD to retrieve BASUTILS, RUN to

reset BASUTILS and OLD again to retrieve the program being edited.

Yours sincerely
 Dr. S. Taylor
 Lecturer
 Mechanical Engineering Dept
 University of Birmingham

```
20P%=&84:[OPT0:LDA£138:LDX£0:LDY&8F:JSR&FFF4:RTS:]:?
5632=&D:25633=&FF:V%=5634:GOTO70
25*FX200,1
40IFJ%=75GOTO70ELSEIFJ%=70PROCF ELSEIFJ%=82PROCR ELS
EIFJ%=84PROCT ELSEIFJ%=77PROCM ELSEIFJ%=69PROCE ELSEIFJ
%=67PROCC
45*FX200
70*TV255
80MODE7:PROCK:GOTO45
200*KEYOR%=256*25+24:S%=256*23+22:PA.=&E00:G.25!M
300*KEY100.!MG.70!M
```

DEPT. ABC,
18 HAZELMERE RD,
STEVENAGE, HERTS
SG2 8RX.

QUAL-SOFT

STEV (0438) 721936

VERDICT ON A SOCCER MANAGER SIMULATION

In Nov. 83 we announced LEAGUE DIVISION ONE. The author, a self-confessed fanatic, spent 4 years in the Research Dept. of International Computers working on computer simulations of human recognition processes, and 6 years at British Aerospace and GEC working on aircraft and missile simulations. Hear his opinion:

"As both a Micro and football fanatic I bought 5 "soccer management" games, only to be disappointed that all of them substituted simple-minded mental arithmetic for "management" judgement and decision making. Not one attempted to show any meaningful "football match" which would allow a "manager" to judge players and teams. Their sales pitch was based on a headcount of meaningless features. So, I set about writing my own."

But was he successful? Here is the verdict of our customers:

"Congratulations on a program that actually corresponds to the game of football." David McClelland, Bangor
"Your game is excellent, the best simulation for any computer." N.W. Edwards, Beaconsfield
"I think you have in your product a complete simulation of the highest standard." W.R. Moys, BRIXMIS
"So realistic it certainly is the best game I've played (and not just on the BBC!)" W.M. van Leeuwen, Holland
"What a superb management game it is." Neil Ormsby, Leeds
"Thanks for a brilliant program." P.J. Sterry, Peterborough
"FANTASTIC!" R. Foster, Benfleet

We could fill pages of this magazine with such comments. But let us introduce you to:

BBC 'B'
(all OS)

DIVISION ONE '85' AND SOCCER SUPREMO

TAPE £9.95
DISC £12.95
(all inc.)

ELECTRON
BBC 'B' (all OS)

TAPE £9.95
DISC £12.95
(all inc.)

BOTH GAMES are role playing games in which you are the manager of a newly promoted 1st Division side. You have a squad of 18 players and a further 15 (12 in SS) available on the transfer market. You must first confirm yourself as a 1st Div. side, assessing your weaknesses and strengths, and then bring along your youngsters to replace your "veterans" (the game lasts for 5 seasons) and intelligently using the transfer market. All decisions are based on YOUR judgements about skills and abilities as you watch your team play through a 42 match season, each match being SIMULATED in your Micro and displayed on your TV or VDU.

DIVISION ONE '85': This game makes justifiable the term "strategic" as applied to soccer management games. Strategy implies "planning ahead" and decisions taken in the 1st season may not bear fruit until the 4th or 5th seasons (up to 20 hrs later in the game) but these decisions must be taken if you are to win the Championship. This game will test your footballing knowledge to the full, coping with injuries, suspensions, financial limitations, a not always helpful press, aging players, inexperienced youngsters etc. etc.

SOCCER SUPREMO: The real game of football is enjoyed on many levels; the strategic over several seasons, the seasonal, and Saturday afternoon's excitement. While retaining the realism of management simulation described by the author the game places more emphasis on football match simulation with a "3D", 22 MAN, FULL PITCH graphics illustration of each match. For those who don't like games that have you banging your head against a brick wall for relief but enjoy the game of soccer, then this is the version for you.

COMBO tape/disc: If you REALLY cannot make up your mind, or feel you would like to graduate on SS before moving on to DIV1 85 then we do supply a COMBO tape/disc for the price of one game plus £3.

CURRENT OWNERS: You will receive a discount of £7 on your tape, £9 on your disc of LD1 or LD1 REV1.

BBC 'B'
(all OS)

PORTFOLIO

TAPE £9.95
DISC £12.95
(all inc.)

In the USA the balance has already shifted away from the "arcade mentality" towards multi-player programs. PORTFOLIO is an investment game for 1-4 players, or teams of players. Each player/team begins with £1,000 and invests his money in a variety of companies against a background of continually changing international, national and commercial news. The news items affect the share values of the companies in a variety of different ways, and the players must shift their money around to maximise their investments; maybe even to become a millionaire.

The game is an ideal family game or perfect in the classroom and with a high pupil/micro ratio. It's suitable for 12 years' old and above, though younger do enjoy the game with some help from their friends, and in this game, competitors. For the adult we have made some of our news items somewhat cryptic, occasionally even red herrings, to really make them think about the effect on share values. Because we call it a family game we have tried to see that there is something in it for all members of the family. Teachers can even tailor the news items to suit the capabilities of the pupils.

All orders DIRECT SALE.
Orders by post delivered
in 3/4 working days.
ACCESS telephone
authorisation 1/2 days.

	TAPE		DISC
	£9.95	<input type="checkbox"/>	DIVISION ONE '85' <input type="checkbox"/> £12.95
	£9.95	<input type="checkbox"/>	SOCCER SUPREMO <input type="checkbox"/> £12.95
	£12.95	<input type="checkbox"/>	COMBO, DIV.1+SS <input type="checkbox"/> £15.95
	£9.95	<input type="checkbox"/>	PORTFOLIO <input type="checkbox"/> £12.95
Soccer Supremo: ELECTRON or BBC			

Name:
Address:
.....
.....
Card No:

Dynamic Duo

Gordon Taylor

Along with the announcement of the new Acorn Business Computer range came the news that the ViewSheet spreadsheet — together with the View word processor — is to be installed as standard in the ABC Personal Assistant. This is the entry-level intelligent version of the ABC range — effectively a re-packaged single processor Beeb with a new, higher capacity disc filing system. This means that ViewSheet (and View) are to be launched into a larger and tougher market — that for 8-bit business software, such as runs under Apple DOS and CP/M 80 — and justifies another, more detailed review than that in **A&B Computing** for May/June 1984.

The utility of spreadsheets is well demonstrated by the enormous success of VisiCalc — the original spreadsheet, which is said to have sold so many Apples — and more recently by the fact that they are at the heart of Lotus 1-2-3 and Symphony — the best-selling programs for the IBM-PC and other “16-bit” machines.

Spreadsheet type programs may be divided into:

- General purpose spreadsheets, capable of statistical and technical calculations as well as financial modelling.
- Specialised financial modelling programs. These generally use a numbered program and one or more spreadsheets for display.

ViewSheet is a general-purpose spreadsheet. This means that it contains a wide range of BASIC functions, as well as some which are peculiar to spreadsheets — such as MIN, MAX etc — and is therefore self-sufficient. No BASIC ROM is needed. This allows all the more specialised financial, statistical and technical functions to be built up as formulae (as opposed to having some of them pre-programmed).

ViewSheet differs from other spreadsheets by being held in ROM — and hence permanently available and much less liable to be lost or corrupted. The Beeb/PA regards ViewSheet as a “language”, much like BASIC — which could be used to do the same job. ViewSheet has a

The ABC Personal Assistant will carry it as standard but all BBC Micro owners can benefit from the power of Viewsheet, especially alongside Raven.

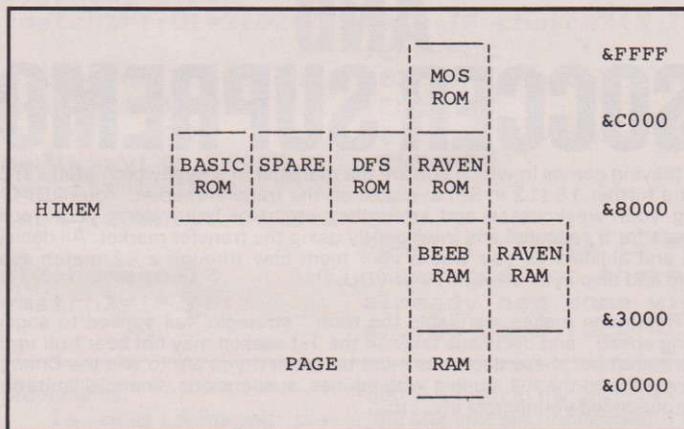


Fig. 1: What the Raven board does. Memory Map (simplified) with addresses in hex.

similar range of functions and constructs available and a ViewSheet program occupies a similar amount of space in the computer memory. However, wherever replication is possible, ViewSheet is easier to program — especially where tabular output is required.

In re-examining ViewSheet, I have followed Mike Liardet's excellent introduction to spreadsheets and what to look for — published in *Personal Computer World*, February 1983.

ARITHMETIC

Looking at the facilities, ViewSheet has the four basic arithmetic functions (+, -, *, /) plus square root, trigonometric (sine etc) and logarithms and sum, min, max and average (but not count). These suffice also to define statistical functions, such as standard deviation and financial functions, e.g. net present value, when required.

CONFIGURATION

It is perfectly possible to use ViewSheet with the standard cassette filing system, although it performs even better with a disc filing system and, of course, with Econet. These last two do however reduce the maximum sheet size somewhat on a standard Beeb.

View Sheet operates in all the Beeb/PA screen modes — including Mode 7 for 40-columns and Mode 3 and Mode 0 for 80-columns. Provided that you have a monitor, Modes 3 and 0 are superior — both because much more of the sheet is visible at once and because you can choose the foreground and background colours (using the same Control S, character, character, space, space, space command as View). However, Modes 3 and 0 take up 16 and 20K of main memory respectively — as opposed to only 1K for Mode 7.

In the interests of spread of

loading, saving and scrolling, ViewSheet uses 15-bit internal pointers, which result in a maximum sheet size of $2^{15} = 32K$. (ViewSheet does not practice “paging” with additional RAM or “virtual memory” with a disc.) In any case, only 32K remain of the 64K maximum addressable by an 8-bit machine, since the Operating System occupies 16K and ViewSheet also takes 16K. This also means that (unlike View), there will be no “Hi-” version for use with a 6502 Second Processor.

ViewSheet in Sheet Mode is designed to use the 10 function keys of the Beeb/PA — both alone and in combination with the Shift and Control keys. These are all labelled on a special strip and are therefore easier to find or remember than the menus or Control plus letter key combinations used by most other spreadsheets. The latter are often implemented on many different machines, but rarely tailored to any one.

ViewSheet is also easy to operate in Command Mode — thanks to the availability of abbreviations. For example, turning off the headings would take 13 keystrokes using the full command, but only five using the simple mnemonic abbreviation.

GRAPHICS

Like many other “standard” spreadsheets, ViewSheet has only a minimal inbuilt graphics facility — capable of plotting bar charts with horizontal bars, using the standard keyboard symbols * and !. However, with its scope for interfacing to BASIC (see below), it can utilize a wide range of graphics programs, capable of producing line graphs, barcharts and pie charts in high resolution and multiple colours — both on-screen and printed. (Adding graphical output to ViewSheet will be covered in a later article.)

INTERFACING

ViewSheet has no special facility to import data — eg as delimited ASCII files. However, it is capable of importing data into

Dynamic Duo

the current worksheet for the purposes of consolidation and so it would be easy to write a simple BASIC program to convert any existing data file to this "transfer" format, and read it in that way. However, the "transfer" files include only slot numeric values and not text — either slot labels or column and row headings — and can be read back into ViewSheet but not read into View.

As well as this "transfer" format, it is possible to save/write files in a spooled ASCII file format for export to a word processor, such as (but not necessarily) View. Spooled files include both numeric values and text — both slot labels and column and row headings — and can read into View but not back into ViewSheet.

The ability to export files to View (and other word processors) is one of the most useful features of ViewSheet. A table may be laid out with the aid of "printer windows" (see Display and Printout below), before SPOOLing onto disc. Such ViewSheet files — with tables up to 132 characters wide — may either be LOADED directly into View or READ into an existing View document.

LINKING

Remarkably for its size and price, ViewSheet has the ability (when used with a disc filing system) to transfer files between sheets — eg for the purposes of consolidation. Moreover, these files can be as small as a single numeric slot value or as large as 10710 values (eg 255 × 42). ViewSheet includes COL and ROW functions, which are especially useful for specifying the parameters of such "transfer" files. Up to five such files can be open on disc and interact with a sixth sheet in memory. This can thus recalculate using any or all of the imported values — ie consolidate.

The five "transfer" files can also link up to six sheets in a chain or pass values from one sheet to another and back to the first. Although each sheet must be loaded into the computer

memory manually, this — as noted below — can be speeded by use of the function keys.

TURNKEY

Considering its modest size and price, the scope for creating turnkey systems using ViewSheet is considerable. Worksheets can be created and saved with almost all columns and rows protected against overwriting or deletion. Data entry can thus be limited to the slots left unprotected. Although it lacks the ability to accept full command/execute files, ViewSheet can accept commands (such as LOAD <filename>) in Command Mode. These may be put onto the function keys, since this buffer is preserved when switching to Sheet Mode. This buffer can be saved with *SAVE <filename> 0B00 0BFF and then *LOADED when required — eg from a !BOOT file. All that the user then needs to do — eg to load sheets in turn — is to press function keys from Command Mode and press Escape to enter Sheet Mode. If the new sheet starts by reading transferred values, all that is necessary is to initiate recalculation — eg by pressing the Tab key.

SPREADSHEET OPERATIONS

ViewSheet operates from the start with the full sheet of up to 255 columns and 255 rows apparently available, and does not require them to be opened up or created explicitly before entering values.

Despite the large sheet size, the default column and row titles of ViewSheet are quite conventional — letters for columns and numbers for rows. This means that the slot references are completely unambiguous and so text entries (labels) do not need to be specially identified — eg with full slots.

ViewSheet does not distinguish between upper and lower case letters — whether for column or row headings or even functions (eg COS etc). However, it is remarkably good

at distinguishing between (alphanumeric) labels and (numeric) values or formulae — and confirms this by indicating on-screen. It can accept alphanumeric strings as labels, even when they begin with numerals. Moreover, it is very easy to enter a number as a label in ViewSheet — they merely require surrounding by non-numeric characters, such as inverted commas.

Control of the cursor and scrolling in ViewSheet is excellent. It is "deadbeat" — with no overshoot and hence much better than in some other spreadsheets and word processors (even View itself). When entering values into ViewSheet, use can be made of the provision for automatic stepping to the next slot — to the right or down. This speeds entry considerably.

An even more powerful facility is available when entering formulae. Provided that at least one character (which can be a space) has been put into the entry line, the sheet cursor may be moved to position it over the slot required and, simply any pressing Shift plus Copy, it can be "picked up" for inclusion in the formula.

INSERT AND DELETE

Among the usual spreadsheet operations, ViewSheet is capable of inserting or deleting whole columns or rows. For deleting, the columns or rows are treated as if they are protected — even if they are not. This requires that the protection be switched off first.

REPLICATION

"Replication" is at the very heart of the spreadsheet concept. This allows a formula to be entered once (eg for the month of January) and then reproduced for all the other months of the year — as required.

Replication in ViewSheet is extremely quick and powerful. Thus it requires only the minimum of keystrokes yet allows every conceivable variation — from one slot to another, from one slot to a range, from one col-

umn or row range to another or from one range to a whole block of slots. Indeed in ViewSheet, replication may even be applied to a column or row of differing formulae — eg one for the months and another, such as the sum, for the year.

ViewSheet allows both Relative and Absolute (so-called "No Change") replication. These operate in the conventional spreadsheet fashion — in that the Relative/Absolute question is posed for each slot reference in turn after the replication formula has been entered. Thus it does not use only a single default or require that, for example Absolute entries be prefixed by a special character.

DISPLAY AND PRINTOUT

Formats may be set on a whole-window or individual slot basis. This covers such things as the number of decimal places, left or right justification within the column and the use of brackets for negative numbers.

All the column and row headings may be re-defined as strings of from three to 15 characters. ViewSheet then allows you to enter the slot references using these directly or the default headings — in which case they are translated when the formula is entered.

The default column width is seven characters but it may be set globally from a minimum of three characters up to whatever will fit on screen in the current mode. Individual column widths may easily be varied by using the screen "windows" — of which there are no fewer than 10.

Windows are of course especially useful for splitting the screen to keep an eye on the "bottom line" while altering one or more input values — the classic spreadsheet "what if" exercise. Moreover, since windows may be displayed without their top or side headings, the sheet can still present a very tidy appearance on the screen. It is even possible to put only

CONTINUED OVER

VA SLOT=B4
CONTENTS=1

DAYS	Jan	Feb	Mar	Apr	May	Jun	January	18
HOLIDAY							February	27
							March	36
Abbott, G	1	3	0	0	10	0	April	49
Abrams, J	5	0	3	0	0	10	May	48
Adams, F	0	7	0	6	0	4	June	61
Arnold, F	1	0	3	0	0	0	July	16
Bailey, T	0	0	4	0	0	0	August	17
Baker, A	2	0	6	0	0	2	September	7
Ball, J	0	0	0	6	0	0	October	2
Barclay, W	3	3	0	0	4	4	November	10
Barrett, P	1	0	1	0	10	0	December	10
Bell, A	0	0	0	9	0	0		
Bentley, N	3	2	0	5	0	0	TOTAL	301
Black, J	0	4	5	0	9	0		
Bowen, H	0	5	2	6	7	0		
Brooks, K	1	0	4	10	0	0		
Brown, J	0	3	3	0	0	4		
Cameron, A	1	0	5	7	0	7		

LA SLOT=A1
CONTENTS=PRICES

	NET PRICE	VAT	TOTAL PRICE
.....1			
.....2			
.....3			
.....4 PENS			
.....5			
.....6			
.....7 Italic	13	1.95	14.95
.....8 Classic	17	2.55	19.55
.....9 Student	9	1.35	10.35
.....10 Senator	111	16.65	127.65
.....11 Premier	85	12.75	97.75
.....12			
.....13			
.....14			
.....15			
.....16			
.....17			
.....18			
.....19			

ViewSheet screens.

headings into windows so that they can appear in the middle of the screen or printout if required. In effect, you can have variable column widths — and far more besides in the way of freedom to compose your sheet.

It is easy to position the several windows relative to each other since they are defined successively to lay either to the right of or below the previous one. Also, each is numbered in the top left hand corner. ViewSheet even resets each window size (after the first) if need be, to allow it to be displayed on the screen. Composing the whole screen is thus a matter of simple trial and error — with ViewSheet doing its best to help.

SCROLLING IN HARMONY

Another reason why such windows are much more powerful than the normal variable column width facility, is that they can be set to scroll in harmony with each other — whether horizontally, vertically or both. The alignment of the columns or rows in a window may be changed simply by scrolling and it will be retained in the window definition.

Any slot can ultimately be scrolled into any window but editing is made much easier by the ability to step successively between the active windows simply by pressing a single function key. ViewSheet automatically keeps track of which windows are active.

As well as saving the sheet complete with window definitions and formulae etc, you can save the window definitions separately. (When doing so, it could be worth putting them into directory "W" to identify them later.) The window definitions include the screen mode. Hence you should set the mode correctly before loading the window definitions file into an existing sheet.

The PRINT command will — by default — dump the top left part of the current sheet to the printer. However, there are another 10 windows available for composing printer layouts. As well as being saved with the sheet, they too may be saved separately for use elsewhere if required. Printer windows may either be copies of the screen windows or quite distinct. Window numbers are not printed.

The printout is composed of one or more printer windows. If no wider than the screen, it may be set up as screen windows and changed (by adding "P" to the window definitions). However, a group of printer windows can extend far beyond the current screen size — in fact up to 255 x 255 characters (as distinct from slots). This allows you to take full advantage of your printer, which may be capable of 132 characters across in condensed mode. Any layout may be checked by using the SCREEN command, before PRINTing it.

To set up a printer mode, you can either use a hardware switch (often a DIP-switch) inside the printer or send the appropriate control code from Command Mode. For example,

to put an Epson-type printer into condensed mode, you should enter a printer control code of "15". The Beeb requires that this be prefaced by "1" to reach the printer and both are expressed using Control, followed by the corresponding letters of the alphabet. Then, set between the codes which turn the printer "on" and "off", it becomes !B!A!O!C. Finally, this may be put onto a function key by starting with *KEY 0 and ending with :M — denoting Return.

Alternatively, with a specific Acornsoft printer driver (eg EPSON) loaded into ViewSheet, each printer window may be set to "highlight" — eg with bold or underlined print — its numerical contents.

PROTECTION

Protection against accidental deletion or overwriting — whether by direct entry or replication — of slot contents is provided on a whole column or whole row basis (as opposed to a single slot basis). This protection may be switched off or on (eg to enable deletion) from Command Mode.

FORMULA PRINTING AND EDITING

Just as a program in BASIC can be listed to screen or printer as a record or to aid debugging, so can the formulae in ViewSheet. Moreover, the formulae — which may be up to 240 characters in

length — may be edited, without the need to re-enter them from scratch — by using facilities very similar to those in View.

AUTO/MANUAL

Even with the very fast recalculation offered by ViewSheet, there is provision for switching off the automatic action each time a slot value or formula is entered. This is particularly desirable when the current sheet reads from or writes to disc files, as each recalculation leads to disc accesses. Even in this state, recalculation can still be initiated manually — eg by pressing the Tab key.

ViewSheet shows when it is recalculating by a pattern of moving dots in the top left corner of the worksheet. However, it recalculates only row by row and so produces totals etc horizontally first. The sheet should be laid out accordingly.

OUT OF MEMORY

The amount of free memory remaining is not visible in Sheet Mode but can be checked at any stage by switching to Command Mode — when it is shown as "bytes free". Even so, it is not necessary to watch this all that closely since the "Out of Memory" error is "soft" and does not cause the sheet to be lost or corrupted.

As well as the usual measure on the standard Beeb/PA of switching to a numerically higher screen mode to release more memory, ViewSheet also allows the problem to be overcome by

VA SLOT=A1
CONTENTS=L4

```

1! #####
23 #####
21 #####
24 #####
32 #####
40 #####
20 #####
11 #####
19 #####
29 #####
    
```

A SLOT=F1
CONTENTS=#Blank*

	F	G	H	I	J	K	L	M
1								
2								
3	CRUNCH!	WHOOOSH!	ZOOM!					
4		5	6	7				
5		0.90	10.70	7.00				
6								
7	SALES ANALYSIS							
8	CODES:	1	2	3	4	5	6	7
9								
10		0.00	0.00	0.00	0.00	89.00	0.00	0.00
11		0.00	0.00	0.00	0.00	0.00	535.00	0.00
12		0.00	975.00	0.00	0.00	0.00	0.00	0.00
13		0.00	0.00	185.00	0.00	0.00	0.00	0.00
14		0.00	0.00	0.00	0.00	890.00	0.00	0.00
15		0.00	520.00	0.00	0.00	0.00	0.00	0.00
16		0.00	0.00	0.00	0.00	1068.00	0.00	0.00
17								
18	TOTALS:	0.00	1495.00	185.00	0.00	2047.00	535.00	0.00
19								

dividing the current worksheet into two or more linked sheets. Although it is possible to operate ViewSheet in Mode 7, no colour is provided and it is easy to lose sight of the Mode 7 cursor (a pair of angle brackets) on a crowded sheet. Also, when replicating formulae, the Relative/Absolute question is applied to the first slot reference — which is then deleted from the entry line — since the inverse video highlighting used in other modes is not available.

LONG JUMPS

One of the "secrets" of ViewSheet's impressive capacity is that only the formulae are stored, and the slot values are only calculated as required — eg when the screen or a window is scrolled. It thus differs from many other spreadsheets, which also store the current values of the sheet (enabling somewhat faster scrolling but of course taking more memory). The scrolling speed is understandably slower in Modes 0 and 3 than in Mode 7 — since there is more on the screen that needs to be re-written.

In ViewSheet however, the scrolling speed is not that important, due to the availability of windows — as mentioned above. Also, slow scrolling can easily be overcome by using the "long jump" facility provided by the Shift plus Cursor keys — which moves the cursor across the sheet by the whole width of the window horizontally or the whole depth of the window vertically. In addition, there is a provision to "Go To" a given slot directly. This command puts that slot in the

middle of the screen wherever possible (ie unless the slot is at the edge of the screen) so that it is seen in context — a nice touch.

SEARCHING AND LOGIC

As well as continuous functions (formulae), ViewSheet can operate conditionally — with IF — on discrete values, through the use of lookup tables. A simple example would be a price discount table, with several volume break-points. Both one-dimensional lists (using CHOOSE) and two-dimensional arrays (using LOOKUP) are possible. In the latter case, the two lists need not even be parallel or contiguous — they only need to contain equal numbers of values. CHOOSE can only use a list of slot references but LOOKUP, which is more powerful and can also use a range, may always be used instead.

ViewSheet can also operate conditionally on the comparison of two values — equals, greater than etc. Moreover, these conditions can be combined with functions, such as MAX (of list or range), and also nested with brackets — to build up more complex conditional tests.

One of the particular opportunities offered by spreadsheets is that of solution by "iteration" — or trial and error. For example, if you have a sheet set up to calculate the life cycle savings or Net Present Value of a project, it is very easy to vary the discount rate and see the effect ("what if"). A few trials will then quickly determine the discount rate

which gives life cycle savings of zero — and this is the return on investment or internal rate of return for the project, determined by iteration.

Some spreadsheets can carry out such iteration automatically — when it is known as "goal-seeking". However, it is still necessary to specify the input and output variables and ViewSheet recalculates so quickly that a few manual trials usually suffice to obtain a solution in a minute or so. Semi-automatic "goal-seeking" is also possible in ViewSheet, by entering formulae to increment the chosen variable if the closing condition is not satisfied. Each recalculation is then initiated manually — by pressing the Tab key.

On the Personal Computer World benchmarks, View Sheet on the standard Beeb performs extremely well. It is comparable in true capacity to MultiPlan or VisiCalc on an Apple and much faster in recalculation than these or Perfect Calc on a CP/M machine. While understandably lower in capacity, it still compares very well for speed with MultiPlan on a Sirius or PeachCalc and even 1-2-3 on an IBM-PC. Indeed, it is faster than all save 1-2-3 at recalculation and also beats some of them at scrolling.

ViewSheet cannot operate on text strings, nor has it any sort facility. Therefore it cannot operate as a simple in-memory database, as can some more expensive spreadsheets. However, Acornsoft offer their own true random access database on disc for such purposes (eg for name and address files). This — with View and ViewSheet — com-

pletes the "big three" business applications.

ViewSheet (and View) will run correctly on the Electron but with the "mapping" of the function keys mixed up. Hence Electron versions have been developed. They come as cartridges which fit in the slots of the Electron Plus 1 add-on.

The only major limitation of such a compact (16K) program is the lesser amount of on-screen help. Given the much lower cost of the hardware and software, this is acceptable — and made up for by the high degree of robustness (with soft errors) and the really excellent manual. This has both tutorial and reference sections (as for View) but they are spiral-bound together in one volume of 138 pages. Beautifully clear and concise, the manual is very well illustrated and also has both contents and an index. The only notable omissions are useful formulae for standard deviation and net present value (but there is room for notes!). The documentation is completed with a very smart quick reference card.

ViewSheet is as good as you could possibly get into a 16K ROM and is a real asset to the ABC range (and bundled with the PA). It is a spreadsheet of very considerable power and provides an excellent business tool for the Beeb/PA. It costs £59.80 including VAT and is available now from Acorn dealers.

If you want other features, such as colour in Mode 7 and a pre-programmed Net Present Value function (but slower opera-

CONTINUED OVER

DYNAMIC DUO

tion), you could look at UltraCalc. If you want more features, such as virtual memory operation (allowing much larger sheet capacity), extensive on-screen help or a simple database capability, you can add an Acorn Z80 Second Processor, and use the bundled program Graph Plan or others available in the Acorn CP/M format. Alternatively, you could fit the Torch Z80 Second Processor and have the choice of Perfect Calc, or others such as The Cracker. All are more expensive — especially with a Second Processor.

RAVEN-20

On a standard (disc) Beeb, ViewSheet provides capacities of 24K in Mode 7, 9K in Mode 3 and 5K in Mode 0. Thus it (like View) can gain greatly from the use of a 6502 Second Processor. As well as greater speed, this gives a capacity of up to 29.5K in any screen mode with any single or multiple filing system and costs £199.

Another way of increasing the capacity is to fit an add-on board which can make HIMEM=&8000 in all screen modes. With increases of 1K in Mode 7, 16K in Mode 3 and 20K in Mode 0, they enable sheet sizes of up to 25K (disc) or 28K (tape) in all modes. Examples are the Aries B-20, costing £79.95 or the Raven-20, costing £69.95 — both including V.A.T.

The Raven board was designed by Rank-Taylor-Hobson and looks very professional. Also the pins on the main connector are slim and round (so-called "turned") that will not overstretch the socket, and are gold-plated to ensure reliable contact.

The board is very easy to fit to a standard Beeb — requiring only the removal of the 6502 microprocessor chip and fitting it into the Raven board, which in turn plugs into the vacant 6502 socket. No trailing wires or soldering is needed for a standard machine. The task is completed by installing the ROM containing the control software into one of

the four "sideways" ROM sockets. Raven suggest that it be placed above any Disc Filing System ROM in priority and I found that it and the other "sideways" ROMs worked best with it in the rightmost socket. When the Raven board is enabled, the software loads programs and data etc extending above &3000 into the Raven RAM and directs all "legal" screen accesses to the Beeb RAM. (See Fig. 1).

For a ROM expansion board, Raven recommend the RAMAMP — one of the few that will physically fit with the Raven board in place. It adds six ROM sockets and 16K of RAM — and costs £47.

The Raven 20 board is also compatible with the Solidisk Sideways Systems, such as the SWR32 and SWR128. However, with two Beeb-powered disc drives, the largest recommended is the SWR32. Also, in order to operate properly, the wire coming from the Solidisk base unit to pin 39 of the 6502 should be re-routed to pin 4 of IC6 on the Raven board and secured by careful soldering.

The Raven software is compatible with Solidisk's in the Sideways RAM mode, but not in the RAM disc mode — nor with the Scribe word processor. However, this hardly matters since the Raven board can be enabled for long programs and applications using the lower numerical screen modes (such as View and ViewSheet) whereas the RAM disc is mainly used by applications such as Scribe (using it as "virtual memory") and databases such as File Plus, Star-Base and DataGem (which are all disc-intensive) — and which would benefit little from the effect of the Raven board.

The utility of the RAVEN board is however very apparent with ViewSheet (and View). It allows Mode 3 (or even Mode 0) to be used for a sheet slightly larger than could be accommodated in the standard Beeb/PA — even in Mode 7. As Modes 0 to 6 also allow colour and a clear, highlighted cursor, this makes ViewSheet much more pleasant to use. The Raven software enables both View 1.4

and View 2.1 to respond correctly to *WORD.

Other existing "languages" that can benefit from the Raven board include BASIC, LISP and BCPL. The recently released Acornsoft languages — ISO-PASCAL (32K), LOGO (32K), COMAL (16K) and FORTH (16K) should also be able to benefit from it. This is because, with the Raven board operative, the Beeb would have room for long (25 to 28K) programs in any of these languages and yet be able to use any screen mode for display — whether of 80-column text or of high-resolution or multi-coloured graphics.

CARETAKER and ADE may be used with the Raven board in its fast mode. However, problems arise with WORDWISE, DISC DOCTOR and GRAPHICS ROM with the Raven software — much as noted in the review of the Aries B-20 board in *A&B* for March/April 1984.

Whereas the Aries B-20 board adds only 19.75K net, the Raven-20 board adds the full 20K of RAM. While the Aries software raises PAGE by ¼K, the Raven software uses a small buf-

fer below standard PAGE in the slow mode and a larger one (the function key buffer) in the fast mode. This larger buffer can however, be relocated anywhere in RAM (below &3000) if required.

At switch-on, the Raven board is disabled — enabling a choice between the slow and fast modes. In the former, the scrolling speeds in ViewSheet and other programs are slowed by around 20 to 25 percent while in the latter, they are slowed by only perhaps one percent.

A modest leaflet gives the installation and details of the commands. (See Fig. 2). However, since *HELP RA. lists all the other commands and their syntax — as well as the current values of PAGE and HIMEM — it is hardly needed after installation.

In sum, the Raven board is a splendid way of expanding your machine. It is well made, fits neatly inside the case, simple to use and attractively priced. My review example was supplied by Twillstar Computers Ltd.

Raven Micro Products are at: 1, Saville Road, Westwood, Peterborough PE3 7PR. Tel: 0733-268853.

Fig. 2: The Raven commands.

* HELP RA.	Lists commands and syntax and reports values of PAGE and HIMEM.
* FRON	Enables the Raven board in fast mode.
* RPAGE nnnn	Relocates the buffer used by fast mode.
* RON	Enables the Raven board in slow mode.
* RVFF	Disables the Raven board.
* RTEST	Tests the Raven board.
* RSTAT	Returns the status — ie on or off.
* RAM h < filename >	Loads a file into "sideways" RAM bank h (h between 0 and F).
* SSAVE < filename >	Saves the screen to the current filing system (tape or disc etc).
* SLOAD < filename >	Loads a saved screen to its correct location in RAM.
* RZAP nnnn	Allows memory contents to be examined.
* RDZAP	Allows disc contents to be examined and edited.
* FX 111,1	Enables the Raven board in slow mode eg from machine code.
* FX 111,0	Disables the Raven board eg from machine code.

£24.⁹⁵

PRICE BREAKTHROUGH

BBC SPEECH

Speech Synthesizer for the BBC Computer

- Totally unlimited vocabulary is now possible with the revolutionary "SWEET TALKER" Speech Synthesizer for the B.B.C. A or B Microcomputer, any series.

- The CHEETAH "SWEET TALKER" simply plugs into speech socket IC99 within the computer. No soldering, no cutting of tracks, no headaches.

- Based on an allophone system you can easily program any word, sentence or phrase and incorporate speech into your software games.

- Fully tested and guaranteed. Complete with demonstration cassette and full instructions.

Cheetah, products available from branches of

John Menzies Boots WHSMITH and Rumbelows

Price includes V.A.T.

Postage and Packing

Delivery normally 14 days

Export orders at no extra cost

Dealer enquiries welcome

Send cheque/PO now to -

Cheetah

Marketing



Dept AB, Cheetah Marketing Ltd, 24 Ray Street,
London EC1R 3DJ. Tel: 01 833 4909.
Telex: 8954958.

Super Disc Menu

Dave Carlos

A menu program that should satisfy even the biggest appetite.

Regular readers of this magazine may remember a program in the March/April '84 issue which made a menu of all the files on your disc and then CHAINED the one you wanted. The program caused quite a lot of interest from disc users and some wanted it to be extended so that it was more capable in terms of its loading possibilities.

Well, here is the updated version, but don't think that it is simply the same program with modifications. There are similarities, but this was written with a much more ambitious purpose in mind. What I wanted to do this time was to provide a menu program to do the following things:

1. Make a simple menu of every one, or just certain, of the files on a disc without having to type all the information into the program for each disc.
2. Make it possible for the software to recognise and take appropriate action to load, the various types of file on the disc e.g. BASIC programs, EXEC or SPOOLED files and Machine Code programs.
3. To incorporate a downloading routine so that the program would be able to take some of the donkey work out of Tape to Disc transfer.

As I hope you can see this was not to be an easy task and in the end it involved some interesting POKEing (sorry!), "indirecting" in Acorn terminology) around in the machine's memory to get all the information that I needed.

TRANSFER ROUTINE

If you break the last aim down into its constituents we need to have a way of knowing where all the various files need to be in memory so that we can load and run them at this location. I therefore needed a Tape to Disc transfer routine which you will find below as Listing 1. All that this routine does is to take any files on a tape that it can read and to write them to disc using the original load and execute locations so that we know where to

put them back to later. The core of this program is the PEEKing of the locations from the memory used by the operating system when *LOADing a file. I suggest that you call the program "TRANS", for transfer, when you save it to disc. This is because it needs to be loaded in low memory so that there is no possibility of it being over written by a program. By using page 9 of memory as its location we can also allow as much memory for programs as possible using a disc system. There is a detailed explanation of its workings below but keep in mind that its sole purpose is to get a program from tape to disc for the main program to be able to take any action required, it is of very little use on its own!

Now presuming we have our programs on the disc and all the original information intact, we need to make a menu of them but there are a few difficulties to be overcome first. The first problem is to find out where to put the menu program, for if it is placed at the normal page setting for discs then any program being loaded by the menu is likely to over write it completely. Therefore we need to locate it as high as possible in memory so that this possibility is reduced to a minimum. We can't put it too

high up because we use rather a lot of variable space whilst the program runs, so we are in great danger of "No Room" errors. A reasonable compromise seems to be page &6500 which has been tested using a disc with 31 files and seems to be about right. (You can, of course, change this if you wish to give more or less room for the variables but I would recommend that this is only done if essential.)

Then we need to decide what type of programs we need to be able to load and how to recognise them. To do this we need to work out the characteristics of the various possible types. By using the *INFO command you come to realise that BASIC programs have an execution address of either &801F (for those written on BASIC 1) or &8023 (for BASIC 2). So we can detect BASIC programs by testing for this execution address but we need to know what age they need to be loaded at too. This can be found from the load address which, if it starts with &FF, indicates that the program was saved using an ordinary SVE rather than the *SAVE command. Please notice that these assumptions might not be valid and there are always exceptions, e.g. those BASIC files with DATA or screen information

placed above TOP, but that they are the best that we can do and are therefore worth trying.

Testing for a program being a file either *EXECable or from a word processor is fairly straightforward too as they usually have both load and execution addresses of 000000. That leaves machine code programs which can have almost any address for both load and execution. Therefore if we test for a load address of greater than zero and an execute address less than the start of the Mode 7 screen (&7C00) we could try to load these files as machine code programs.

If there are any files with other addresses or which don't correspond to these tests then we need to issue a message to the user so that they may investigate the problem. This is what the PROCedure 'help' does and it offers a chance to load something else.

That then is the heart of this program. All we need to do is arrange all the pieces in the right order and then we have solved the problem. For those who aren't familiar with the use that the Acorn DFS makes of memory let me explain the major details.

USE OF MEMORY

Every time you load any program off a disc the DFS needs to know all about the program and so it transfers the information from the catalogue sectors of the disc into memory. This information is held on sector 0 and section 1 of track 0 of every disc and it is loaded in-



to memory at page E and page F. By understanding how this information is organised we can get at the details we need and use them in any way we want. That is how this program works. The BOOTING of the disc, by pressing BREAK whilst holding SHIFT down, causes the DFS to try to find a file called !BOOT, which means that the catalogue information is in memory as we require. If we make the file !BOOT CHAIN our menu program then the operation becomes simplicity itself.

In order to make your disc menu program "auto boot", i.e. run automatically when the keys above are pressed you need to create a !BOOT file. The easiest way to do this is to use the *BUILD command as follows, which will create an EXEC file for us.

First put a blank formatted disc into your DRIVE 0 and close the drive door.

All the things that you type are underlined whilst the computer's responses are not (remember to press RETURN at the end of each underlined section);

*BUILD !BOOT (NB the disc will whirr as you press RETURN, this is normal!)

1 PAGE=&6500
2 CHAIN "MENU"

3 (Press ESCAPE now)

The disc should then whirr and you will have a file called !BOOT on your disc.

The next thing we must do is to tell the DFS what to do with the !BOOT file. This is set by option 4 using the *OPT command. So with the disc still in the drive type *OPT 4,3 and the disc will then be marked in such a way that if you press BREAK and SHIFT as described above the !BOOT file will be *EXECed and if the menu program is on the disc then it will run automatically.

I would suggest that when you have a fully debugged version of this program you put it and a !BOOT file on each of your newly formatted discs. The fact that there are no files on the disc won't matter but the advantage of having a menu which grows as you put files on the disc is very desirable. Don't forget to do a *OPT 4,3 though!

Finally for those who would like to customise the program to their own desire there are full details of its workings below but a couple of suggestions might help. Firstly if you need more space for programs in memory or less space taken up on your discs by the menu program itself, then you need to "pack" it. I always use a packed version of the pro-

gram as by doing so I can save two sectors per disc. It isn't easy to do by hand however and I would recommend one of the following programs to help; GTM's Super Utility ROM which is by far the best and simplest to use, BEEBUGSOFT's Toolkit ROM which packs well but doesn't shorten variables or concatenate lines and BBC SOFTWARE's Toolbox which uses three programs known as the "Squeeze Utilities". Be warned though ALWAYS save an unpacked copy of the program in case of trouble and DON'T try to pack the program until it is completely bug free or you are likely to lose it completely.

Secondly if you are interested in keeping multi-part programs on your disc and don't want them all to appear in the menu then a simple modification will make this possible. All you need to do is to name the programs to this rule. The first program in the sequence is given the name you want to appear in the menu e.g. FRED and to all the others give names ENDING with a number eg FRED2 FRED3 FRED4 and even F2 F3 F4. Then modify line 330 of the program to read as follows:

```
330 IF filename$(counter%) = "MENU" OR filename$(
```

```
counter%) = "!BOOT" OR
ASC(RIGHT$(filename$,
counter%),1)) 58 NEXT
```

This checks each name for a number at the end and only writes on screen those without the number.

To conclude, if you use double sided discs and want to be able to change sides at the push of a button put a program on your discs called "SIDETWO" for side zero of the disc and "SIDEONE" for side two of the disc. Then use the programs given as listings 3 and 4 on the appropriate sides and if you select them from the menu they will change side and *EXEC the appropriate !BOOT file. N.B. for this to work properly you need to have both !BOOT and MENU on both sides of the disc.

MAIN MENU PROGRAM (Listing 2)

The variable names in this program are long, I know, but this is in order that you may better understand what is happening in each part. Therefore rather than giving you a list of variables and their purpose, the variable names themselves explain their purpose. I hope that the procedure names do the same too.

PROGRAM LISTING 1

```
10 IF PAGE<>&900 THEN PAGE = &900 : CHAIN "TRANS"
20 REPEAT
30 VDU 15
40 CLS
50 *T.
60 *OPT1,2
70 *LO." " 1200
80 FOR loop% = &3BA TO &3B2 STEP -1
90 IF ?loop% = 0 ?loop% = &0D
100 NEXT
110 *D.
120 ?&7A0 = ?&3B2
130 ?&700 = &A0
140 ?&701 = &7
150 ?&702 = !&3BE
160 ?&706 = !&3C2
170 ?&70A = &FFFF1200
180 ?&70E = (&FFFF1200+!&2FB)
190 A% = 0
200 X% = 0
210 Y% = &7
220 CALL &FFDD
230 UNTIL FALSE
240 END
```

PROGRAM LISTING 3

```
10 REM SIDETWO put on side 0 of disc
20 CLS
30 *DRIVE 2
40 *EXEC !BOOT
```

PROGRAM LISTING 4

```
10 REM SIDEONE put on side 2 of disc
20 CLS
30 *DRIVE 0
40 *EXEC !BOOT
```

CONTINUED OVER



10 Reloads the program in the right place in case you decide to CHAIN it without resetting PAGE.

20-60 Main program loop just 3 procedures.

90-170 **FNpeekstring.** This procedure takes a string from anywhere in memory starting at memorybase%. The string can only be as long as maxlen% and the procedure terminates if a value equal to limit% is found.

200-260 **PROCdouble.** Takes a string and prints it in double height yellow characters on a blue background centred on screen.

290-490 **PROCmenu.** This simply arranges the filenames in the array on the screen.

330 Excludes both !BOOT and MENU from the menu and because they are excluded we need to use the actual number% array. This makes certain that we actually load the right file.

360 Deals with the spacing on screen.

370-400 Only prints the directory if it isn't directory \$.

450-470 This loop makes sure that a valid key is pressed.

520-580 **PROCload.** This procedure contains the tests for the various types of program we expect to find.

530 Sets the directory for the file concerned.

540 Tests for BASIC programs which load at &1900 and CHAINs them.

550 Checks for other BASIC programs.

560 These tests are the minimum required to suggest machine code programs.

570 The final tests are for ASCII files of some kind.

580 If we get to this line we're in trouble so call PROChelp.

620-660 **PROCdisctitle.** If there is a title on the disc then this is used as the menu title otherwise it is set to be "Disc Menu".

640 Checks to see if it is all in sector 0 (Disc titles are held part in sector 0 and part in sector 1). If not then the remainder is found from sector 1.

650 Sets the default if there is no title on the disc.

690-790 **PROCgetfilename.** This is the main procedure which gets all the information the rest of the program needs.

700 Peeks the number of files off the disc.

710 Uses this file number to dimension the arrays.

720-780 This loop finds the name, directory, length, load address and exec address for every file on the disc.

820-860 **PROCchain.** This is used if it is a BASIC program starting at PAGE &1900.

890-900 **FNpeeknumber.** Very similar to FNpeekstring but

930-960 to get vital numbers for each file e.g. load address.

950 **PROCreset_chain.** This uses a two part process to run a BASIC program.

960 Loads the program at &1900 and then relocates it to the required address.

N.B. Causes PROCbasic to start the program. There need not be an ENDPROC — it never reaches it!!!!

990-1020 **PROCstarrun.** Used for machine code programs.

1010 Does as line 950 above.

1020 Uses the execution address to start the program.

1050-1120 **PROCTYPE.** Tries to display ASCII files in a readable form. N.B. This could be changed to a *DUMP procedure if yo wish.

1070 Clears screen and sets paged mode.

1080 Displays the file.

1090-1110 Reoffers the menu.

1150-1240 **PROChelp.** Displays a message to the user about those files not loadable by the program and then offers a retry.

1270-1320 **PROCoscli.** Passes * commands onto the operating system for action.

1280 &700 is the keyboard buffer and so is a safe location for the command.

1350-1430 **PROCdownload.** This is used to load and then relocate those programs which don't run at &1900.

1390 This stops the disc workspace being over written by the program and ensures that any LOAD or SAVE operations do not corrupt the disc.

1400-1420 This is the actual downloading routine.

1460-1520 **PROCbasic.** If a file which needs downloading is BASIC to use a normal CHAIN command wouldn't work. This routine simulates the CHAIN command.

1470 Resets the user defined keys.

1480 Flushes the keyboard buffer.

1490 Sets up key 0 to be used in line 1510.

1500 Resets page as required.

1510 Simulates the pressing of key 0.

1550-1670 **PROCmessage.** Simply gives the message about what the program intends to do about the file being loaded and allows you to override your choice.

1700-1730 **PROCretry.** Reprints the menu on screen ready for another selection.

TRANS, tape to disc program

10 Reloads programs into page 9 where it won't be overwritten and it gives the maximum space to the program being transferred.

20 Master REPEAT loop ensures that an entire tape is transferred and the program runs until you press ESCAPE.

30 Turns paged mode off so that there are no scrolling problems.

50-60 Set up tape loading to give full file information.

70 *LOADs the program at location &1900.

80-100 A rather crude method of shortening the program name to a maximum of 7 characters and preparing it for string indirection. (Strings must end in &OD or RETURN in order for them to be peeked out of memory successfully.)

110 Sets disc filing system.

120-180 Set up the information block for the operation

- 120 systems file saving routine.
 Sets the title of the program to be the same as the one loaded in but truncated to seven characters.
 130-140 Tells the O.S. where the title is in memory.
 150 Sets the load address of the file.
 160 The execution address is set here.
 170 Gives the start address of the file being saved.
 180 Sets up the length of the file to be saved by adding the length of the file loaded to the location it was loaded to.
 190-220 Call the operating systems save file routine using OSfile at &FFDD.

SIDEONE and SIDETWO (Listings 3 & 4)

- 10 REMark to remind you which program goes where!
 20 Clears the screen of the old menu.
 30 Sets the drive to the opposite side.
 40 Starts the process again by EXECing the !BOOT file.

OFFER OF DISC

As this is a very complex suite of programs and because it is possible to "pack" them into a much smaller space than we could print, we are able to offer a disc containing all the programs in this article (and others).

The disc menu program works very well as it is printed here but if the whole program is run through a "packer" then it will take up far less space on your discs. We expect you to want to use the program on a large number of discs and therefore the wasted space is going to become quite important to you. The packed version of the program is impossible to print (after tokenisation takes place, some spaces become unnecessary and can therefore be removed but you cannot type the program into your machine in the same way or disaster strikes!) but can be copied from disc to disc.

The disc we offer contains all the programs in the listings, so will save you a great deal of typing too. Also in order that you

can try the menu out, there are a few extra files on the disc just for fun. The disc is being sold as near to cost as possible at only £3. It is a 40 track double sided disc but it can be used by owners of single sided drives very easily. If you require an 80 track copy please mark your order "80 TRACK" but expect a slight delay in delivery. The price above includes the cost of the disc, postage and packing so there is nothing to add. The disc is not protected in any way, so there is no need to send for more than one.

The address to send to for this offer is:
 Garforth BBC User Group,
 c/o 1 Manley Court,
 Garforth,
 LEEDS,
 LS25 2HY

Please note that this address is only for the offer of this disc and should not be used for any editorial correspondence.

Cheques, Postal Orders etc should be made payable to "Garforth BBC User Group" and crossed. Don't forget to enclose your name and address too!

```

60 END
70 :
80 :
90 DEF FNpeekstring(memorybase%,maxlength%,limit%)
100 LOCAL count%,string$
110 count% = 0
120 string$ = ""
130 REPEAT
140 IF count%?memorybase%<>limit%string$ = string$+ CHR$(count%?memorybase% MOD 128)
150 count% = count%+1
160 UNTIL count%?memorybase% = limit% OR LEN(string$)>maxlength%
170 = string$
180 :
190 :
200 DEF PROCdouble(string$)
210 LOCAL counter%
220 FOR counter% = 0 TO 1
230 PRINT CHR$132; CHR$157; CHR$131; CHR$141; TAB(20-(LEN(string$)/2));string$;
240 PRINT
250 NEXT
260 ENDPROC
270 :
280 :
290 DEF PROCmenu
300 PROCdouble(disctitle$)
310 count2% = 0
320 FOR counter% = 1 TO numberoffiles%
330 IF filename$(counter%) = "MENU" OR filename$(counter%) = "!BOOT" GOTO420
340 count2% = count2%+1
350 actualnumber%(count2%) = counter%
360 IF count2%/2 = INT(count2%/2) THEN PRINT TAB(23); ELSE IF (numberoffiles%<19) PRINT ' TAB(4); : ELSE PRINT TAB(4);
370 dir% = ASC(directory$(counter%))
380 dir% = dir% MOD-128
390 PRINT CHR$(129); CHR$(count2%+64);" _"; CHR$(RND(5)+129);
400 IF dir%<>36 AND dir%<>0 PRINT CHR$(dir%);"."
: ELSE PRINT " ";
410 PRINT filename$(counter%);
420 NEXT
430 PRINT '
440 PROCdouble("Which File to load ?")
450 REPEAT
460 reply% = GET-64
470 UNTIL reply%>=0 AND reply%<=count2%
480 PROCload(actualnumber%(reply%))
490 ENDPROC
500 :
510 :
520 DEF PROCload(filenameumber%)
530 PROCoscli("DIR "+directory$(filenameumber%))
540 IF loadaddress%(filenameumber%) = &1900 AND execaddress%(filenameumber%)>&8000 THEN PROCchain
550 IF loadaddress%(filenameumber%)>&900 AND execaddress%(filenameumber%) = &801F OR execaddress%(filenameumber%) = &8023 THEN PROCreset_chain
560 IF loadaddress%(filenameumber%)>0 AND execaddress%(filenameumber%)<&7C00 THEN PROCstarrun

```

PROGRAM LISTING 2

```

10 IF PAGE <>&6500 THEN PAGE = &6500 : CHAIN "MENU"
20 MODE 7
30 PROCdisctitle
40 PROCgetfilename
50 PROCmenu

```

CONTINUED OVER

```

570 IF loadaddress%(filename%) = 0 AND execaddress%(filename%) = 0 THEN PROCtype
580 PROChelp
590 ENDPROC
600 :
610 :
620 DEF PROCdisctitle
630 disctitle$ = FNpeekstring(&E00,7,0)
640 IF LEN(disctitle$) = 8 disctitle$ = disctitle$ + FNpeekstring(&F00,3,0)
650 IF disctitle$ = ""disctitle$ = "Disc Menu"
660 ENDPROC
670 :
680 :
690 DEF PROCgetfilename
700 numberoffiles% = ?&F05/8
710 DIM filename$(numberoffiles%),directory$(numberoffiles%),actualnumber%(numberoffiles%),loadaddress%(numberoffiles%),execaddress%(numberoffiles%),filelength%(numberoffiles%)
720 FOR counter% = 1 TO numberoffiles%
730 filename$(counter%) = FNpeekstring(&E00+counter%*8,6,&20)
740 filelength%(counter%) = FNpeeknumber(&F04+counter%*8)
750 loadaddress%(counter%) = FNpeeknumber(&F00+counter%*8)
760 directory$(counter%) = FNpeekstring(&E00+(counter%)*8+7,0,&FF)
770 execaddress%(counter%) = FNpeeknumber(&F02+counter%*8)
780 NEXT
790 ENDPROC
800 :
810 :
820 DEF PROCchain
830 PROCmessage("CHAIN")
840 PAGE = &1900
850 CHAIN directory$(filename%)+". "+filename$(filename%)
860 ENDPROC
870 :
880 :
890 DEF FNpeeknumber(memorybase%)
900 = !memorybase% AND &FFFF
910 :
920 :
930 DEF PROCreset_chain
940 PROCmessage("Reset PAGE & CHAIN")
950 PROCdownload
960 PROCbasic
970 :
980 :
990 DEF PROCstarrun
1000 PROCmessage(" *RUN")
1010 PROCdownload
1020 CALL execaddress%(filename%)
1030 :
1040 :
1050 DEF PROCtype
1060 PROCmessage(" *TYPE (Press SHIFT to scroll)")
1070 VDU 14,12
1080 PROCoscli("TYPE "+filename$(filename%))
1090 PROCdouble("Any key to continue !")
1100 ans% = GET
1110 PROCretry
1120 :
1130 :
1140 :
1150 DEF PROChelp
1160 CLS
1170 PROCdouble("I cannot recognise file")
1180 PROCdouble(CHR$136+filename$(filename%))
1190 PROCdouble("SORRY !!!!!")
1200 PRINT
1210 PROCdouble("Press SPACE BAR to try again")
1220 PROCdouble("or another key to END")
1230 answer% = GET
1240 IF answer% = 32 PROCretry ELSE END
1250 :
1260 :
1270 DEF PROCoscli(command$)
1280 $&700 = command$
1290 X% = 0
1300 Y% = 7
1310 CALL &FFF7
1320 ENDPROC
1330 :
1340 :
1350 DEF PROCdownload
1360 PROCoscli("L. "+filename$(filename%)+ " 1900")
1370 CLS
1380 PROCdouble("Downloading.....")
1390 IF loadaddress%(filename%)<&1100 THEN *TAPE
1400 FOR location% = 0 TO filelength%(filename%) STEP 4
1410 location%!loadaddress%(filename%) = location%!&1900
1420 NEXT
1430 ENDPROC
1440 :
1450 :
1460 DEF PROCbasic
1470 *FX18
1480 *FX15,1
1490 *K.OO.;MRUN;M
1500 PAGE = loadaddress%(filename%)
1510 *FX138,0,128
1520 END
1530 :
1540 :
1550 DEF PROCmessage(message$)
1560 CLS
1570 PROCdouble(filename$(filename%))
1580 PRINT '
1590 PROCdouble("Trying to")
1600 PROCdouble(CHR$136+message$)
1610 PROCdouble("this program")
1620 PRINT '
1630 PROCdouble("Press SPACE BAR to proceed")
1640 PROCdouble("or another key to try again")
1650 *FX15,1
1660 answer% = GET
1670 IF answer% = 32 ENDPROC ELSE PROCretry
1680 :
1690 :
1700 DEF PROCretry
1710 CLS
1720 PROCmenu
1730 END

```


Laser Cycles

Shingo Sugiura

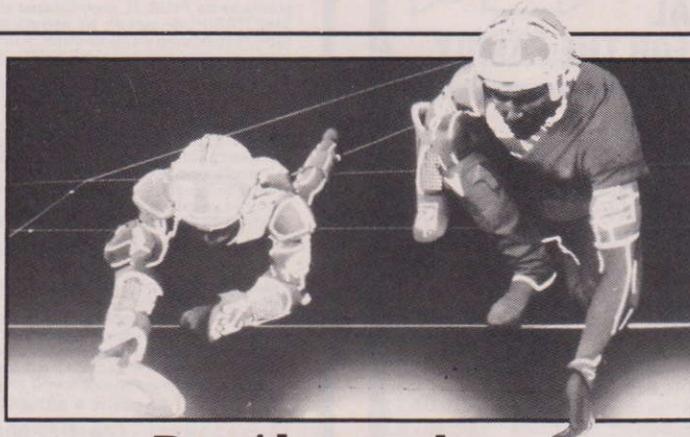
You have been shot into an incredible electronic world where computer programs are the alter egos of their programmers and video games are battles of life and death...

You have been chosen by the MCP to fight against the warriors of SARK on the grid. Ride your LASER CYCLE to force the enemy into the energy barriers but you have to be fast as your laser cycle will disintegrate after a certain number of clock cycles. How many enemy cycles can you de-rezz off the grid before you are de-rezzed?

When the main program (second program) is loaded, the control keys will be explained and it will wait for you to press the space bar. When you do, the screen will clear and the play area — the grid — will be drawn. Then the two cycles materialise accompanied by a swoooosh sound. You are in control of the green cycle which materialises on the left hand side of the screen. To control the cycle press "Z", "X", "*" and "?" to move left, right, up and down respectively. You must finish the enemy off before the time indicated at the bottom right hand corner of the screen reads zero. If you manage to do this, you will encounter another enemy with a shorter time limit. When you are finally de-rezzed, you will be told how many enemy cycles you managed to vapourize off the grid.

During the game, the action can be frozen by pressing the DELETE key. This will pause the action until the COPY key is pressed. Also, anytime during the game, sound may be disabled by pressing "Q" (for quiet) and enabled back on by pressing "S" (for sound). The sound is switched off simply by a *FX210,1 (or the equivalent osbyte call in machine code during the game itself) which is only available on the OS1.2 but that should not be too much of a problem since there are very few — if any — people now with the provisional 0.1 operating system. If you still have the 0.1 OS, I urge you to upgrade immediately. Most of the commercial software houses have abandoned!

When you type in these pro-



**Death or glory.
Obliterate the enemy
before self-destruction
in this desperate
struggle against time.**

grams, save them before running them. The first program must be saved as "LASER" and the second as "CYCLES". Since the second program uses machine code routines assembled by the

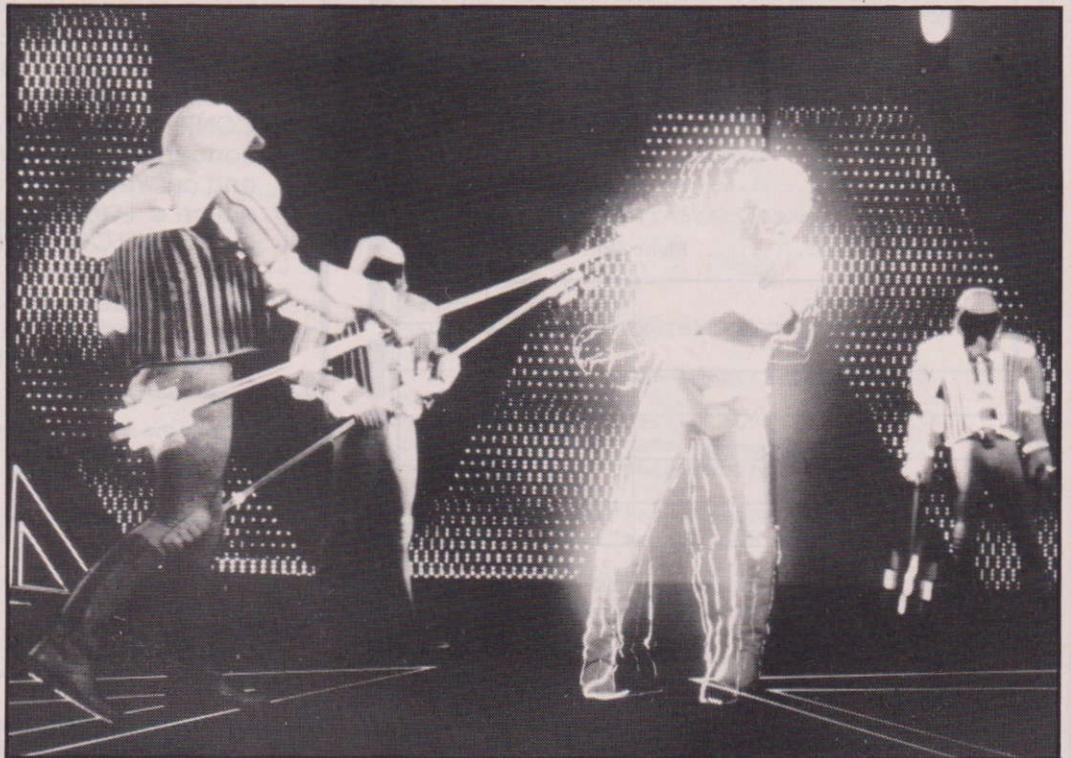
first program, it can not be run on its own.

HOW IT WORKS

The first program sets the scene

by printing the instructions and informing you of the general situation. Also, this program defines the user defined characters and the envelopes, assembles machine code routines to be used by the main program then chains the second, main program automatically. The machine code routines (explained in detail later) are assembled into page &B, the function key definition area. So while you are debugging, don't use the function keys. As with any programs that have machine code, SAVE it before you run it, otherwise the result could be heart breaking!

Both the programs are well structured considering the limitations of BASIC. Not only are there no GOTOs or GOSUBs, the whole program is very modular because of the use of procedures. The procedures and variables are generally sensibly named so you shouldn't have many problems understanding the programs but for those who want to understand every minute detail of the program, here is a (virtually) line by line breakdown of the programs.





LISTING 1

10-30 REM statements.
 50 Call a procedure which assembles a machine code routine used to find the current filing system.
 60 Call a procedure which assembles machine code routines used by the main program.
 70 Select MODE7 then print the instructions.
 80 Define characters and envelopes.
 90 Chain in the second, main program (disc owners, change this line to PAGE = &1200:CHAIN"CYCLES").
 110-270 Print the instructions.
 280 Find the current filing system by calling function "file". This function returns 4 if the current filing system selected is disc otherwise 1.
 290 End of this procedure.
 300-330 This procedure is called if the current filing system is discs. It waits until the space bar is pressed.
 340-370 This procedure is called if the current filing system is tape. It defines a text window and automatically chains in the second program without waiting.
 380-480 Routine which is used to determine which filing system is in use.
 490 The following procedure assembles short machine code routines into the function key area. They are used by the main program.
 500 Defines calls.
 510 Beginning of machine code.
 540-580 Routine which increments the current score by one.
 590-670 General routine which prints a 16 bit number held in zero page locations &80 and &81 (not in BCD).
 680-720 Routine which decrements the time limit and prints it.
 730-830 Routine which scans keys and takes appropriate action (i.e. freeze and sound off).
 840-860 Machine code equivalent of negative inkey, i.e. INKEY with a negative argument.
 870-880 Routine which is called when DELETE is pressed. It freezes the action.
 920 End of this procedure.
 930-1260 Procedure to define characters and envelopes.

LISTING 2

20 Select MODE7 and switch off flashing cursor.
 30 Call procedure which prints instructions.
 40 DIM.
 50 Select MODE2 and switch off flashing cursor.
 60-80 This is a loop which calls the procedure which actually plays the game an infinite number of times!
 100 Beginning of games procedure.

110-190 This loop is repeated until you're dead!
 200 End of games procedure.
 220 Defines constants.
 240 Procedure which is called before the beginning of a game.
 250 Initialises variables.
 260-270 Print the title.
 280-290 Print "SCORE" in bottom left hand corner in nice big chunky writing.
 300-370 Print the grid.
 380-400 The cycles materialise accompanied by a suitable whoosh sound.
 410 End of this procedure.
 420-500 Player. Decrements time, increments time checks whether you're dead etc.
 510-580 Scan keys then take appropriate action.
 590-710 Procedure which moves the computer's cycle.
 720-1120 Decides which direction the computer's cycle should move. The movement depends on the relative position of the computer's cycle to player's cycle.
 1130-1160 Procedure which is called when you win. The remaining time is added onto your current score.
 1170-1210 Procedure which flashes the title (as in PLANETOID, close enough anyway). If you are an experienced machine code programmer, you may like to write an interrupt routine to do this.
 1220-1380 Procedure which is called when you're de-rezzed. Prints how many enemy cycles you managed to de-rezz off the grid.
 1390-1410 General routine which causes a delay.
 1420-1500 Procedure which waits for the space bar to be pressed. If "Q" is pressed at this point, all sound is disabled.
 1510-1760 Materialisation of cycles.
 1770-1960 Print instructions.
 1970-2070 Define strings to be used in PROCEDURE "death".

MAIN VARIABLES

killed Number of enemy cycles de-rezzed.
 limit Initial time limit.
 1% Pixel size.
 C1% Computer cycle's position.
 win Boolean to decide whether you've won or not.
 death Boolean to decide whether you're dead or not.
 time Actual time limit.
 PX%,PY% X and Y coordinate of player's cycle.
 dir Direction of computer's cycle.
 rnd A variable to introduce a certain amount of randomness to the computer cycle's movement.
 loop General variable for FOR-NEXT loops.

CONTINUED OVER

NOTE TO DISC OWNERS

As it stands, this program will not run on machines with the DFS fitted. However, one simple way of running the game with some DFSs is to change line 90 of the first program to PAGE = &1200:CHAIN "CYCLES". This method will be satisfactory with most popular DFSs but unfortunately not Wat-

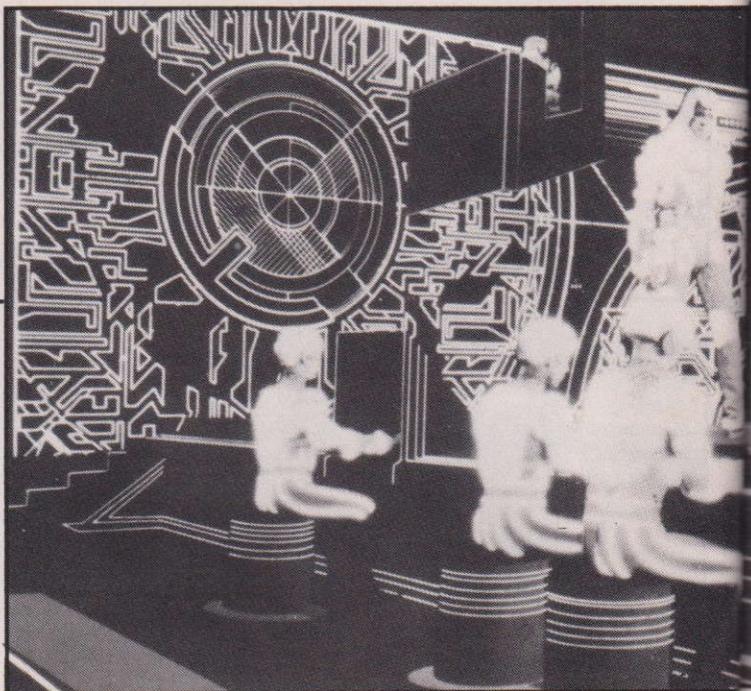
ford's. If you have the Watford DFS (which is by the way, very good), you will have to avoid all unnecessary spaces, and use shorter variable names. But this will make the program difficult to read. A rather better solution would be to add a short routine to the first program which loads the second program then moves it down to &E00. The method for this has been published before in various publications so will not be repeated here.

PROGRAM LISTING 1

```

10 REM Laser Cycles
20 REM By Shingo Sugiura
30 REM
40
50 PROCassemble
60 PROCprint
70 MODE7:PROCinst
80 PROCdefine
90 CHAIN"CYCLES"
100
110 DEFPROCinst
120 PRINTCHR$129CHR$141CHR$157CHR$131TAB(12)"LASER CYCLE
S"
130 PRINTCHR$129CHR$141CHR$157CHR$131TAB(12)"LASER CYCLE
S"
140 PRINTTAB(9)CHR$130"By Shingo Sugiura"
150 PRINT" You have been sucked into an"
160 PRINT"incredible electronic world where"
170 PRINT"computer programs are the alter-egos of"
180 PRINT"their programmers, where video games"
190 PRINT"are battles of life and death..."
200 PRINT""
210 PRINT" You - the video games virtuoso -"
220 PRINT"must battle it out on the grid inside"
230 PRINT"the ""LASER CYCLES"" in order to"
240 PRINT"overthrow the powerful Master Control"
250 PRINT"Program. Your chances are slim but the"
260 PRINT"outcome will decide whether man or"
270 PRINT"machine will control the system..."
280 IF FNfile=4 PROCdisc ELSE PROCTape
290 ENDPROC
300 DEFPROCdisc
310 PRINT"CHR$134CHR$136"Press the SPACE BAR to continu
e.";
320 REPEAT UNTIL GET=32
330 ENDPROC
340 DEFPROCTape
350 PRINTTAB(0,23)CHR$134CHR$136"Please leave cassette r
unning."
360 VDU28,5,21,35,19
370 ENDPROC
380 DEFFNfile
390 CALLcode
400 =?&70
410 DEFPROCassemble
420 DIM code 15
430 P%=code
440 [OPT 0
450 LDA#0:LDY#0:LDX#&70
460 JSR &FFDA:STA &70
470 RTS:]
480 ENDPROC
490 DEFPROCprint
500 oswrch=&FFEE:osbyte=&FFF4
510 FOR pass=0 TO 2 STEP2:P%=&B00
520 [OPT pass
530 .score CLC
540 LDA &70:ADC #1:STA &70:STA &80

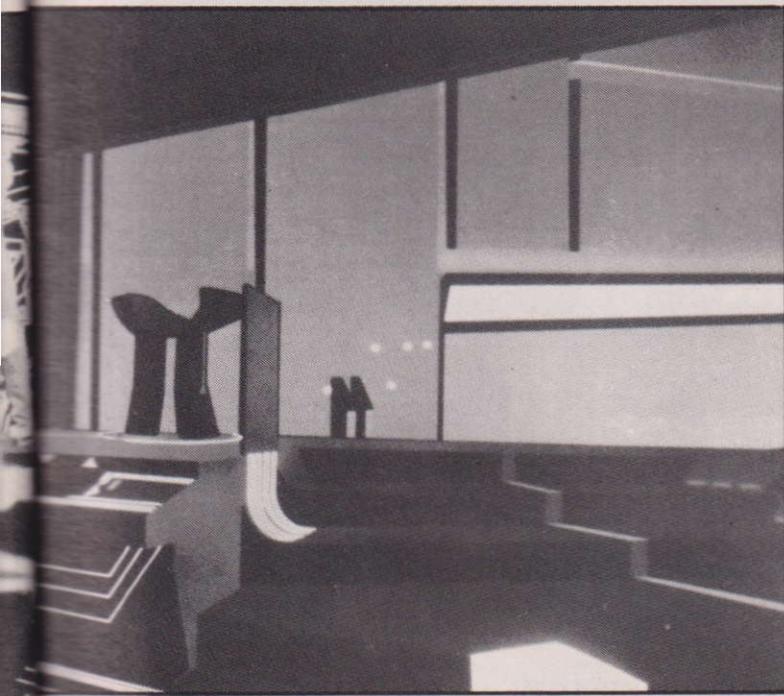
```



```

550 LDA &71:ADC #0:STA &71:STA &81
560 LDA#31:JSR oswrch
570 LDA#6:JSR oswrch
580 LDA#31:JSR oswrch
590 LDY #0
600 .print LDX #16:LDA #0
610 .sbd3 ASL &80:ROL &81:ROL A
620 CMP #10:BCC sbd4:SBC #10:INC &80
630 .sbd4 DEX:BNE sbd3
640 PHA:INY:LDA &81:ORA &80:CPY #5:BNE print
650 .sbd5 PLA:CLC:ADC #138:JSR oswrch
660 DEY:BNE sbd5
670 RTS
680 .time LDY#0
690 LDA #31:JSR oswrch
700 LDA #14:JSR oswrch
710 LDA #31:JSR oswrch
720 JMP print
730 .keys
740 LDX #&A6:JSR inkey:BEQ not_freez
750 JSR freez
760 .not_freez
770 LDX #&EF:JSR inkey:BEQ not_quiet
780 LDA#210:LDY #0:LDX #1:JMP osbyte
790 .not_quiet
800 LDX #&AE:JSR inkey:BEQ not_noisy
810 LDA #210:LDY #0:LDX #0:JMP osbyte
820 .not_noisy
830 RTS
840 .inkey
850 LDY #&FF:LDA #&81:JSR osbyte
860 TYA:RTS
870 .freez
880 LDX #&96:JSR inkey:BEQ freez
890 RTS
900 INEXT
910 Z%=time:B%=keys
920 ENDPROC
930 DEFPROCdefine
940 VDU23,224,192,192,192,224,224,224,252,0
950 VDU23,225,124,196,196,252,228,228,228,0
960 VDU23,226,248,192,192,252,12,12,252,0
970 VDU23,227,252,192,192,252,224,224,252,0
980 VDU23,228,248,200,200,248,236,236,236,0
990 VDU23,229,252,192,192,224,224,224,252,0
1000 VDU23,230,140,140,140,252,28,28,252,0
1010 VDU23,231,252,196,196,196,228,228,252,0
1020 VDU23,232,196,196,204,248,252,228,228,0
1030 VDU23,233,48,48,48,56,56,56,56,0
1040 VDU23,234,252,196,196,196,196,196,252,0
1050 VDU23,235,48,48,48,48,48,48,48,0
1060 VDU23,236,252,12,12,252,224,224,252,0
1070 VDU23,237,252,12,12,252,28,28,252,0
1080 VDU23,238,140,140,140,140,252,28,28,0
1090 VDU23,239,252,192,192,252,28,28,252,0
1100 VDU23,240,252,192,192,252,228,228,252,0
1110 VDU23,241,252,12,12,12,28,28,28,0
1120 VDU23,242,252,196,196,252,228,228,252,0
1130 VDU23,243,252,140,140,252,28,28,28,0

```



```

1140 VDU23,232,196,196,204,248,252,228,228,0
1150 VDU23,244,252,48,48,48,56,56,56,0
1160 VDU23,245,196,196,196,228,228,228,252,0
1170 VDU23,246,252,196,192,224,236,228,252,0
1180 VDU23,247,196,196,196,252,228,228,228,0
1190 VDU23,248,248,204,204,204,236,236,236,0
1200 VDU23,249,248,204,204,204,236,236,248,0
1210 VDU23,250,194,194,194,202,234,254,254,0
1220 VDU23,251,252,28,28,224,224,224,252,0
1230 ENVELOPE1,6,0,0,0,1,1,1,126,-4,-1,-4,126,80
1240 ENVELOPE2,4,6,-3,-3,4,2,2,0,0,-1,0,63,58
1250 *FX229,1
1260 ENDPROC

```

PROGRAM LISTING 2

```

10 PROCdefine
20 MODE7:VDU23;8202;0;0;0;
30 PROCinst
40 DIMUX(1,10)
50 MODE2:VDU23;8202;0;0;0;
60 REPEAT !&70=0:killed=-1:limit=200
70 PROCgame
80 UNTILFALSE
90 :
100 DEFPROCgame
110 REPEAT
120 PROCstart:PROCinit
130 REPEAT
140 PROCflash
150 PROCplayer1
160 PROCcomputer
170 UNTIL win OR death
180 IF win THEN PROCwin
190 UNTIL death:PROCdeath
200 ENDPROC
210 DEFPROCstart:CLS
220 IX=16:CIX=IX:limit=limit-20
230 ENDPROC
240 DEFPROCinit
250 win=FALSE:death=FALSE:killed=killed+1:time=limit:cou
nt=1
260 COLOUR15
270 VDU31,4,0,224,225,226,227,228,32,229,230,229,224,227
,226
280 COLOUR7
290 VDU31,0,31,226,229,231,228,227
300 GCOLO,4
310 FOR X%=0 TO 1248 STEP16
320 MOVEX%,48:DRAWX%,976
330 NEXT
340 FOR Y%=48 TO 976 STEP16
350 MOVE0,Y%:DRAW1248,Y%
360 NEXT
370 GCOLO,3:MOVE0,48:DRAW1248,48:DRAW1248,976:DRAW0,976:
DRAW0,48
380 PX%=IX*2:PY%=(RND(768/IX)+3)*IX:PROCmat(PX%,PY%):IX%
=0:IY%=IX%
390 CX%=1248-2*IX%:CY%=(RND(768/IX)+3)*IX%

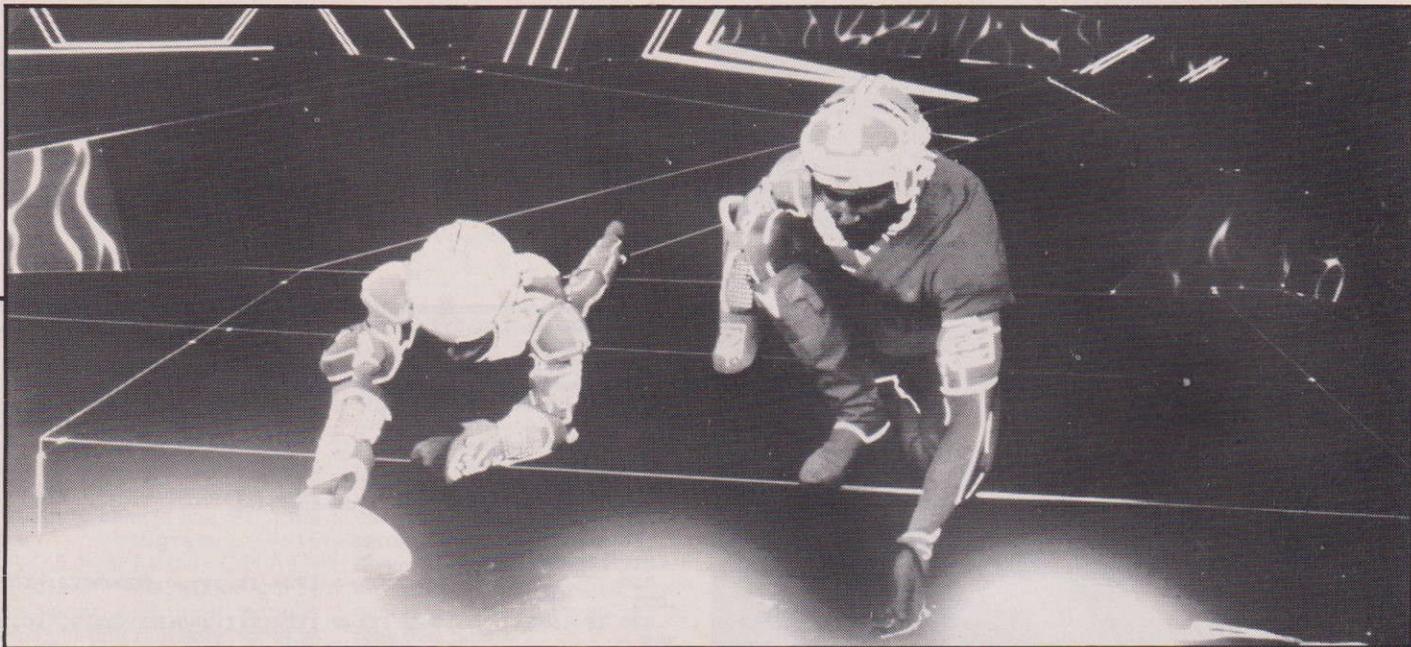
```

```

400 PROCmat(CX%,CY%):CIX%=0:CIY%=-CIX%:dir=3
410 ENDPROC
420 DEFPROCplayer1
430 time=time-1:CALL&B00:!!&80=time:CALLZX
440 IF time<=0 death=TRUE ELSE IF time<30 SOUND&13,2,1,2
55
450 MOVEPX%,PY%:GCOLO,2
460 PROCkeys
470 PX%=PX%+IX%:PY%=PY%+IY%
480 IF POINT(PX%,PY%)<>4 death=TRUE
490 DRAWPX%,PY%
500 ENDPROC
510 DEFPROCkeys
520 IF INKEY(-98) AND IX%=0 IX%=-IX%:IY%=0:SOUND&12,-10,1
,255
530 IF INKEY(-67) AND IX%=0 IX%=IX%:IY%=0:SOUND&12,-10,2,
255
540 IF INKEY(-105) AND IY%=0 IY%=-IY%:IX%=0:SOUND&12,-10,
3,255
550 IF INKEY(-73) AND IY%=0 IY%=IY%:IX%=0:SOUND&12,-10,4,
255
560 IF INKEY(-113) death=TRUE
570 CALLBX
580 ENDPROC
590 DEFPROCcomputer
600 GCOLO,1:rnd=RND(50)
610 MOVECX%,CY%
620 a=0:b=0:c=0:d=0
630 PROCtest
640 IF dir=1 CIX%=0:CIY%=CIX%:SOUND&13,-10,1,255
650 IF dir=2 CIX%=CIX%:CIY%=0:SOUND&13,-10,2,255
660 IF dir=3 CIX%=0:CIY%=-CIX%:SOUND&13,-10,3,255
670 IF dir=4 CIX%=-CIX%:CIY%=0:SOUND&13,-10,4,255
680 CX%=CX%+CIX%:CY%=CY%+CIY%
690 IF POINT(CX%,CY%)<>4 win=TRUE
700 DRAWCX%,CY%
710 ENDPROC
720 DEFPROCtest
730 IF POINT(CX%,CY%+IX%)<>4 a=1
740 IF POINT(CX%+IX%,CY%)<>4 b=1
750 IF POINT(CX%,CY%-IY%)<>4 c=1
760 IF POINT(CX%-IX%,CY%)<>4 d=1
770 e=SGN(PX%-CX%):f=SGN(PY%-CY%)
780 IF dir=1 PROCcompute1 ELSE IF dir=2 PROCcompute2
790 IF dir=3 PROCcompute3 ELSE IF dir=4 PROCcompute4
800 ENDPROC
810 DEFPROCcompute1
820 IF (a=1 AND b=1 AND d=1) win=TRUE:ENDPROC
830 IF (a=1 AND b=1)OR(b=1 AND e AND rnd<20) dir=4:ENDPR
OC
840 IF (a=1 AND d=1)OR(d=1 AND e=1 AND rnd<20) dir=2:END
PROC
850 IF (b=1 AND d=1) dir=1:ENDPROC
860 IF a=1 dir=(e=1)*-2+(e=-1)*-4+(e=0)*-2:ENDPROC
870 IF (a=0 AND b=0 AND d=0 AND rnd<10) dir=(e=1)*-2+(e=
-1)*-4+(e=0)*-1
880 ENDPROC
890 DEFPROCcompute2
900 IF (a=1 AND b=1 AND c=1) win=TRUE:ENDPROC
910 IF (b=1 AND c=1)OR(c=1 AND f=1 AND rnd<20) dir=1:END
PROC
920 IF (a=1 AND b=1)OR(a=1 AND f AND rnd<20) dir=3:ENDPR
OC
930 IF (a=1 AND c=1) dir=2:ENDPROC
940 IF b=1 dir=(f=1)*-1+(f=-1)*-3+(f=0)*-3:ENDPROC
950 IF (a=0 AND b=0 AND c=0 AND rnd<10) dir=(f=1)*-1+(f=
-1)*-3+(f=0)*-2
960 ENDPROC
970 DEFPROCcompute3
980 IF (b=1 AND c=1 AND d=1) win=TRUE:ENDPROC
990 IF (c=1 AND d=1)OR(d=1 AND e=1 AND rnd<20) dir=2:END
PROC
1000 IF (c=1 AND b=1)OR(b=1 AND e AND rnd<20) dir=4:ENDPR
OC
1010 IF (b=1 AND d=1) dir=3:ENDPROC
1020 IF c=1 dir=(e=1)*-2+(e=-1)*-4+(e=0)*-4:ENDPROC

```

CONTINUED OVER



```

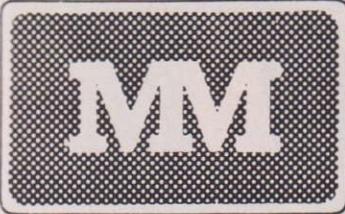
1030 IF (b=0 AND c=0 AND d=0 AND rnd<10) dir=(e=1)*-2+(e=
-1)*-4+(e=0)*-3
1040 ENDPROC
1050 DEFPROCcompute4
1060 IF (c=1 AND d=1 AND a=1) win=TRUE:ENDPROC
1070 IF (d=1 AND a=1)OR(a=1 AND f AND rnd<20) dir=3:ENDPR
OC
1080 IF (c=1 AND d=1)OR(c=1 AND f=1 AND rnd<20) dir=1:END
PROC
1090 IF (c=1 AND a=1) dir=4:ENDPROC
1100 IF d=1 dir=(f=1)*-1+(f=-1)*-3+(f=0)*-1:ENDPROC
1110 IF (c=0 AND d=0 AND a=0 AND rnd<10) dir=(f=1)*-1+(f=
-1)*-3+(f=0)*-4
1120 ENDPROC
1130 DEFPROCwin
1140 SOUND&11,0,0,0:SOUND&12,0,0,0:SOUND&13,0,0,0:SDOUNDO,
1,6,10
1150 !&70=!&70+time:PROCwait(8000)
1160 ENDPROC
1170 DEFPROCflash
1180 count=count+1
1190 IF count>15*7 count=1
1200 VDU19,15,count;0;
1210 ENDPROC
1220 DEFPROCdeath
1230 SOUND&11,0,0,0:SOUND&12,0,0,0:SOUND&13,0,0,0
1240 VDU19,0,7;0;:PROCwait(300):VDU19,0,0;0;
1250 SOUNDO,1,6,10:PROCwait(10000):CLS:*FX15
1260 COLOUR1
1270 PROCinf(tough$,4,10)
1280 PROCinf(green$,3,12)
1290 PROCinf(you$+" "+CHR$(killed+138),2,16)
1300 PROCinf(warrior$,5,18)
1310 PROCoption
1320 ENDPROC
1330 DEFPROCinf(A$,X,Y)
1340 FOR A=1 TO LEN(A$)
1350 PRINTTAB(X+A,Y)MID$(A$,A,1)
1360 SOUND&10,-15,6,1:PROCwait(200)
1370 NEXT
1380 ENDPROC
1390 DEFPROCwait(T%)
1400 FOR del%=1 TO T%:NEXT
1410 ENDPROC
1420 DEFPROCoption
1430 REPEAT
1440 REPEAT
1450 A=INKEY(0)
1460 UNTIL (A=32 OR A=81 OR A=83)
1470 IF A=81 THEN *FX210,1
1480 IF A=83 THEN *FX210
1490 UNTIL A=32
1500 ENDPROC
1510 DEFPROCmat(xco%,yco%)
1520 GCOL3,3

```

```

1530 VDU29,xco%;yco%;
1540 SOUND&11,0,0,0:SOUND&10,-15,7,255
1550 FOR loop=0 TO 9
1560 UX(0,loop)=(RND(30)-15)*250
1570 UX(1,loop)=(RND(30)-15)*250
1580 Q=UX(0,loop):W=UX(1,loop)
1590 PLOT69,Q,W:PLOT69,Q+4,W:PLOT69,Q,W+4:PLOT69,Q+4,W+4
1600 NEXT
1610 FOR outer=1 TO 3
1620 FOR loop=0 TO 9
1630 Q=UX(0,loop):W=UX(1,loop)
1640 SOUND&11,0,20+(outer*10+loop)*4,2
1650 PLOT69,Q,W:PLOT69,Q+4,W:PLOT69,Q,W+4:PLOT69,Q+4,W+4
1660 Q=Q*.2:W=W*.2
1670 PLOT69,Q,W:PLOT69,Q+4,W:PLOT69,Q,W+4:PLOT69,Q+4,W+4
1680 UX(0,loop)=Q:UX(1,loop)=W
1690 NEXT,
1700 FOR loop=0 TO 9
1710 Q=UX(0,loop):W=UX(1,loop)
1720 PLOT69,Q,W:PLOT69,Q+4,W:PLOT69,Q,W+4:PLOT69,Q+4,W+4
1730 SOUND&11,0,loop*20,5
1740 NEXT
1750 SOUND&11,0,0,0:SOUND&10,0,0,0:VDU29,0;0;:PLOT69,xco%
,yco%
1760 ENDPROC
1770 DEFPROCinst
1780 PRINTCHR$129CHR$157TAB(11)CHR$131CHR$141"LASER CYCLE
S"
1790 PRINTCHR$129CHR$157TAB(11)CHR$131CHR$141"LASER CYCLE
S"
1800 PRINT'TAB(10)CHR$130"By Shingo Sugiura"
1810 PRINT" You have the option of committing"
1820 PRINT"suicide if absolutely everything goes"
1830 PRINT"wrong."
1840 PRINT"This can be brought about by pressing"
1850 PRINT"the switch marked ""ESCAPE""."
1860 PRINT" During battle, the sonics may"
1870 PRINT"disturb your concentration. Press ""Q""
1880 PRINT"to enter silent mode."
1890 PRINTTAB(15)CHR$131"Controls:"
1900 PRINTTAB(15)""Z"" - Left"
1910 PRINTTAB(15)""X"" - Right"
1920 PRINTTAB(15)""*"" - Up"
1930 PRINTTAB(15)""/"" - Down"
1940 PRINT'CHR$134CHR$136"Press the SPACE BAR to enter gr
id"
1950 PROCoption
1960 ENDPROC
1970 DEFPROCdefine
1980 tough$="":green$="":you$="":warrior$=""
1990 FOR loop=1 TO 10:READ A:tough$=tough$+CHR$(A):NEXT
2000 FOR loop=1 TO 12:READ A:green$=green$+CHR$(A):NEXT
2010 FOR loop=1 TO 12:READ A:you$=you$+CHR$(A):NEXT
2020 FOR loop=1 TO 8:READ A:warrior$=warrior$+CHR$(A):NEX
T
2030 ENDPROC
2040 DATA 244,231,245,246,247,32,224,245,229,232
2050 DATA 246,228,227,227,248,32,32,229,230,229,224,227
2060 DATA 230,231,245,32,249,227,228,227,251,251,227,249
2070 DATA 250,225,228,228,233,231,228,226

```



TOP SAVINGS

	EX VAT	INC VAT
PRINTERS		
BROTHER HR 15	329.00	378.35
TRACTOR	62.00	71.30
SHEETFEEDER	185.00	212.75
KEYBOARD	135.00	155.25
EPSON RX80T	195.00	224.25
EPSON RX80F/T	220.00	253.00
EPSON FX80F/T	320.00	368.00
EPSON FX100F/T	430.00	494.50
EPSON RX100F/T	350.00	402.50
FX80 TRACTOR	30.00	34.50
JUKI 6100	325.00	373.75
MANNESMANN TALLY MT80	199.00	228.85
NEC 2050 (IBM PC)	725.00	833.75
OKI MICROLINE 82A	255.00	293.25
OKI MICROLINE 83A	395.00	454.25
OKI MICROLINE 92P	379.00	435.85
SEIKOSHA GP100A	165.00	189.75
SHINWA CP80	175.00	201.25
STAR GEMINI 10X	199.00	228.85
COMPUTERS		
COMMODORE 64	152.17	174.99
COMMODORE 1541 DISK	165.21	189.99
COMMODORE C2N CASSETTE	32.00	36.80
INTFACE 64-PARALLEL	59.50	68.43
APRICOT 2"D+MON	1,395.00	1,604.25
APRICOT 10MB	2,195.00	2,524.25
SANYO MBC555	795.00	914.25
EPSON QX10	1,600	1,840.00
STAR DELTA 10	329.00	378.35

Blenheim House, Podmore Road, London SW18 1AJ
01-870 3255

SOURCE LIBRARY MANAGER (SLM) & TEXT LIBRARY MANAGER (TLM)

ROM based software for DISK owners on the BBC MICRO

*** FEATURES INCLUDE ***

- * Stores and retrieves any amount of BASIC and/or ASSEMBLER source code, wordprocessing files, M/C routines, data files, etc. upto the full capacity of each disk (100k or 200k).
- * Creates a library of up to 399 "members" per 80 track, or 199 "members" per 40 track disk.
- * Uses 8 character names and a 20 character description for each "member".
- * Allows upto 99 versions of the same "member" to be retained in the library.
- * Will simply and easily "construct" programs developed in a modular fashion.
- * Stores fully documented source code which can be "stripped" when required for execution.
- * Fully menu-driven (i.e. no messy command syntax).
- * Incorporates a full set of library management functions (to maintain, compress, etc).
- * Many other professional features.
- * Supplied on two ROM chips for a price normally associated with single chip software.
- * Includes comprehensive User Guide and fitting instructions.

ACORN USER said: Source Library Manager works very well and, being ROM-based, it takes up no user RAM. The disc capacity, in terms of the number of members that can be held, is a great improvement on the 31 files allowed by the DFS.

*** FULLY COMPATIBLE WITH 6502 SECOND PROCESSOR ***

IDEAL FOR BEGINNERS AND EXPERIENCED USERS ALIKE

PRICE £36 (incl. p&p) or large SAE for Factsheet to:

GUARDIAN SOFTWARE

21 Harvey Road, Walton-on-Thames, Surrey KT12 2PZ

ANSWER BACK SENIOR AND JUNIOR QUIZZES

GENERAL KNOWLEDGE

THE ULTIMATE CHALLENGE

BBC (32K)*ELECTRON



Juniors (Ages 6 to 11)

-defeat the mythical dragon and save the princess of KOSMOS Castle...

Seniors (Ages 12 and Over)

-pit your wits against the KOSMOS robot and destroy the Alien invaders...

But be warned, in your endeavours you will learn vast amounts of fascinating facts on an enormous variety of subjects. The ANSWER BACK quizzes provide an incredible adventure in education by allowing successful challengers to participate in the compelling games.

Each program comes complete with 15 enormous quizzes providing a total of 750 questions and 3000 optional answers. But that is only the start, you can also create and save an unlimited number of quizzes of your own design.

FEATURES INCLUDE

- Multiple choice answers
- True or False?
- Find the missing letters
- "Pass" facility
- Immediate correction of errors
- Timer option
- Performance summary
- Re-run of questions passed or incorrectly answered
- Full facilities for creating and saving an unlimited number of new quizzes

Available from your computer store or by mail order Price £10.95

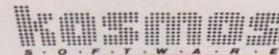


Other educational titles include...
"The French Mistress"
"The German Master"
"The Spanish Tutor"

KOSMOS SOFTWARE LTD, 1 Pilgrim Close, Harlington, DUNSTABLE, Beds. LU5 6LX
Please supply the following programs for the BBC/ELECTRON computer

ANSWER BACK Junior Quiz @ £10.95
ANSWER BACK Senior Quiz @ £10.95

Mr/Mrs/Miss
Address
Postcode



KOSMOS SOFTWARE LIMITED
1 Pilgrim Close, Harlington
DUNSTABLE, Beds. LU5 6LX
Tel. (05255) 3942

Random Access

Deve Carlos

Our first problem is from those readers who already own, or can buy very cheaply, disc systems for other computers and want to know if they can be made to work on the BBC machine easily.

Whilst it is difficult to give any firm answers to such general questions as this, the answer is usually yes, they can be used on the BBC system and with surprisingly little modification. This is because the 8271 floppy disc controller chip isn't dedicated to one particular type of drive but is looking for a certain type of interface, ie one with an IBM standard bus. This means that any drive which can be wired to the following configuration should be usable with the BBC and DFS.

Table 1 Signal connections

Signal Pin	Signal Name
2	Not used
4	Not used
6	Not used
8	Index pulse (signals start of track)
10	Drive select 1
12	Drive select 2
14	Drive select 3 (Not used by BBC)
16	Motor on
18	Head direction select
20	Step (each pulse causes one step)
22	Write data
24	Write gate (must be enabled for data to be written)
26	Track 00 (signals when head is at track 0)
28	Write protect is covered (signals that disc cannot be written to)
30	Read data (actually reads file data and other identification from disc)
32	Side select (double sided drives)
34	Not used

In each case the pin on the other side of the circuit board is the signal ground or earth line. (So Pin 1 is the ground for Pin 2 etc.)

The type of connector used at the drive end of the cable, a 34 pin pcb edge card connector, is a Scotchflex Ribbon connector part number 3463-000 or 3462-0001. There should be a key slot between pins 4 and 6 to ensure that you have the cable the right way round. In certain cases, especially the Tandy drives, all that is needed is the addition of the correct connector for the BBC end of the cable. If this is inserted in a suitable position on the existing cable you can even use the same drive on both

This month we look at two questions often asked by disc users.

computers.

If you have any further doubts, try to find BBC dealers with good engineering facilities and take your drive to them, requesting help. It could save you a packet in the long run, especially as some drives are available, very cheaply, secondhand at the moment.

*Mr. J. Henderson of York is a new DFS user and would like an explanation of the use of the *BUILD, *TYPE and *LIST DFS commands.*

128. For example the keyword STEP has a token value of 136 (&88 in hexadecimal notation). This has distinct advantages in that it makes BASIC programs shorter than they would be otherwise and it speeds up the execution of BASIC.

What it makes difficult is the merging of different program parts and the use of file systems to give commands. In order to do either of these tasks easily we need to make up ASCII files instead of BASIC tokenised files. This is what you are doing when you use the *SPOOL command from BASIC and then list a program. The whole program is shown on the screen and the ASCII codes are also passed to a file so that you can use them later. This file is simply a collection of numbers which when called back into the machine, probably using *EXEC, is understood by the operating system in just the same way as if the letters were typed at the keyboard. This makes it very simple to add lines to programs if you have stored them in ASCII format.

Back to the DFS commands now. As I have already said these commands all manipulate ASCII files and the one you are most likely to be familiar with is *BUILD. As explained in most disc manuals this can be used to create a file called !BOOT which will be *EXECed when you press SHIFT/BREAK, if you have used *OPT4,3. What happens when you type *BUILD followed by a file name is that the machine responds with a line number. You can then enter any command that you might use at the keyboard and it will be placed into the ASCII file that you named. Pressing the RETURN key causes a RETURN to be written to the file and a new number to appear. When you have finished, pressing ESCAPE writes any remaining characters to the file and closes it. You then have a file of commands that can be called from the disc (using *EXEC)

and will be acted upon just as if you had typed them at the keyboard. This means that a string of important commands can be kept and this saves you having to retype them constantly.

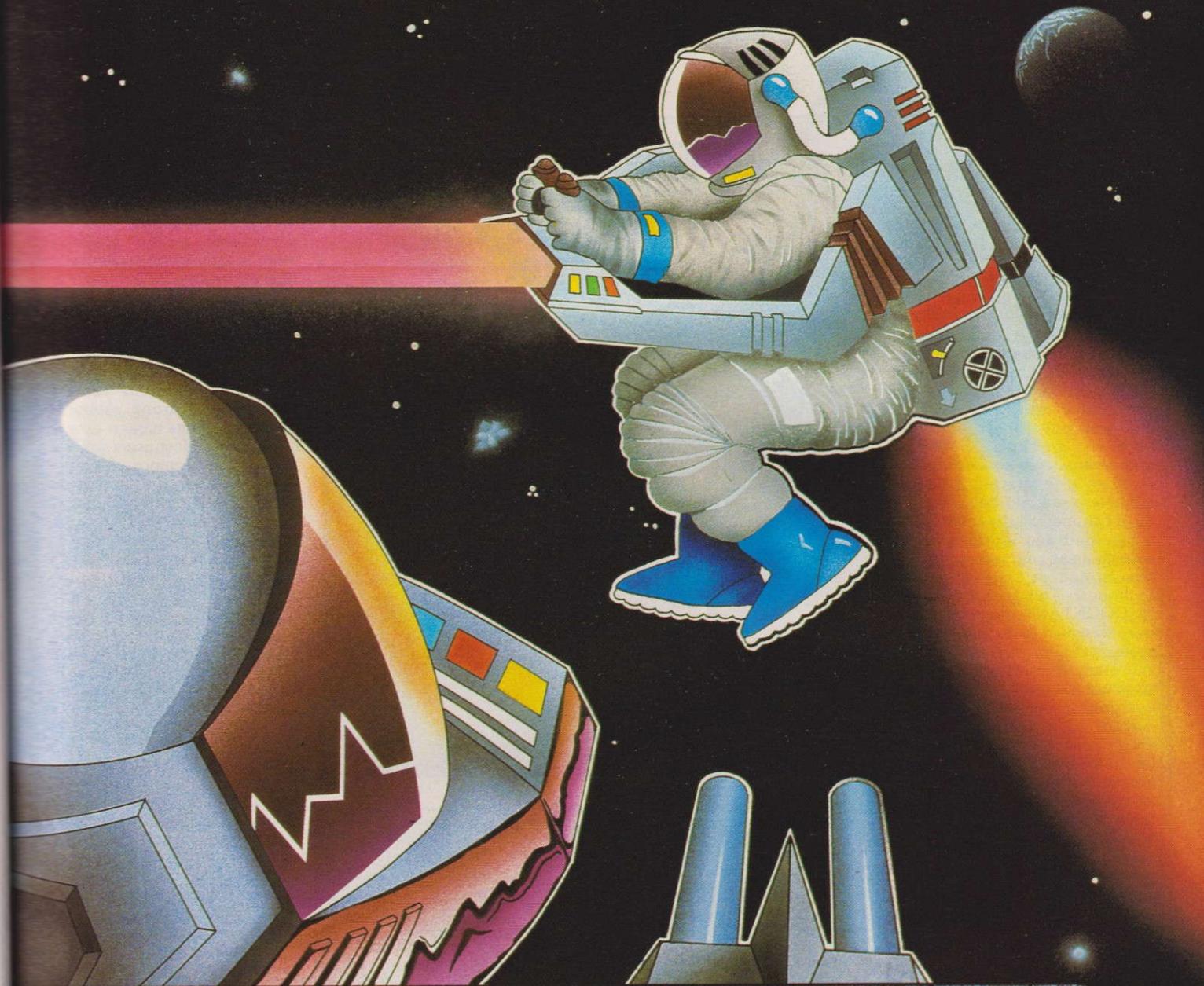
On a disc, using the file !BOOT, you might reset PAGE and then call a menu program (like the one in this issue). If you are developing a program and want to use the red keys as debugging aids you might hold the key definitions in an ASCII file which you *EXEC before each programming session. You can even build up a file of commands to demonstrate the features of a program that you have written and then sit back and watch it going through its paces.

Once you have written such a file there are two commands that allow you to view it and even change or edit it. The first of these is *TYPE, which seems to have been named after a CP/M command that has a similar action. Typing *TYPE followed by a file name causes that file to be displayed on the screen without line numbers after each RETURN character. I usually find that typing VDU 14 is an advantage if you want to read the file carefully, then you need to press SHIFT for each new page. This is one way that someone without a wordprocessor can read a file created using one. As long as the file is in ASCII, ie has been "SPOOLed" from the word processor onto the disc, it can be read on screen, or even sent to a printer, by using this command.

*LIST is very similar but it displays the file with a line number in front and a new line number after every RETURN is found. This is the ideal way to look at your !BOOT files and check that they look as you wish them to. After you have checked a file in this way, if there is a mistake it can be rectified by typing *BUILD "filename" and then you make the necessary changes using the cursor editing. Unfortunately you do need to start again at the beginning, there is no simple way of editing an ASCII file once written to disc.

If you have any questions about discs, drives, DFS or their use, please let me know at our editorial address.

ULTIMATE



ULTIMATE PLAY THE GAME

Available from W.H.Smith, John Menzies, Boots, Woolworths,
and all good software retailers.

Also available from Ultimate Play The Game,
The Green, Ashby-de-la-Zouch, Leicestershire LE6 5JU

£7.95

Accountant

Jon Vogler

The problem with programs like ACCOUNTANT is that they are written by accountants, not by practising business managers. If this sound revolutionary (or just plain daft), let me explain:

Accounting performs two functions for a company. The first is to satisfy those interfering outsiders: the auditors, the Inland Revenue, the VAT man and the shareholders, all of whom, quite properly, want assurances that the business is being honestly run and profits are being declared and not put straight into the boss's pocket. "Audit accounting" tries to ensure that every invoice or cash payment and every nut and bolt, taxi fare or telephone call they represent, is recorded and included in the overall year-end accounts, so that an auditor can certify them as honest. This is the task that ACCOUNTANT has obviously been designed to do and it does it pretty well.

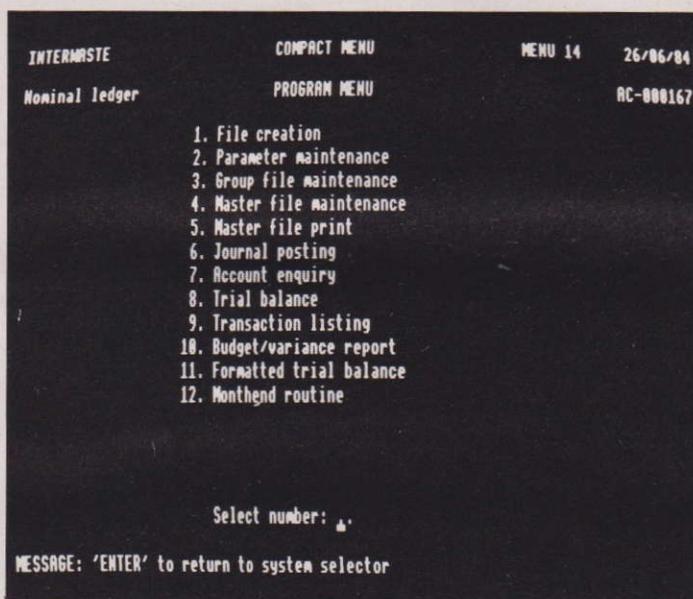
I am the last to decry this process which safeguards everyone: customers, shareholders, creditors and employees. Unfortunately it tends to overshadow the other function of accounting, which is to tell the manager responsible for a business operation exactly what is happening, why it is happening and what is going to happen tomorrow and next year. This process is called "management accounting" and neither ACCOUNTANT, nor dozens of similar programs, does it.

LET ME ILLUSTRATE

This is no place for a lecture on the topic so I will confine myself to three illustrations:

ACCOUNTANT does not allocate costs and revenues to "profit-centres"; it conventionally groups costs by "account", such as "stationery", "telephone", "depreciation", or "consumables" (which is important and essential), and then groups accounts by "group", in order to combine them when presenting annual profit-and-loss or balance sheet. Thus it offers no

An assessment of the bookkeeping program from Acorn's Z80 package.



1. The menu shows ACCOUNTANT to be a sophisticated program

guide to the profitability of one division of product or project; essential for the manager to know which to expand, which to close, where to direct his advertising budget, his capital investment or his time. It does take one first and most valuable step: it offers a facility for constructing a budget and compares "actuals" with it. It starts to take a second by allocating a box for "type" of each transaction, but then draws hastily back, saying "for reference on printouts only".

Likewise with customer accounts: the best reason for keeping them is not to please the auditors but to make sure your customers pay and pay promptly. ACCOUNTANT duly produces an "account" of debtors but does not break it down into individual customers. As one cannot ring up a customer and say "I am owed £10,000 by all my customers put together, so pay up", this is pretty inadequate information!

Thirdly, and perhaps worst of all, the dreaded words "cash-flow", which brought Freddie Laker and a million lesser tycoons to their knees are nowhere mentioned. This is the most vital function of accountancy; without it the program should be renamed "BOOKKEEPER", else Rolls Royce died in vain!

WHAT ACCOUNTANT CAN DO

So much for tears over what ACCOUNTANT will not do; now consider what it does. It is a formidable program with 45 separate parts and 20 different files. To make it easy to change from a manual to computerised system, it follows ordinary manual procedures for entering sales, purchases and cash transactions in day books and analyses them into the separate

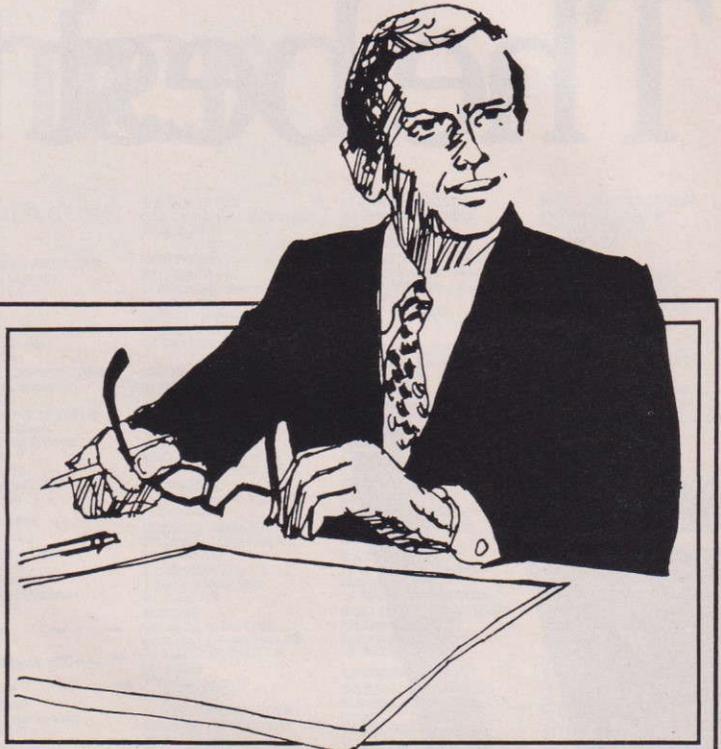
accounts of a "nominal ledger". This makes it possible to transfer only part of the system, for example the cash book, at one time.

The budgeting process is particularly simply presented, there is a choice of no budget, or of breaking the year's budget into quarters, calendar or lunar (four week) months and of spreading the budget equally across the year or variably. Likewise the selection of the nominal ledger codes has enormous flexibility, coupled with strong support of suggested codes broken down in great detail. Most users will need to make only minor changes to these and there is a sensible procedure at the start for printing out those that are selected as a permanent memorandum for the clerk who has to type in the data.

The main anxiety expressed by my own accountant when I discussed computerising my accounts, was that one can end up with worse confusion than with a manual system. To avoid this ACCOUNTANT insists on printing out "audit trails" (details of all the transactions that have been entered), with their postings to the nominal ledger, to the debtor control account and to the VAT accounts. It will produce a completely adequate VAT return, query any account and its transactions and produce nominal ledger trial balances, either at the year end or at the end of the accounting period.

A variance report analyses the actual expenditure against budget for each account. It insists that all this be carried out before the month-end routine which, in order to save space on floppy disc, clears all individual transactions from the files and only carries forward month-end balances. It warns you to take a back-up copy of the data disc before doing this and to have produced all the necessary reports and audit trails.

A model accounting system is provided with some clear explanations of how the results of ACCOUNTANT can be used at the year end to produce profit-and-loss accounts and balance sheets. A full range of balance sheet accounts for reserves, suspense balances and capital account is provided and there is



provision for special cases such as partnerships. If other outputs are required, these can be produced (by those sufficiently skilful), in unlimited variety, by use of NUCLEUS, with which ACCOUNTANT is fully integrated.

There are some detailed criticisms. Most arise because accountants are obsessed with accuracy, whereas what businessmen are looking for is less work and more speed:

- I can pardon American spelling of "disks" but not "enter" for the "return" key.
- All single-key responses have to be followed with a "return".
- It leaves the operator to calculate VAT quantities.
- It uses a "batch" entry system; you have to calculate manually the total value of all the transactions in the batch.
- There is no facility for the "VATless" user to avoid all references to VAT in the program; instead he or she has to make countless nil entries.

CONCLUSION

I have tried many book-keeping and accounting programs designed for the BBC B on its own and found most of them hopeless. I am impressed with ACCOUNTANT's lucid hand book, the clarity of its screen explanations and the comprehensive range of its operations. A potential user could get the following advantages:

- A clean, crisp set of books with full audit trails, that will reduce the amount of work that his accountant has to do at the end of the financial year and thereby reduce his accountancy costs.
- Complete VAT returns at year-end or more frequently if required.
- The rapid provision of comparisons of actual expenditure and sales against budget, soon after the month end. Normally the work required to do this manually delays it beyond the time when effective action can be taken.
- Rapid production of trail balance so that any inquest

can be carried out while details are fresh in people's memories.

- Rapid solution of queries.

Despite my earlier reservations, there are substantial benefits. The price that will be paid to achieve them is that:

- It will undoubtedly take longer to post transactions using ACCOUNTANT than simply to write them into day-books.
- If the office is in a muddle when ACCOUNTANT is first used the process will be either uncomfortable or totally disastrous and time will be wasted to produce poor results at the end. However the improvement of office discipline and tidiness is in itself a great advantage, not likely to be achieved by any other method!
- Regularity of book-keeping becomes essential. My lazy habit of letting six months' invoices and receipts accumulate and then shutting myself away for three bad-tempered days would not work at all well under the ACCOUNTANT regime.

To the businessman willing to adapt in this way, I would offer the following advice:

- Play around with ACCOUNTANT for two or three days. Practice entering samples of your own transactions and practice the month-end routine before you delegate anything.
- If as a result you are confident your staff are able to use ACCOUNTANT, ask your own accountant to examine these tentative efforts, study the hand-book and confirm that

there are no obvious pitfalls.

- For at least the first month, (and many people would urge for the first year!) continue keeping books by hand, for safety's sake. It is highly probable that data will be lost most during the first few weeks.
- Buy enough (good quality) floppy discs so as to make two backups of every data disc, each day.
- Spring-clean the book-keeper's office and organize sufficient filing trays, lever-arch files and other aids to being systematic. Arrange for the cleaners to dust daily and ensure windows are not left open so papers blow around.

If these careful procedures are carried out I see no reason why ACCOUNTANT should not produce an excellent set of books. It will not save money, indeed may actually increase book-keeping costs. However it will improve control which, if the business has potential for profitability, will soon recover these costs. However it does not provide an alternative to effective management accounting and careful budgeting and control of cash-flow.

MEMO TO FINANCE DIRECTOR

ACCOUNTANT will assist in keeping a good set of books and produce adequate VAT returns but does not provide total management information such as cost or cash-flow control.

```

INTERNISTE          CREDIT SALES          05 DAVICHI3    25/06/84
Batch number :      1          INVOICES

Default date : 25/06/84    Default nominal code: 100
                          Default description : Report on scrap

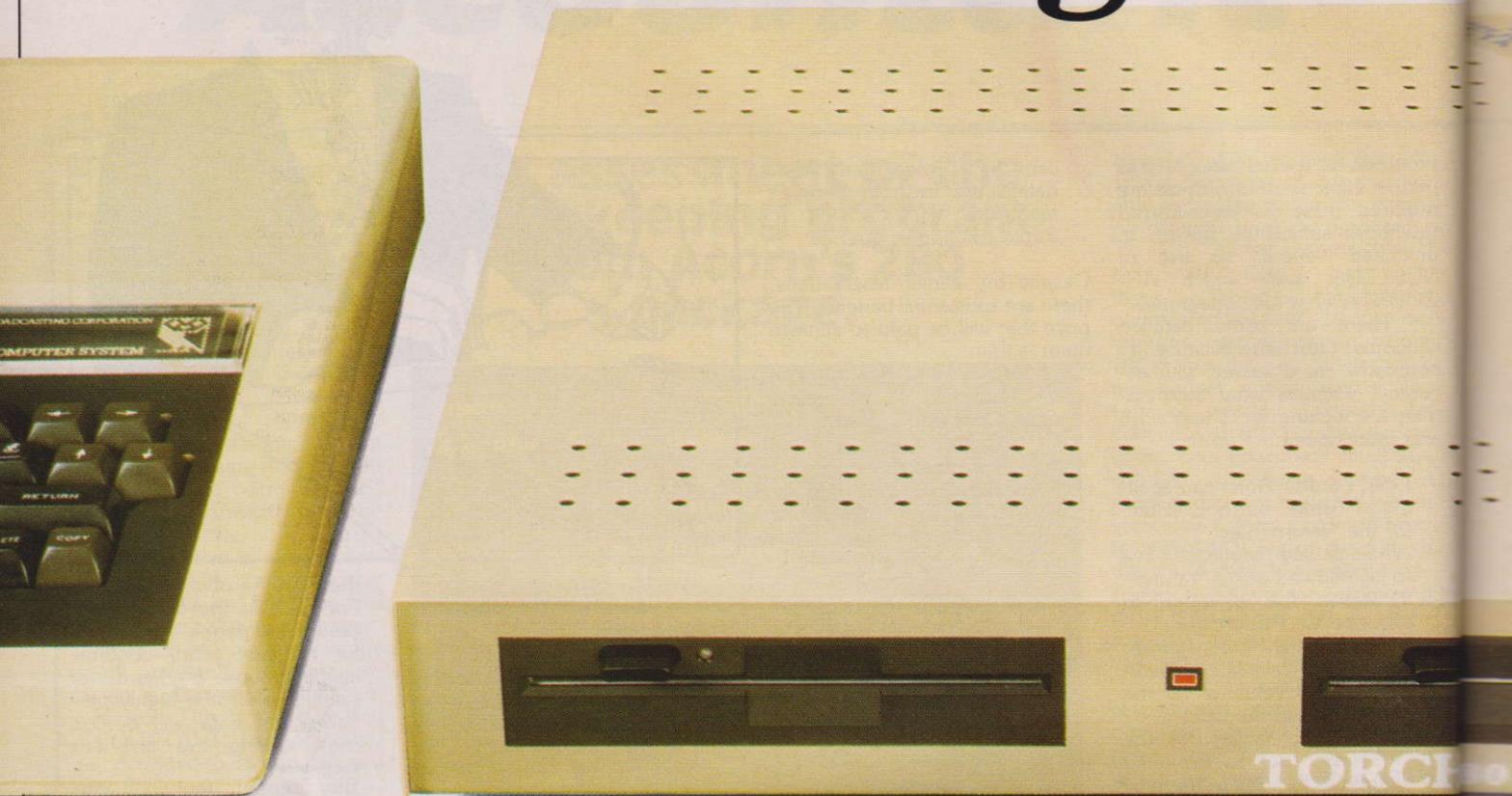
DATE   REF.NO.   NOM CODE   VALUE   VAT   VAT   TOTAL
25/06/84 1203     100       225.00  0

DESCRIPTION : Survey

MESSAGE: Nominal ledger a/c No. - up to 8 digits or 'ENTER' for default
    
```

2. Entering an invoice into the credit sales ledger; a pity "ENTER" is not altered to "RETURN", that VAT references cannot be deleted for the VATless and that the computer does not do the batch totalling

The best thing next



The BBC Model B Microcomputer is widely recognised as an impressive first computer for the home or the school, but its capabilities are restricted by its lack of data storage and the limitations of Basic for serious programming. For the user who needs more from this computer the Torch Z80 Disc Pack is a gateway to the world of advanced computing.

Model B's fitted with disc interface can be upgraded to full business machines by the Torch Z80 Disc Pack thereby offering the use of more powerful and flexible languages such as Fortran, Pascal, BCPL and Cobol while twin 400K disc drives provide a massive storehouse for information and rapid data transfer from disc to processor.

Torch Z80 Disc Pack
The Torch Z80 Disc Pack is the



proven upgrade for the BBC Model B microcomputer. It provides 800K of disc storage plus a Z80 second processor with 64K RAM running TORCH's own CP/M[®] compatible operating system based in ROM.

This advanced design means that almost all of the 64K RAM provided by the Z80 board is available for programming use - an advantage no other BBC micro upgrade can offer.

If your BBC micro has the Econet[®] option, there is a further benefit the Torch Z80 Disc Pack can offer. TORCHNET can link together up to 254 upgraded Model B's on a local area network, so for enthusiasts, clubs, schools and businesses it is a simple and low-cost way to achieve networking facilities.

The discs can be used for storage under the Acorn DFS system or for CP/M[®] programs and data.

A comprehensive software package is provided which includes word and data processing and a spreadsheet program, along with utility programs and manuals.

The Torch Z80 Disc Pack is recommended by the CCTA for government use.

At £699 the Torch Z80 Disc Pack is exceptionally good value.

Torch Z80 Extension Processor (ZEP100)

When fitted to a BBC system which already has compatible high quality twin 400K disc drives, the ZEP100 provides a complete business or scientific computer.

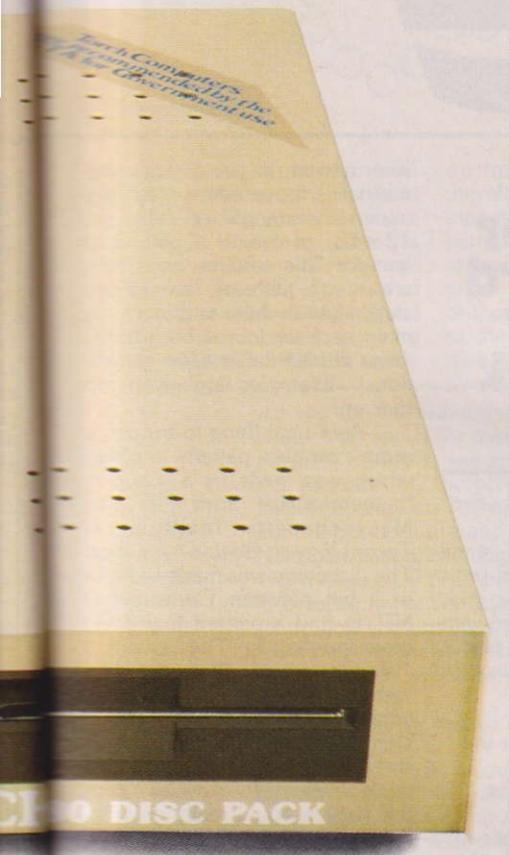
Alternatively, a ZEP100 may be fitted to a BBC system to enable it to be used as a Torchnet station.

The ZEP100, priced at £299, comes complete with full software support. There are already over 10,000 users of Torch computer systems.

Our customers include hospitals, universities, private businesses, the Government and schools.

If you are ready to take a step into the world of serious computing contact your local dealer listed on the facing page.

to a BBC micro.



Where to find your Torch dealer

- AVON**
MICROSTYLE
29 Belvedere, Lansdowne Road
Bath
Tel: 0255 334659
- BEDFORDSHIRE**
3D COMPUTERS
1 Manor Road, Caddington, Luton
Tel: 0582 458575
ABC COMPUTING
Systems House, Houghton Parrell
Dunstable
Tel: 0582 899640
BROADWAY ELECTRONICS
Aston Road, Bedford
Tel: 0234 58303
DATASINE
59 North Street, Leighton Buzzard
Tel: 0525 374200
- BERKSHIRE**
3D COMPUTERS
26 Stanley Road, Newbury
Tel: 0635 30047
DPCE (UK) LTD
26/28 Market Place, Wokingham
Tel: 0734 790703
MICROSTYLE
Newbury Computer Centre
47 Cheap Street, Newbury
Tel: 07535 55211
MICROWISE
21 Duke Street, Reading
Tel: 0734 591816
- BUCKINGHAMSHIRE**
MICRO MASTERS (RUISLIP) LTD
6 Windsor Street, Uxbridge
Tel: 0895 70766
MICROSTYLE
52 Friars Square, Aylesbury
Tel: 0296 25487
- CAMBRIDGESHIRE**
CAMBRIDGE COMPUTER STORE (2)
4 Emmanuel Street, Cambridge
Tel: 0223 358264
GCC (CAMBRIDGE) LTD
66 High Street, Sawston, Cambridge
Tel: 0223 835330
HI-TEK DISTRIBUTION LTD
Trafalgar Way, Bar Hill, Cambridge
Tel: 0954 81931
- CHESHIRE**
3SL COMPUTERS LTD
Brook House, 513 Crewe Road
Whealock
Tel: 09367 61249, 09367 61798
FAIRHURST INSTRUMENTS LTD
Dean Court, Woodford Road
Wilmslow
Tel: 0625 525694
NATIONAL MICRO CENTRES LTD
36-38 St. Petersgate, Stockport
Tel: 061 428 8060
STOCKPORT MICRO CENTRE
4 Brown Street, Stockport
Tel: 061 480 0539
- CLEVELAND**
AUTOCALL COMPUTERS LTD
17 Middlesbrough Road, Southbank
Middlesbrough
Tel: 0642 488618, 0642 722064
CUSTOMISED ELECTRONICS
155 Morton Road, Middlesbrough
Tel: 0642 247727
- CORNWALL**
MICROTEST LTD
18 Normandy Way, Bodmin
Tel: 0208 31717
- DERBYSHIRE**
FBC SYSTEMS LTD
10 Main Centre, London Road, Derby
Tel: 0332 365280
NASTAR COMPUTER SYSTEMS LTD
57 Saltergate, Chesterfield
Tel: 0246 207048
- DEVON**
A & D COMPUTERS
6 City Arcade, Fore Street, Exeter
Tel: 0392 77117
DEVON COMPUTERS LTD
The White House, 39 Totnes Road
Paignton
Tel: 0803 526303
- DORSET**
LANSDOWNE COMPUTER CENTRE
5 Holdenhurst Road, Bournemouth
Tel: 0202 20165
LANSDOWNE COMPUTER CENTRE
14 Ardale Centre, Poole
Tel: 0202 67091
- DURHAM**
DARLINGTON COMPUTER SHOP
75 Bondgate, Darlington
Tel: 0325 487478
- ESSEX**
AKHTER INSTRUMENTS LTD
28 Burnt Hill, Harlow
Tel: 0279 443521
CAPRICORN COMPUTER CENTRE
37-38 Osborne, Colchester
Tel: 0206 68471
ESSEX COMPUTER CENTRE LTD
216 Moulsham Street
On-The-Parkway, Chelmsford
Tel: 0245 358702
MICROCORE LTD
5 Broomfield Road, Chelmsford
Tel: 0245 264230
- GLOUCESTERSHIRE**
COMPUTER SHACK
14 Pitville Street, Cheltenham
Tel: 0242 584343
TELEMATICS WEST
31 Dyer Street, Cirencester
Tel: 0285 68349
- HAMPSHIRE**
ADACS
Foresters House, 4 London Road
Andover
Tel: 0264 52187
ELECTRONEQUIP
34/38 West Street, Fareham
Tel: 0329 230670
COMPUTERWAY LTD
Brook House, Milbrook Road East
Southampton Road East
Tel: 0703 38868, 0483 62626
FERRANTI AND CRAIG
5 New Market Square, Basingstoke
Tel: 0256 64015, 0256 69966
- HERTFORDSHIRE**
3D COMPUTERS
Greystone Works, The Green
Croxley Green, Rickmansworth
Tel: 0923 779250
COMPUTER PLUS
47 Queens Road, Watford
Tel: 0923 33927
- HUMBERSIDE**
THE COMPUTER CENTRE
(HUMBERSIDE) LTD
26 Anlaby Road, Hull
Tel: 0482 26297
HOLDERNESS COMPUTER
SERVICES
17 Westgate, Patrington, Hull
Tel: 0964 30225
- ISLE OF MAN**
TYPESTYLE LTD
1 Avondale Court, Onchan
Tel: 0624 24650
- KENT**
DATA STORE,
THE (MICRO) COMPUTERS)
6 Chatterton Road, Bromley
Tel: 01-460 8991
WATERS COMPUTER SYSTEMS
Army and Navy PLC, High Street
Bromley
Tel: 01-460 9991
KENT MICROCOMPUTERS LTD
57 Union Street, Maidstone
Tel: 0622 52784
MEDWAY COMPUTERS LTD
141 New Road, Chatham
Tel: 0634 826080
MODATA LTD
30 St. Johns Road, Tunbridge Wells
Tel: 0892 41555
- LANCASHIRE**
CABIN COMPUTERS LTD
183 St. Helens Road, Bolton
Tel: 0204 652100
DOUBLELINE LTD
Unit 2, Forrest Way
Gateworth Industrial Estate,
Great Sankey, Warrington
Tel: 0925 573212
NORTHERN COMPUTERS
Churchfield Road, Frodsham
Warrington
Tel: 0928 35110
- LEICESTERSHIRE**
D. A. COMPUTERS LTD
104 London Road, Leicester
Tel: 0533 549407
PERCY LORD & SON
83 Blaby Road, Wigston
Tel: 0533 785033
- R. H. MURCOTT LTD**
Great Central Road, Loughborough
Tel: 0509 214444
- LINCOLNSHIRE**
FELIX COMPUTERS
63 Wide Burgate, Boston
Tel: 0203 54321
OAKLEAF COMPUTERS
Balls Yard, Dysart Road, Grantham
Tel: 0476 60000
- LONDON**
3D COMPUTERS
114 Gunnersbury Avenue, Ealing, W5
Tel: 01-992 5855
BRAINSTORM COMPUTER
SOLUTIONS
103a Seven Sisters Road, N7
Tel: 01-272 6619, 01-263 6926
CHROMASONIC
48 Junction Road, Archway, N19
Tel: 01-263 9493
LION HOUSE (RETAIL) LTD
227 Tottenham Court Road, W1
Tel: 01-580 7383
ACORN COMPUTERS LTD
10 Henrietta Street, WC2
Tel: 01-379 7358
MICROAGE
Unit 72, Capitol Park Estate
Capitol Way, Edgware Road, NW9
Tel: 01-906 3666, 01-957 7119
MICROFAST
57 Hoxton Square, N1
Tel: 01-729 1778
WATERS COMPUTER SYSTEMS
Barkers, High Street, Kensington, W8
Tel: 01-837 5432
PILOT SOFTWARE CITY
32 Rathbone Place, W1
Tel: 01-536 2666
TECHNOMATIC LTD
17 Burnley Road, NW10
Tel: 01-452 1500, 01-450 6597
TOMORROWS WORLD TODAY
27-29 Oxford Street, W1
Tel: 01-439 7799
TRIGON COMPUTER SYSTEMS LTD
98 Victoria Road, NW10
Tel: 01-961 1466
OFF RECORDS
Computer House, 59 Battersea Rise
SW11 Tel: 01-223 7730
SYSGO LTD
Hawkehouse, Green Street,
Sunbury on Thames
Tel: 09327 89571
TWICKENHAM COMPUTER CENTRE
72 Heath Road, Twickenham
Tel: 01-891 4991
- MANCHESTER, GREATER**
BYTE SHOP
THE (MANCHESTER) LTD
11/12 Gateway House,
Piccadilly Station Approach
Manchester
Tel: 061 236 4737
GM CUS MICRO SERVICES
The St. Thomas Centre
Ardwick Green North, Manchester
Tel: 061 273 6480
NSC COMPUTER SHOPS
29 Hanging Ditch, Manchester
Tel: 061 832 2269
- MERSEYSIDE**
DATA EXCHANGE LTD
Exchange House,
164 New Chester Road, Birkenhead
Tel: 051 647 9185/6
MICROMAN (SHAVE ELECTRONICS)
Unit 1a, Rainford Ind. Estate,
Mill Lane, Rainford, St. Helens
Tel: 074488 5242, 074488 5295
- MIDLANDS (WEST)**
BYTE SHOP, THE (BIRMINGHAM)
94-96 Hurst Street, Birmingham
Tel: 021-622 3165
WATERS COMPUTER SYSTEMS
Rackhams, 35 Temple Row
Birmingham
Tel: 021 236 3333
STARMER COMPUTERS LTD
Richmond House, 69 School Street
Wolverhampton
Tel: 0902 73173, 0902 20251
WALTERS COMPUTER SYSTEMS
12 Hagley Road, Stourbridge
Tel: 03843 70811
CAMDEN COMPUTER SYSTEMS
462 Coventry Road, Small Heath
Birmingham
Tel: 021 771 3636
COMPUTACCOUNT
21 Spring Hill, Ladywood,
Birmingham
Tel: 021 236 3455
- J B C MICRO SERVICES LTD**
200 Earlsdon Avenue North,
Earlsdon, Coventry
Tel: 0203 73813
MICRO BUSINESS CENTRE LTD
Wolverhampton Computer Centre
17-19 Lichfield Street
Wolverhampton
Tel: 0902 29007/29021
- NORFOLK**
JARROLD OFFICE EQUIPMENT
Barrack Street, Norwich
Tel: 0603 660661
SYNERGY LTD
E Block, University Village, Norwich
Tel: 0603 503015
ELECTRONEQUIP
17 Tenneyson Avenue, Kings Lynn
Tel: 0553 3782
- NOTTINGHAMSHIRE**
ATAN COMPUTERS LTD
T/A COMPUTER MARKET
27 Goosegate, Nottingham
Tel: 0602 586454
G. A. COMPUTERS LTD
20/22 High Street, Ruddington
Nottingham
Tel: 0602 213492, 0602 21225
H N & L FISHER (HUTHWAITE) LTD
264 Huthwaite Road, Nottingham
Tel: 0623 553437
- OXFORDSHIRE**
ABSOLUTE SOUND AND VIDEO
19 Old High Street, Headington
Oxford
Tel: 0955 65961
- SHROPSHIRE**
COMPUTER VILLAGE LTD
Walker House, Telford Town Centre
Telford
Tel: 0952 506771
- STAFFORDSHIRE**
CANNOCK ITEC
Chaseley House
New Penkridge Road, Cannock
Tel: 05435 77039
COMPUTERAMA
59 Foregate Street, Stafford
Tel: 0785 41899
PEN SPEED LTD
Wharf House, Fradley Junction
Alrewas, Burton on Trent
Tel: 0283 793336
- SUFFOLK**
BRAINWAVE MICROS LTD
24 Crown Street, Ipswich
Tel: 0473 50965
S. J. EMERY & CO
10 Market Place, Bungay
Tel: 0986 2141
- SURREY**
3D COMPUTERS
231 Towpath South, Surbiton
Tel: 01-337 4317
3D COMPUTERS
30 Station Road, Belmont, Sutton
Tel: 01-642 2534
CROYDON COMPUTER CENTRE
29a Brigstock Road, Thornton Heath
Tel: 01-889 1280
DATASOLVE LTD
99 Staines Road West
Sunbury on Thames
Tel: 09327 85566
J. S. SIMNET COMPUTERS LTD
Unit 14, St. Georges Ind. Estate,
380 Richmond Road,
Kingston-Upon-Thames
Tel: 01-541 1495
VULCAN COMPUTING LTD
32 Guildford Road, Farnham
Tel: 0252 724182
- SUSSEX**
CASTLE ELECTRONICS
7 Castle Street, Hastings
Tel: 0424 426844
COMPUTA4 LTD
22 Queens Road, Brighton
Tel: 0273 204228
- TYNE & WEAR**
HCSS
533 Durham Road, Low Fell
Gateshead
Tel: 0632 821924
OFFICE INTERNATIONAL
W. Harold Spink Ltd
112/114 Pilgrim Street
Newcastle-Upon-Tyne
Tel: 0632 610285
- WARWICKSHIRE**
CARVELLS OF RUGBY
9 Bank Street, Rugby
Tel: 0788 55275
- WATERS COMPUTER SYSTEMS**
Rackhams, 76 The Parade
Leamington Spa
Tel: 0926 27900
- WILTSHIRE**
WILTSHIRE MICRO CENTRE
Unit 9, Central Trading Estate
Signal Way, Old Town, Swindon
Tel: 0793 612299
- YORKSHIRE (SOUTH)**
COM-TEC COMPUTER CENTRE
23 Sheffield Road, Barnsley
Tel: 0226 46972, 0226 296100
WATERS COMPUTER SYSTEMS
Rackhams, 50 High Street, Sheffield
Tel: 0742 28121
- YORKSHIRE (WEST)**
ELTEC COMPUTERS LTD
Lister Hills, Science Park
Campus Road, Bradford
Tel: 0274 72252
GTM COMPUTERS LTD
864 York Road, Leeds
Tel: 0532 647474
MICROPOWER
Northwood House, North Street
Leeds
Tel: 0532 458800
- WALES, NORTH**
TECHNEG CLWYD TECHNICS LTD
Unit 4b, Antelope Ind. Estate
Rhydymwyn, Mold, Clwyd
Tel: 0352 83766
TRYFAN COMPUTERS LTD
57 Madoc Street, Llandudno
Gwynedd
Tel: 0492 70802
- WALES, SOUTH**
BUCCON LTD
35-36 Singleton Street, Swansea
West Glamorgan
Tel: 0792 467880
GWENT COMPUTERS
95 Chepstow Road, Newport, Gwent
Tel: 0633 841760
HIGH ANDS COMPUTER SYSTEMS
27 Murray Street, Llanelli, Dyfed
Tel: 05542 70517
PRINTRONIC LTD
Hill House, Raglan, Gwent
Tel: 0291 690214
- SCOTLAND**
ANDREW WHYTE & SON LIMITED
Microworld, 12 Leven Street
Tolcross, Edinburgh
Tel: 031 228 1111
WEST COAST
PERSONAL COMPUTERS
20 Wellington Square, Ayr
Tel: 0292 285082
COMMSCOTT LTD
30 Gordon Street, Glasgow
Strathclyde
Tel: 041 228 4878
COMPUTER SERVICES (SCOTLAND)
86/90 Westlaw Place
Whitehill Ind. Estate, Glenrothes, Fife
Tel: 0592 73710
LORNE COMPUTER SERVICES LTD
12 High Street, Oban, Argyll
Tel: 0631 65635
SILICON CENTRE
7 Antigua Street, Edinburgh
Tel: 031 557 4546
- IRELAND (NORTHERN)**
CEM MICROCOMPUTER SERVICES
117 University Street, Belfast
Tel: 0232 244111, 0232 243564
- IRELAND (SOUTHERN)**
LENODAC DATA SYSTEMS
8 Dawson Street, Dublin 2
Tel: 0001 710226, 0001 710796

TECHNICAL SPECIFICATION

Torch Z80 Extension Processor (ZEP100) Processor - 4 MHz Z80A

Memory - 64K RAM Accessible from the Z80

Firmware - 8K CCCP ROM on ZEP100 card
- 16K MCP ROM for BBC board

Software provided

- TORCH CPN CP/M® compatible O/S
- Disc Utilities
- Music System
- Misc. Utilities
- PERFECT® SOFTWARE comprising -
- Perfect Writer - Word Processor
- Perfect Speller - Spelling Checker
- Perfect Calc - Spreadsheet
- Perfect Filer - Database

Other Operating Systems Available

- UCSD p-System

Torch Z80 Disc Pack. As for ZEP100 but includes 2 x 400K 5 1/4" floppy disc drives with separate power supply unit.

Unicorn. These products are part of the best selling range of add-ons to the BBC Micro by Torch Computers Ltd, Abberley House, Great Shelford, Cambridge, CB2 5LQ. Tel. (0223) 841000. Telex 818841 TORCH G.

TORCH
COMPUTERS
Lighting the way ahead.

Prices quoted are ex-VAT. CP/M is a registered trademark of Digital Research Inc. Econet is a registered trademark of Acorn Computers Ltd. Perfect Software is a registered trademark of Perfect Software Inc. Text, graphics and keyboard provided by BBC Model B.

Life

John Kortink

This program plays a game called "Life" a fascinating game invented by an English mathematician Conway.

The game plays all by itself, supervised by one or more persons who only have to determine the start position of the game. It is played on a large grid, in which the individual squares will be referred to as "cells". These cells can be in two conditions: empty or full (dead or alive if you wish).

In the first "generation" of cells, the player(s) determine which cells will be alive and which are dead. After that the computer will apply three rules on the situation of every cell, which determine the next state that the cells will be in. The rules are based on the cells being adjacent to each other (each cell has eight adjacent cells). These cells will cause the cell to "die" or cause the cell to "survive" or be "born". The rules are:

1. A living cell that has two or three living neighbours survives and will remain alive.
2. A living cell that has less than two or more than three alive cells adjacent to it will die.
3. A dead cell that has exactly three adjacent alive cells will be born.

These three rules are applied all at the same time on every cell on the grid, generation after generation, until the end.

The game is absolutely fascinating, and because of the simple but very carefully thought out rules, most generations of cells will survive for a long time or even never die. The program will generate beautiful moving patterns when the start position is chosen well, and the player(s) will discover more and more patterns that expand, die out, oscillate, move or just remain static. The possibilities are infinite!

THE ULTIMATE GAME

The implementation I have made of "Life" on the BBC can be considered to be the ultimate one. It has a very large grid of 80x60 cells and calculates new fields

One of the most fascinating games ever devised and all the hard work is done by your computer. Just sit back and enjoy Life!

with the ultimate speed of about a second! The calculations and the printing are done in highly optimised machine code, and it works about 500 times faster than it would have, were it written in BASIC. In BASIC you would have to wait about eight minutes for the next generation!

The game has features that make it comfortably easy for the player. It operates in two modes, called "play" and "adjust", so, you can make all kinds of adjustments to the grid or set up a new start position. The top two screen lines are used for indicating the mode you're in, the number of generations that have passed, and the number of "living" cells on the grid. In "play" mode the following controls are available:

Spacebar	Will display the next generation and the numbers are adjusted to the new situation on the grid.
Copy	Allows an automatic display of 30 generations, one after the other, so you don't have to press the spacebar each time. If you want to stop the screen in the middle of the 30-generations option, you can press CTRL and SHIFT together, and each time you want the next generation you should release one of the keys shortly.
f5	Will only work when you're not in 30-generation mode, and will switch to "adjust" mode.
Escape	Will reRUN the

program, so you can start again.

In "adjust" mode a small square will appear. This is your cursor for manipulating the grid, and you can move it around with the cursor-controls to the places you want to alter. The controls in "adjust" mode are:

f0	clears the cell at the cursor-position
f1	fills the cell at the cursor-position
f2	resets the number of generations to 1 (this will be displayed in "play" mode only)
f3	clears the whole field, but not the number of generations
f4	fills 100 randomly chosen cells in the middle of the grid
f5	returns you to "play" mode
Escape	acts as in "play" mode

The cursor will appear on the other side of the screen if you pass over the edges. The grid has "wrap-around" on the left and right-hand sides, which means that if cells wander off the screen, they will reappear on the opposite side. The bottom and top lines are where the grid stops, so you have to watch out for the outer edges, as things can go wrong here. Only large generations or small generations that have survived for a long time tend to wander off the screen, but in most situations everything will go just fine, as the grid is big enough.

INEXHAUSTIBLE

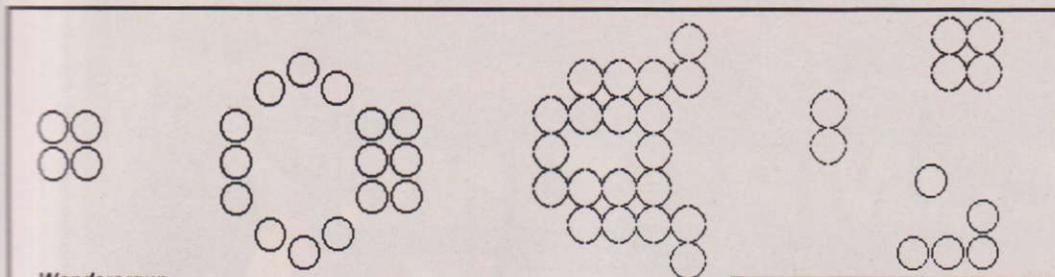
A few tips to get beautiful patterns: keep your start positions

symmetrical if you want symmetrical movements, eg just make a rectangle of cells, say 12x12, or create a pattern of lines or little squares etc. There are many patterns that remain static after a while, and lots more even oscillate (come back at the same situation after a few generations). Examples are given further on.

As a final thing to try out, a more complex pattern is given, which was made by a group of mathematicians from MIT, the Massachusetts Institute of Technology in Boston, America. The discovery was made because of a bet between Conway and MIT to find a pattern that could grow indefinitely. The result is a "Wanderergun" that oscillates with a frequency of 30 generations and fires a "wanderer" every cycle. The wanderer is a small pattern that moves a grid position every four cycles. Thus this pattern could really grow indefinitely! The program is of course capable of such little discoveries too! Try to find another pattern that grows indefinitely! Altogether the program is bound to keep you busy for hours and hours. You will discover all kinds of patterns and the possibilities are inexhaustible. I hope you'll enjoy the program!

HOW IT WORKS

To calculate the new situations, the machine code routines operate on memory locations &1C90 to &2F4F (4800 locations, 80x60) which all represent a cell on the grid. The top left cell has &1C90, the one right of that &1C91 etc. A 1 in those locations after calculation means the cell is full, and 0 means the corresponding cell is empty. Also some memory locations just "before" and "after" that block are used for calculations, making the total calculation-block &1C3F to &2FA1. The machine code calculates the new situation by looking at all the cells, counting the full cells of the eight cells adjacent to them and, determining the new situation, but doesn't directly alter the location of those cells. Instead it can be said that the computer "marks" the cells to

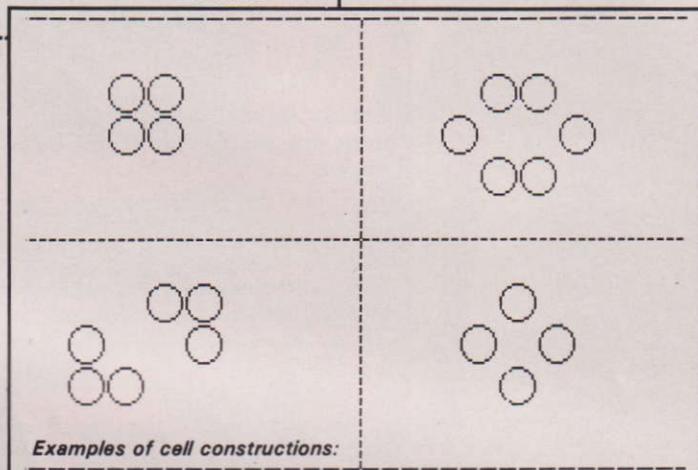


Wanderergun

become full or empty and then, after all the cells are "marked" the mark is used to determine the final new situation. This is because the rules have to be applied on all the cells at the same time, so they must not be altered directly while marking is going on. The machine code is highly

optimised for speed, and therefore quite complex. An explanation is therefore not relevant, and would only make sense to machine code programmers with experience, so I won't bother you with it. The working of the program will now be explained line by line:

10-50	An ego-trip for the author.
60	Dimension space for machine code.
70	Pressing ESCAPE will reRUN the program (leave this line out until the program is fully debugged!).
80-100	Initialises, and lets the machine code be generated.
110-200	Main loop, until the end.
120-140	Next generation and display it.
150-160	Get a key (COPY, f5 or SPCbar).
170	f5 pressed, switch to "adjust" mode then join the main loop without counting another generation.
180	COPY pressed, fills keyboard buffer with 29 extra spaces, which will be read by GET every time, until empty.
190	Call new field to calculate next generation.
220-320	PROCinitialise Blanks cursor, sets colours, set up screen, zero numbers, clear field, program function keys and cursor keys to generate ASCII-codes, and simulate f5 to be pressed (direct fall into "adjust").
340-490	PROCadjust Makes the adjustments to the grid.
350	Prints "adjust" mode.
360	Set cursor to middle of screen.
370-470	Get key and perform action until f5 pressed to return to "play" mode.
380	Put cursor-square on screen and flush keyboard buffer.
390	Get key (fl-f5 or COPY or cursor keys).
400	Clear cursor-square.
420	f3 pressed, clear grid and display it.
410	f2 pressed, number of generations = 1.
430	f4 pressed, randomly place full cells 100 times.
440	f0-f1 pressed, clear or fill appropriate cell.
450-460	Adjust cursor-position if keys pressed.
470	End if f5 pressed.
480-490	Print "play" mode and exit.
510-530	PROCcross Uses inverse plotting (GCOL 4,0) to plot the cursor square, so the second time called the square will disappear again.
550-1140	PROCassembler Assembles machine code.
560-590	Give zero page locations used a name.
600-610	Set up loop for two passes with OPT.
620-810	Routine newfield, calculates new generation.
830-880	Routine clearfield, clears grid.
900-1110	Routine displayfield, displays grid on Mode1 screen (accessing screen memory directly) and counts the full cells.
1130-1140	Next pass and exit.
1160-1170	FNstr(N%)
1180-1190	FNcalc Calculates right address of location for the cell at the cursor-square.



Examples of cell constructions:

Variables

name	use
ass%	start address machine code
Generation	holds the generation number
key	holds number of key pressed
A%,X%,Y%	used for OSBYTE call 138, filling the keyboard buffer
N%,N	loop counters
xpos	x coordinate in PLOT format of cursor square on screen
ypos	y-coordinate in PLOT format of cursor-square on screen
C%	dummy for colour and code in line 440
add1/adh1	vector for calculations in machine code part
adl2/adh2	vector for screen-access in machine code part
count	counter location in machine code part

COMMENTS

Finally a few comments on the program. It uses almost every byte available in a Model B, so adding lines is not advisable. The program occupies memory from about &E00 to &1920, the machine code from &1920 to about &1A30, variables from BASIC from about &1A30 to &1C00 and the grid-memory for calculation of the new cells from &1C3F to &2FA0, so only a few bytes are unused, and care must be taken not to use occupied memory.

The program will work on a model B or A with 32K and OS 1.20 or 1.00 (as I have made extensive use of FX-calls and another OSBYTE call), and Electron. Changes are difficult, but not impossible: all key-input has to be converted to inkey (-xx) or other keys have to be used for all the functions, the automatic 30-generation option has to be

skipped completely, and all OSBYTE/FX-calls have to be removed. For owners of BASIC 1, changes have to be made in the machine code part. Line 620 becomes:

```
620.point:] :!P% =
&50020100: P%!4 =
&A2A1A052:P% = P% + 8:
[OPTN
```

and line 1110 becomes:

```
1110.data:] :!P% = 0:P%!4 =
&0E0E0E00: [OPTN
```

This will not make the program too big, and fits nicely. You can find out your OS by typing FXO, and your BASIC can be found by pressing BREAK and typing REPORT, which will display a (C) message from Acorn. 1981 indicates BASIC 1, 1982 BASIC 2.

CONTINUED OVER

MODEL B COMPUTING

£3.99

For 32K BBC Micros
Over 110K Of Programs Ready To RUN

● **3 Original Games**

Arcade, Adventure and Strategy – more fun, more value – only from Argus!

● **UTILITIES**

Gamesters delights galore – improved graphics, sounds, disassemblers – it's all here!

● **On screen reviews of newly launched games**

News and views of the wonderful, whacky world of home computing



'NO Quibble'
GUARANTEE
Quality Assured
Loading

Model B Computing adds a new dimension to your micro!

Run this Argus Model B tape and you'll soon see why it's Britain's top selling tape magazine. Each issue gives you a variety of exciting and challenging games to play, reviews of other newly released software plus valuable utilities enabling you to write your own programmes and games.



Stretch your imagination and skills with Model B Computing – available every other month from WH Smith, Menzies and other leading stores.

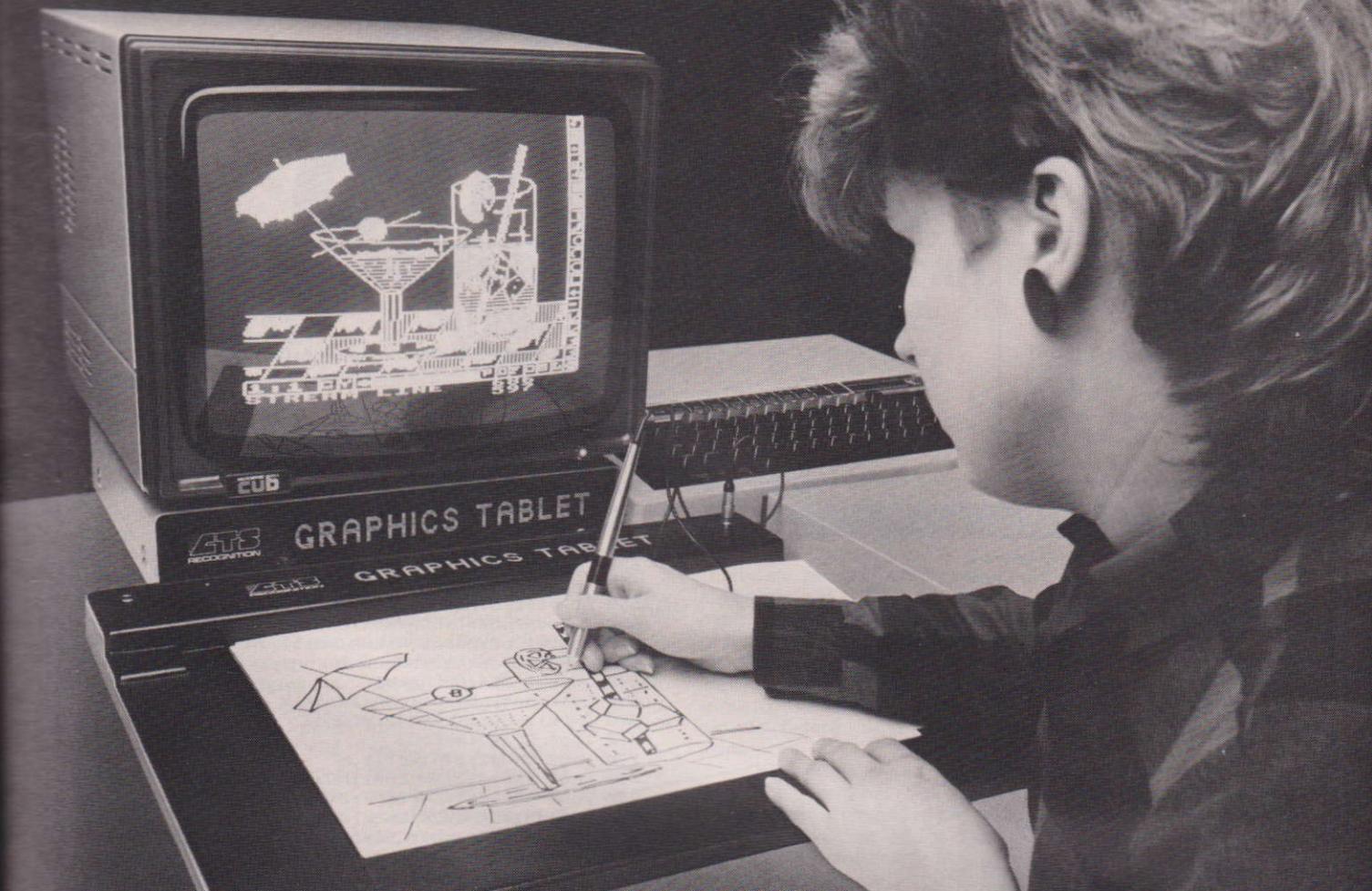
(You'll see them advertised on TV from September!)

Get your copy today!

Argus Tape Magazines produced by
ARGUS PRESS SOFTWARE

1 Golden Square, London W1R 3AB
Telephone: 01 437 0626

CTS GRAPHICS TABLET + CADPAK SOFTWARE = THE BEST IN BBC GRAPHICS



The CTS Graphics Tablet is a highly sophisticated device enabling graphic drawings and designs to be input directly into the computer by the most natural method known to man.

Data entry can be via an electronic pen or using a crosswire cursor, ensuring pin-point accuracy every time. The tablet, together with the CADPAK software, adds up to what we believe is the most sophisticated graphics package currently available for the BBC-B Micro.

But why stop here . . . ?

The experienced programmer can make full use of the tablet's high resolution for all sorts of design and menu selection applications.

Many schools, colleges and businesses have already found the CTS Graphics Tablet to be invaluable . . . Wouldn't you?

For further information, ring Julie Davis on (0273) 421509, or fill in the coupon.

CTS RECOGNITION

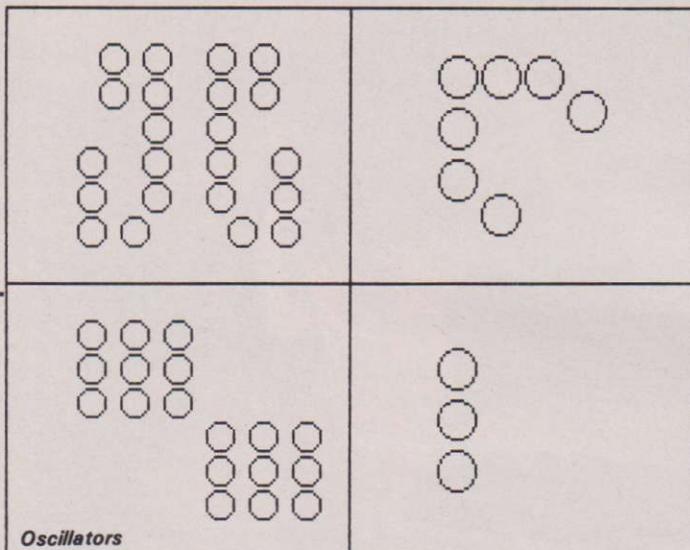
North Street, Portslade, Brighton, East Sussex BN4 1ER
Telephone: Brighton (0273) 421509 Telex: 87488 ABSBRI G

Please send me further information about The CTS Graphics Tablet.
£495 + VAT



Name _____
Address _____

Telephone _____



Oscillators

PROGRAM LISTING

```

10 REM*****
20 REM Life by John Kortink
30 REM JK-programs
40 REM 6-1984 (C) JK'84
50 REM*****
60 DIM ass% 265
70 ONERRORRUN
80 MODE1
90 PROCassembler
100 PROCinitialise
110 REPEAT
120 Generation=Generation+1
130 CALLdisplayfield
140 COLOUR1:PRINTTAB(27,0);FNstr(Generation);TAB
(27,1);FNstr(!alvl AND&FFFF)
150 REPEATkey=6ET
160 UNTILkey=149ORkey=135ORkey=32
170 IFkey=149 PROCadjust:GOTO130
180 IFkey=135 AX=138:X%=0:Y%=32:FORN%=1TO29:CALL
&FFF4:NEXT
190 CALLnewfield
200 UNTIL FALSE
210
220 DEFPROCinitialise
230 VDU23;8202;0;0;0;
240 VDU19;7;0;0;19,2,5;0;19,3,4;0;
250 COLOUR3:PRINTTAB(0,0)"Mode"TAB(15)"Generatio
n"TAB(15,1)"Full cells"
260 PRINTTAB(0,1)"Life ";:COLOUR2:PRINT"80x60"
270 Generation=0
280 CALLclearfield
290 *FX138 0 133
300 *FX225 144
310 *FX4 1
320 ENDPROC
330
340 DEFPROCadjust
350 VDU7:COLOUR2:PRINTTAB(6,0)"Adjust"
360 xpos=38*16:ypos=28*16
370 REPEAT
380 PROCcross:*FX15 1
390 REPEATkey=6ET:UNTIL(key>135ANDkey<140)OR(key
>143ANDkey<150)
400 PROCcross
410 _IFkey=146 Generation=1
420 IFkey=147 CALLclearfield:CALLdisplayfield
430 IFkey=148 FORN%=1TO100:?((&1C90+80*NRND(38)+80
0+NRND(58)+10)=1:NEXT:CALLdisplayfield
440 IFkey=144 ORkey=145C%=key-144:GCOL0,C%:?FNca
lc=C%:MOVExpos,ypos+4:PLOT0,0,10:PLOT81,10,-10:PLD
T81,0,10
450 xpos=xpos+((key=136)*(16+1280*(xpos=0)))-((k
ey=137)*(16+1280*(xpos=1264)))
460 ypos=ypos+((key=138)*(16+960*(ypos=0)))-((ke
y=139)*(16+960*(ypos=944)))

```

```

470 UNTILkey=149
480 VDU7:PRINTTAB(6,0)"Play "
490 ENDPROC
500
510 DEFPROCcross
520 GCOL4,0:MOVExpos-8,ypos-4:PLOT1,24,0:PLOT1,0
,24:PLOT1,-24,0:PLOT1,0,-24
530 ENDPROC
540
550 DEFPROCassembler
560 ad1=&80:adh1=&81
570 ad12=&82:adh2=&83
580 alvl=&84:alvh=&85
590 count=&86
600 FORN=0TO2STEP2:P%=ass%
610 [OPTN
620 .point EQU&50020100:EQU&A2A1A052
630 .newfield
640 LDA#&1C:STAadh1:LDA#&3F:STAad11
650 .block LDX#7:LDA#0:STAcoun
660 .getb1 LDYpoint,X:LDA(ad11),Y
670 LSRA:BCCnexb1:INCCoun
680 .nexb1 DEX:BPLgetb1
690 LDXcount:LDY#81:LDA(ad11),Y
700 AND#1:BEQco1:CPX#2:BEQco2
710 .co1 CPX#3:BNEco3
720 .co2 ORA#2:STA(ad11),Y
730 .co3 INCad11:BNEco4:INCadh1
740 .co4 LDAad11:CMP#&FF:BNEblock
750 LDAadh1:CMP#&2E:BNEblock
760 LDA#&1C:STAadh1:LDA#&50:STAad11
770 LDA#0:STAcoun:LDY#&40
780 .rotate LDA(ad11),Y
790 LSRA:STA(ad11),Y:INY:BNERotate
800 INCadh1:LDAadh1:CMP#&2F:BNERotate
810 RTS
820
830 .clearfield
840 LDA#&1B:STAadh1:LDA#&A1:STAad11
850 LDY#&9E:LDA#0
860 .clear STA(ad11),Y:INY:BNEclear
870 INCadh1:LDXadh1:CPX#&2F:BNEclear
880 RTS
890
900 .displayfield
910 LDA#&1C:STAadh1:LDA#&40:STAad11
920 LDA#&35:STAadh2:LDA#&00:STAad12
930 STAcoun:STAalvl:STAalvh
940 .display LDX#0:LDY#&50:LDA(ad11),Y
950 BEQdis0:LDX#4
960 INCalvl:BNEdis0:INCalvh
970 .dis0 LDY#3
980 .dis1 LDAdata,X:STA(ad12),Y:INX
990 DEY:BPLdis1:INCad11:BNEdis2
1000 INCadh1:LDAadh1:CMP#&2F:BNEdis2
1010 RTS
1020 .dis2 INCCoun:LDAcoun:CMP#80
1030 BNEdis4:LDA#0:STAcoun
1040 LDAad12:AND#4:BNEdis3
1050 LDAad12:SEC:SBC#&74:STAad12
1060 LDAadh2:SBC#2:STAadh2:BCSdisplay
1070 .dis3 LDAad12:CLC:ADC#4:STAad12
1080 BCCdisplay:INCadh2:BNEdisplay
1090 .dis4 LDAad12:CLC:ADC#8:STAad12
1100 BCCdisplay:INCadh2:BNEdisplay
1110 .data EQU0:EQU&0E0E0E00
1120
1130 JNEXT
1140 ENDPROC
1150
1160 DEFFNstr(N%)
1170 =RIGHT$("000"+STR$(N%),4)
1180 DEFFNcalc
1190 =&1C90+(59-(ypos/16))*80+xpos/16

```

Sorting on Index

Mark Webb

Silversoft has set out to provide an easy to use disc based filing system, a no frills but equally no complications, database. It's a standard sequential file with a separate index held in RAM, and stored as a separate file on your data disc.

Index comes on disc and boots up to a title page and an initialisation sequence. This sequence sets up the program to work with the combination of hardware available and in use for this particular session.

The hardware concerned is disc drives and printer. If we answer "yes" to printer, we are invited to set the BBC to send or not to send carriage returns, to enter a short sequence of control codes to trigger special print facilities (Epson compatible) and to specify the page length we wish to work with. The program will work with a single or double disc drive configuration. With a single drive, prompts are issued throughout the program to remind the user to swap between data and program discs.

Index does not however utilise the second side of a double sided disc, and most 80 track drives are double sided. This

What useful features can Silversoft's database offer the disc system user?

means that only two files can be stored on an 80 track disc. A 40 track 100K disc drive can cope with only one per disc. This fact could be a considerable constriction if a number of separate small files need to be stored. From a management point of view however, one file to each clearly labelled disc is a good idea.

Although at this stage we can tell Index that we do not wish to use a printer this session, unfortunately this does not stop it asking us whether we wish to print records later on, when we may be just examining records.

Planning and setting up your file, the records and fields within it, is the most important stage of the initialisation process. Index allows us to change the definitions of field and record that we specify at this point but it is wholly desirable not to have to enter into the time consuming process of re-initialisation.

SPACE RESTRICTIONS

Index allows 15 fields within each record, a maximum of 30 characters per field, but only a maximum of 250 characters overall. It is surprising how quickly characters can be eaten up by the simplest records and if 250 looks like a small number, do some mental arithmetic with your records before using the software.

There are also two internal restrictions on the field and record lengths of Index. If you wish to make use of the label printing facility then account must be taken of the label width when assigning numbers of characters to each name and address field. Secondly the link to VIEW (and since Index was called Viewbase before Acorn stepped in, it may well be purchased with the inten-

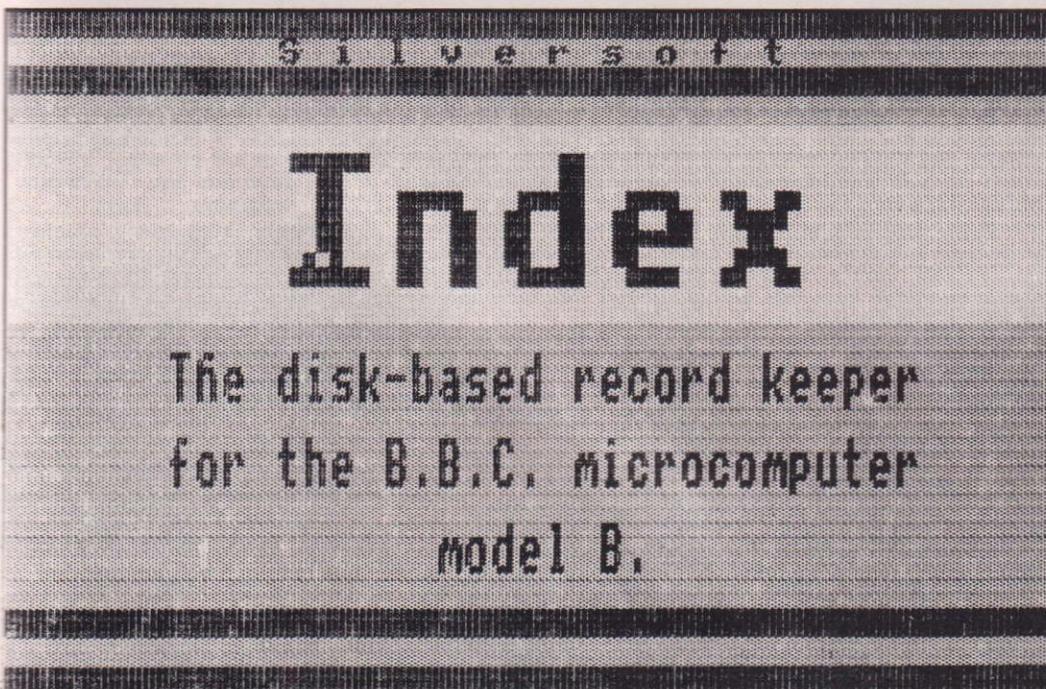
tion of combining the two) is restricted by the number of characters allowed within a single VIEW macro — 132. In fact with punctuation and control code overheads this becomes 120 in practice. Once again, if this figure looks a little on the small side then do some forward planning to see if it can encompass the sort of records you are going to keep. Index is ideal for the name, address, phone number type of record keeping but a personnel file or resource database would not fit.

Index initialises its file according to the original specification and any under utilisation will be wasted storage on your disc. The manual is very good in this respect and describes the best way to handle initialisation including the suggestion that a test run be made with only a few records entered. When you have decided upon the format of your file, the program creates a file of your chosen name on disc and a similarly named file in directory D. This second is the index file, pointing the program to the records stored on the disc.

Re-initialisation, if the need occurs, does not actually change your file in any way but rather creates a new framework into which the data is read. A separate disc is needed. You tell Index which old field links to which new field. Watch out if you are reducing the size of fields since Index will cut the data to fit the new format. Fields can be inserted or deleted.

FIELD TRIALS

Index is menu driven and operations from now on involve making choices 1 to 9 for entering, altering, deleting, examining records, printing the file, file definition, labels and linking to VIEW. Entering records is not as easy as it might be. For instance you have to hit Space and Return to leave a field blank. At the end of each record we are asked if the record is OK to store. "Yes" transfers the data to the disc buffer and "no" offers the chance to edit the record or start again.



CONTINUED OVER

Each field of the record has to be typed in if it is to be changed, although Return will take you on to the next field. Each record is a simple field name and data combination but some editing with the cursor keys would make altering records less of a chore.

There is no way to economically reproduce regularly used data. The price of a number of items in stock might be the same, but you will have to type each one individually. The field names are there to remind you what information is required and these are not printed out with the records. When a session of entries is over, the TAB key initialises the saving of the file definition. Records are continually being moved into the buffer space and out to disc (automatically achieved by the DFS).

When considering the security of your file, the definition file must also be taken into account. If it has not been updated then even records on the disc will not be retrievable. I had the unfortunate experience of losing the definition file to a flawed disc. All the records were intact but apparently beyond reach. Fortunately Index is written in BASIC and not protected. It is possible to construct your own definition file but this sort of repair work can be avoided by regular backing up of both files and, I suggest, hitting the TAB key now and again to save your file definition — just in case.

SORTING AND SELECTING

All the options, alter, delete, examine and print file are straightforward in operation. Each time the name of your data file has to be specified and the file definition displayed before you. All these functions have access to the fairly powerful sorting and searching facilities of Index. Records can be chosen according to any field in the record. Any selected set (searched out by string or number with > and <) can be displayed in sequence, sorted according to any field and

I N D E X

Your options are:

1. Initialise/Reinitialise a file.
2. Enter records.
3. Alter records.
4. Delete records.
5. Examine records.
6. Print the file.
7. Print the file definition.
8. Print labels.
9. Link to VIEW.

Press the appropriate number:

The main menu of Index

displayed, or further reduced by selecting a further subset of the file according to any field.

These operations enable you to pinpoint records, to skip through them, editing, deleting or printing. Unfortunately when you merely examine, you still get the choice of printing or not. There is no going back if you hit the wrong key. With altering and deleting, Index asks for conformation that it has found the correct record before starting anything drastic.

The print option lets you print the whole field, or just selected subsets. You specify the number of lines per page and whether a pause should take place at the end of each page. The records are printed out as seen on the screen display, without field titles but with an underline separating each record. The 30 character width does not make full use of your paper.

INTO VIEW

This is potentially the most powerful aspect of Index — its ability to produce a file which can be read into the Acornsoft VIEW wordprocessor. The action is designed to allow the merging of names and addresses with word-processed text, utilising VIEW's macro facility. A macro can be set

up so that it will incorporate, on meeting with a control code, a specific string of text within the main body of a letter or form. In this way the same standard letter can be printed but with individual information on each.

The link between Index and VIEW is made by creating a separate file, with your file name, in directory V. The restrictions detailed above apply and data can be lost if they are not adhered to. Trailing spaces are stripped off each field if they exist. The new file needs yet another disc and the process can be a bit monotonous if you have a single drive. Even with a double, it is fairly time consuming with around the 50 record mark. If you intend to get up to hundreds of records per file, it will undoubtedly take a number of minutes.

The file contains all your specified records ready to be incorporated into a VIEW macro using the symbols @0, @1 and so on.

SUMMARY

Index surprised me in how useful it could be, especially with my records which follow the simple name, address, data format, small chunks of information which need to be bashed in via

the keyboard and searched or sorted. There is no sophisticated screen formatting, or form writing, such as you might find in a DataGem, File Plus or Cardiff disc database. The method of searching convinced me of its usefulness and the printed output is neat. The link to VIEW is there for those who wish to use their wordprocessor for business mailing although this is not a particularly friendly mail merge when compared to a properly integrated package, such as the Merlin one promises to be and which the Acornsoft disc database will provide.

Now and again Index proved infuriating. There is no recovery from many situations you might get yourself into. For instance if your disc is not entirely empty, the program will crash with disc full error and you will not be able to reuse your carefully thought out file definition. Still, if you follow the instructions, things like that will not happen and Index will perform adequately. There are also a few errors in the screen displayed text which I am sure the final version will iron out and one strange use of the word "printing" for writing to the disc. The facilities of the more advanced databases are not available with Index but the price is fair at £24.99. You pay your money and you take your choice!

RAVEN BOARD POWER

... at Twillstar or your local Acorn dealer

- *20K USABLE MEMORY
- *CUSTOMED MADE

The RAVEN-20 is a 20K RAM EXPANTION for the BBC MICRO MODEL B, fitted with O.S. 1.2.

This specially designed product plugs in to the C.P.U. socket of your micro (centre socket of the 3 available) with the miniumum of effort – the pins are specially custom made, thus avoiding any possible damage to the circuitry!

The RAVEN BOARD provides the user with an extra 20K of usable RAM in screen modes 0 to 3. This together with the aid of software makes the system completely transparent to both the user and the computer.

The RAVEN-20 software ROM gives much more than just the standard commands, it has been programmed to give commands like; "STAR S. SAVE", LOAD for saving and loading the screen, "R. TEST" for testing the board; "STAT" for checking whether Board ON or OFF ... and many more unique features – not available in any other product.

The RAVEN-20 comes complete with;

1. RAVEN-20 Board.
2. RAVEN-20 software.
3. Fitting and operating instructions (see picture).

Don't Forget SOFTWARE UPDATE! – return your guarantee/Registration slip and you will automatically be entered onto our files for registration and notification of new software updates!

Purchase with complete confidence on the "TWILLSTAR RELIABILITY".



TELEPHONE ORDERS
(01) 574 5271



HOW TO ORDER

● To purchase the 'RAVEN BOARD', simply write your name and address on a piece of paper, and post to the address below, enclosing your cheque/P.O. made payable to: TWILLSTAR COMPUTERS LTD.

● If you are a credit card holder, simply use the telephone to order.



£69.95
INCLUSIVE
VAT
ADD £150 P&P

DEALER ENQUIRIES INVITED

*Service contracts to educational authorities at discount.

*Official orders from dealers, government departments, colleges and schools welcomed.

*Price inclusive of VAT.



Specification may change without notice



Twillstar Computers Limited

7 REGINA ROAD, SOUTHALL, MIDDLESEX UB2 5PL. TEL: (01) 574 5271



CRTC Under Control

Barry Landsberg

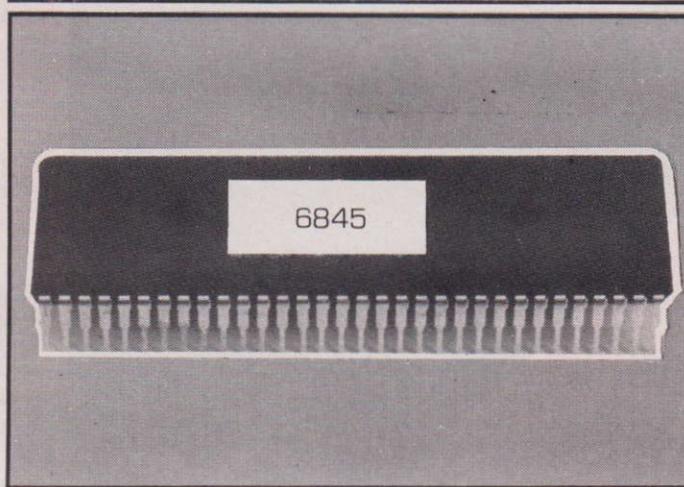
The VDU23 command is usually used to reprogram graphics characters, and various aspects of this were covered in detail by my article in the last issue. However, VDU23 also has another function, and that is to program the chip which affects the way your TV or monitor displays the screen. The chip in question is the 6845 CRTC (Cathode Ray Tube Controller), and it controls the shape of the cursor and the position of the screen, and allows various "tricks" to be performed which would otherwise be difficult to program using conventional techniques. The aim of this article is to demonstrate how the 6845 may be programmed purely in BASIC without the user having to wade through and intimately understand the rather complicated hardware specifications, and to describe some of the more unusual effects which may be achieved by this method.

The CRTC contains 19 internal registers which may be used to program various aspects of the screen format, and in addition return the current position of the light-pen if one is connected. The normal method of communicating with the 6845 is via the Address Register, and a typical machine code sequence to write the value V into register R is as follows:

```
LDA &97 / OSBYTE &97...
LDX #0 / ... which writes into
the address register...
LDY #R / ... the value R.
JSR &FFF4
LDA #&97 / OSBYTE call &97
...
LDX #1 / ... which writes into
the 6845 register R...
LDY #V / ... the value V.
JSR &FFF4
```

Note that a simpler piece of code writing directly to the SHEILA addresses &FE00 and &FE01 could be written instead, but this kind of code may not work in all BBC configurations — especially down the Tube! However, we never need to concern ourselves with this kind of complexity if we do not wish to as the BBC micro can do all this with one VDU command which effectively writes the value V into the 6845

Direct programming of the 6845 CRTC can result in some powerful and unusual effects.



register R:
VDU 23,0,R,V,0,0,0,0,0 (or
VDU 23; R,V:0;0;0;).

The other 18 registers are numbered R0 to R17, but a R16 and R17 are read-only registers which are solely concerned with the position of the light-pen, the value of R in the above VDU23 command must be in the range 0-15. Table 1 shows the function of registers R0-R15 and the initial values they are given for each of the graphic modes. I will be frequently referring to Table 1 throughout this article. I do not propose to delve too deeply into the timing characteristics of the system (the 6845 data sheet contains all the raw information needed for that) but instead intend to show how to use some of the registers to produce certain interesting effects. To that end, I will start by discussing control of the cursor in some detail.

CURSOR CONTROL

The two registers which control the kind of cursor displayed on the screen are R10 and R11. The bottom 5 bits of R10 (or in other words the value of R10 MOD 32) dictate where the cursor starts,

and the bottom 5 bits of R11 determine where it ends. Bit 6 of R10 determines whether the cursor is blinking — if this bit (or the value R10 DIV 64 MOD 1) is set to 1 then the cursor blinks otherwise a steady cursor is displayed. If bit 6 is set to 1 then bit 5 of R10 (or the value R10 DIV 32 MOD 1) controls the blink period — if it is zero then the blink rate is 0.32 seconds otherwise it is 0.64 seconds. If bit 6 is zero, then bit 5 has a completely different function. In this case setting bit 5 to 1 *does not display a cursor at all!* You may recall that the User Guide recommends that (for OS 0.1) the cursor may be turned off using the extremely strange-looking command VDU23;8202;0;0; — what this is actually doing is writing the value 32 (setting bit 5) into register R10 as described above. ($8202 = 32 * 256 + 10$).

In order to understand how to program the cursor, the concept of "scan lines per character" should now be explained. A scan line is quite literally one of the many horizontal lines on your screen that go to make up your display. If you have ever used the VDU23 command to reprogram a character you will be aware that

a normal graphics character consists of 8 rows and 8 columns. A scan line corresponds to one of these rows. Thus for modes 0,1,2,4 and 5 where there is no gap between the lines of graphic characters there are 8 lines per character, while for modes 3 and 6 where there is a small gap between each line of text there are 10 scan lines per character. For mode 7 which uses a different type of interlacing than the other modes there are 19 scan lines per character. The number of scan lines per character (minus 1) is held in register R9 as shown in Table 1.

We now have enough information to design our own cursors! The basic rule is that the cursor start value (of R10 MOD 32) must be less than or equal to the cursor end value R11 otherwise no cursor is displayed at all. In addition, if R11 is greater than R9 then it is the value in R9 which determines the size of the displayed cursor — unless you are in mode 7 in which case it may be one greater. Using these rules, let us design some cursors for mode 4.

Firstly, mode 4 has R9 set to 7, R10 to 103 and R11 to 8. The value in R10 sets the cursor to start on line 7, and in addition bits 5 and 6 are both set which programs the cursor to blink at the slower rate. The value in R11 is actually greater than the value in R9, and so would generate the same effect even if it were 7 instead of 8. There is nothing wrong with setting it to 8, but on the other hand there doesn't seem any good reason not to set it to the proper value of 7. Thus in mode 4 you get a thin slowly blinking cursor which starts and ends on scan line 7. If you want a solid block cursor, simply set R10 to zero using the command VDU23,0,10,0,0,0,0,0,0. To get the block cursor to blink, set R10 to 96 for a slow blink rate or to 64 for a fast blink rate. If you want a thin blinking cursor to act as an overline instead of an underline then set R10 to 96 and R11 to 0. Finally, if you don't like the fat-bottomed cursor that you get in modes 3 and 6, simply set R11 to 7 to get a thin-line cursor like in all the other modes.

TELETEXT DISPLAY

Mode 7 is somewhat different to the other modes, and the difference in the way its interlacing is performed may be shown to good effect. Table 1 shows that it is set up for a slow flashing cursor which starts on scan line 18 and ends on scan line 19. Actually, the two scan lines ought to be adjacent, but for many VDUs are almost in the same position on the screen. If we program a similar cursor, but starting on line 19, by setting R10 to 115 we get a very distant fast flicker of the cursor. It flicks off when scan line 18 is being drawn, and comes back on when line 19 is being drawn. If you do not want this flicker, then ensure that R10 is given an even number and R11 an odd one. If you want a double-thick flickering cursor then set R10 to 113 and R11 to 18, although this effect depends very much upon the hardware in your VDU.

Imagine you want a cursor that is guaranteed to attract attention when you want the user to input something. Variations of the following sequence could be installed as a routine to return to X the ASCII value of the next key pressed, and while it is waiting for input to keep altering the size of the cursor:

```
I=0
REPEAT
VDU23,0,10,1,0;0;0;
I=(I+1) MOD 9
X=INKEY (2)
UNTIL X>0
VDU23,0,10,103,0;0;0;
```

The first VDU23 command alters the starting line of the cursor and suppresses its blinking. This sequence is supposed to be used in the graphics modes 0-2 or 4-5, and for modes 3 or 6 MOD 11 instead of MOD 9. When a key has been pressed, the second VDU23 command resets the cursor to its default form.

Another trick that might be performed on the cursor may be programmed by noting that the top two bits of R8 control what is called the "skew" of the cursor. This amounts to displaying the cursor shifted a little bit to the



right, but this shift varies from mode to mode. For example setting R8 to 129 moves the cursor two characters to the right for modes 0,3,4, and 6, while in modes 1 and 5 it moves the cursor one character to the right and in mode 2 it only moves it a half character. Setting R8 to 65 moves the cursor only half the amount in each case. Mode 7 is different as R8 already has bit 6 set, so subtracting 64 or 128 from the value given in Table 1 moves the cursor one or two characters to the left.

Finally, there is still more that may be done with the cursor. The width of the cursor may be altered, but to do this you have to program the video ULA instead, and this is beyond the scope of an article which is supposed to be on the 6845 CRTC. Still, to get a taste of what else can be done, try typing *FX154,258 or *FX154,152 while in mode 1.

Before leaving cursors, it should be noted that from OS 1.0 onwards there is another VDU23 command to turn cursors off and on, and they are:
VDU23,1,0,0,0;0;0; — turns cursor off.
VDU23,1,1,0,0;0;0; — turns cursor on.

The difference between this VDU23,1 command and the methods outlined above for turning off the cursor is that the VDU23,1 command "remembers" the details of the way the cursor was set up, but that when using MODE or VDU23,0 command it is up to you to keep track of the details of whatever fancy cursors you are programming!

HARDWARE SCROLLING

This section will discuss two methods by which some kind of hardware scrolling of the screen may be achieved. Scrolling is taken to mean moving the whole display vertically or horizontally in such a way that what disappears off one end of the screen will reappear in some shape or form on the other end.

The first method depends on programming the memory address which the CRTC takes as a starting point for the top left-hand side of the screen, and this is achieved by writing to registers R12 and R13. Table 1 shows the values initially given to these registers, but for modes 0-6 the values represent one-eighth of the actual memory address. To illustrate, modes 0-2 use RAM starting at &3000 and one eighth of this address is &600 which corresponds to 0 in the low byte (R13) and 6 in the high byte (R12) as shown in Table 1. Mode 7, as always, is an exception and in this case the lower byte goes into R13 untouched and the high byte must have 84 subtracted from it thus giving rise to the value of 40 in R12 as the mode 7 starting address is &7C00.

Program 1 shows a hardware scroll which works for all modes. The first line determines which mode the BBC is currently in by examining the contents of memory location &355, although strictly speaking it should have been done using OSBYTE call &A0 which is designed to read bytes from page 3 of memory.

Once we know which mode we are in we select from the DATA statements the start address, the number of bytes to make the screen scroll one character and the number of bytes to scroll one line into START, C and L respectively. We then use the cursor keys to alter the memory location (held in S) that we wish to appear in the top left-hand corner of the screen, while ensuring that S remains within its proper limits (between START and &7FFF) thus scrolling the screen in the same direction as the arrow in the key.

Although this method of scrolling may cycle as many times as you like, it has various deficiencies. Firstly, it doesn't work properly for modes 3,6 and 7 as each new display is offset from the last by two-fifths of a screen width, and so five vertical scrolling cycles are needed to get back to where you started. This problem does not arise for the other modes.

Secondly, any character which is scrolled off to the right reappears on the left-hand side of the screen one line lower, and similarly scrolling left off the screen makes the characters reappear on the right-hand side of the screen one line higher — this is not true scrolling! Yet another problem encountered, and that is when a linefeed is thrown on what the BBC micro thinks is the bottom line of the screen, a software scroll is forced which overwrites the numbers we so carefully programmed into R12 and R13, and the normal

CONTINUED OVER

screen reappears once again.

SYNC PULSE

There is a second way of performing a hardware scroll which suffers from different disadvantages, and relies on altering the positions of the horizontal and vertical sync pulses. Very briefly a sync pulse, whether it be for a horizontal or a vertical scan, is a signal to the TV or monitor to end that scan and start a new one. Normally these sync pulses occur a little way off the end of the display, and are carefully positioned to place the screen centrally. Register R2 contains the position of the horizontal sync pulse which for modes 0-2 is 98 characters from the beginning of the screen.

The screen displays only 80 characters (as held in R1), but the timing between one scan and the next corresponds to 128 characters (as controlled by R0). Decreasing R2 will move the screen to the right, and increasing it will move it to the left. The only strict rule is that R2 must not be less than zero and must not be greater than R0, otherwise the display will be unstable. Similarly, the vertical sync pulse position held in R7 must not be less than zero and must not be greater than R4, and increasing R7 moves the display upwards.

Program 2 determines the current mode as before, and then reads the appropriate starting values of R2 and R7 (into H and V), and also the values of R0 and R4 which are regarded as the upper limits to the sync pulse position. The screen is moved by the cursor keys, and a beep (VDU 7) is issued if an attempt is made to set either R2 or R7 outside the limits mentioned above. It should be noted that the display may still become unstable in certain positions, but this depends upon your VDU and also upon exactly what is being displayed — a screen with a white background is generally far less stable than an almost empty screen with a black background. Still, programming R2 and R7 may be quite useful

for small scrolling motions, especially as the effects persist until either a MODE or BREAK is issued.

It is tempting to think that programming R7 has an identical effect to a *TV command, but this is not so. The difference is that *TV does not come into effect until the next MODE or BREAK, which is precisely the opposite behaviour to that of programming R7 via the VDU23 command.

VERTICAL TAKE-OFF

What is the most noticeable difference between text displayed in mode 6 and mode 4? Apart from the difference in the number of lines of text, the lines themselves are squashed much more closely together in mode 4 than in mode 6. In this section we will program registers R4-R6, and persuade modes 3 and 6 to display their lines closer together as in the other modes.

It has been mentioned earlier that the reason the text modes have such large gaps between their lines is that they have been programmed via R9 to give 10 scan lines per character instead of the usual eight, thus leaving a gap of two scan lines. If you directly attempt to reduce this gap by setting R9 to 7, all you will see is a useless unstable

display. This happens because such a change upsets the delicate timing involved in driving a VDU, as the number of scan lines per screen is critical in ensuring that the vertical sync pulse is not ignored.

We can get an idea of how many scan lines we need by adding 1 to R9, multiplying it by R4 and adding the adjustment R5. In modes 0-2, this total comes to 304 and for the text modes it comes to 302, which is just under half of the standard 625 lines per frame. Our attempt to alter R9 brought the total down to under 250 — no wonder we confused the poor display! It is evident that if you want eight scan lines per character in mode 6, you need to program R4, R5 and R9 to have the same values as for the graphics modes — thus you must set R4 to 38, R5 to 0 and R9 to 7.

Note that it is probably best to write a program to do this, or at least a multiple VDU command, as if you make these changes one at a time there is no order you can set the values without the screen going unstable. The screen is now vertically squeezed down by about 20%, but otherwise the text modes are now much more reminiscent of the graphics modes.

I think the situation halfway between these two extremes (where the text lines are

separated by only one scan line) looks the best. If we take a desired total of 302 lines per screen, and divide by 9 we get 33 with 5 left over. Bearing this in mind, you should try setting R4 to 33, R5 to 5 and R9 to 8 while in mode 3 or mode 6. This gives rise to a display which is vertically about 10% narrower than normal with a reasonable spacing between the lines. It is quite feasible to program the graphics modes to have an interline spacing like the text modes, but as well as losing some of your screen as you will not be able to display as many character lines, the extra scan lines will run through and make a mess of any graphics plots that you might be doing. Nevertheless, I will be taking advantage of an effect akin to this at the end of the article.

Another register which controls the vertical aspects of the screen is R6 which determines the number of character lines displayed. A "Piccadilly Circus" effect may easily be programmed, even for a BASIC listing, where each line disappears until there is only one line left and then the screen comes back again in full. The program would go something like this:-

```
I=32 : REM Use 25 for text modes
REPEAT
I=I MOD 32 + 1
VDU23,0,6,1,0;0;
X=INKEY (50)
UNTIL X=ASC("Q")
```

HORIZONTAL HORRORS

Whereas causing interesting effects by programming the vertical control registers was relatively straightforward, the horizontal control registers do not seem to offer as much flexibility. The 6845 does not seem to have a horizontal equivalent of the scan lines per character, and all that one can do is alter R0, R1 and R2. Note that R2 is just horizontal sync pulse register, and has already been discussed in the hardware scrolling section. Initial attempts to alter R0 by very much result only in an unstable screen as a normal VDU takes 64

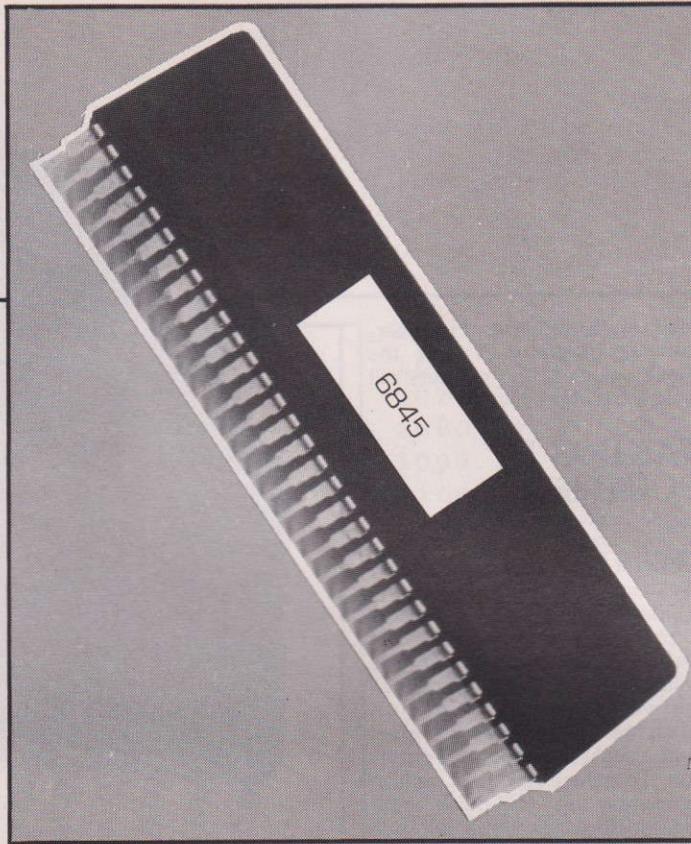


microseconds to draw one horizontal scan line, and reprogramming R0 usually upsets this timing and causes chaos! It turns out that modes 0-3 send out a "fast" clock to the 6845 which drives the scan at 2MHz (two million cycles per second) while modes 4-7 drives the 6845 at 1MHz, and 128 characters per line at 2MHz or 64 characters at 1MHz ensure a 64 microsecond scan line time. Whether the 6845 is driven by a fast or slow clock can be programmed via the video ULA chip using *FX154 commands.

The register R1 controls the number of characters displayed on a line, and is initialized to 80 for modes 0-3 and to 40 for modes 4-7. Why is this so when we know that mode 1 displays 40 characters per line and mode 2 displays only 20? The answer is that as far as the 6845 is concerned, one byte of memory is the same as one screen character, but this is not the case for multi-coloured graphics modes. Mode 1 is a two-colour mode and each byte represents one full 8-pixel character, but mode 1 is a four-colour mode and as each pixel requires 2 bits in order to specify its colour, each byte represents only 4 pixels (or half) of a character.

Similarly, mode 2 is a 16-colour mode and each pixel requires 4 bits to specify its colour so each byte represents only 2 pixels, and thus what the 6845 'thinks' is one character is in fact one-quarter of a mode 2 character. A hint of this state of affairs appeared in the hardware scrolling section where we programmed what I called 'the number of bytes to make the screen scroll one character' as 1 for mode 0, 2 for mode 1 and 4 for mode 2. It is actually possible to scroll by one-quarter of a character at a time in modes 2 and 5!

You might imagine that setting the horizontal displayed register R1 to 40 in mode 0 would display the left-hand side of the screen and simply blank out the right-hand side (in a similar fashion to setting the vertical displayed register R6) but you would be wrong! What it actually does is to display the first



40 characters on line 1 of the screen, and then the next 40 characters on line 2 of the screen, and so on. This results in only the top half of the screen being displayed, and two screen lines are used to display what would normally take up one line. The situation is twice as bad if you program R1 to contain 20 in modes 0-3 as effectively only the top quarter of the screen is shown.

AMUSING EFFECT

An amusing effect may be generated by programming R1 to 79 or 81 in modes 0-3 (or similarly to 39 or 41 in modes 4-7). In the first case where R1 is one less than its initial value, each line starts with an offset to the right of one character more than the last line, and so pressing RETURN many times generates a diagonal line of prompt characters '>' starting at the top left hand corner. This effect is heightened by reducing R1 even further, but you lose more and more of the screen by doing this — by the time R1 is down to 78 you have already lost the last 64 characters of the display in mode 0, and you lose 32 more every time you reduce R1 by one. You might enjoy listing a program under these conditions!

If we increase R1 to 81 in

modes 0-3, then pressing RETURN many times generates a diagonal line of prompt characters starting from the top right hand side of the screen down towards the lower left — note that the first character is still in the top left-hand corner of the screen. However a new effect occurs — in mode 0 there is no space on the screen for 32 more characters than the BBC micro has been programmed to expect. Where do these extra characters come from? The MOS does its scrolling by altering registers R12 and R13 to represent the starting address of the beginning of the line which is to currently appear at the top of the screen. This range of addresses for modes 0-2 are from &3000 to &7D87 (= &7FFF - 80) in steps of 80, and the extra 32 characters simply continue from the next screen memory location. This means that the first 32 characters on the screen may be repeated at the bottom of the screen.

Another new effect is observed when R1 is set to 83 or more. If R1 is 83 then there are 96 extra characters to display on the screen, and when the scrolling is such that R12 and R13 point to &7D87, 16 of these characters will be taken from outside the range &3000-&7FFF. What the BBC micro actually does is to take those 16 characters from page 0, and we observe that if we keep pressing RETURN then one time in 32 a

strange pattern will be displayed at the bottom right-hand side of the screen. This situation becomes more pronounced as R1 is increased yet further, and so some of these page 0 addresses keep changing their contents (for example the timing registers) parts of the pattern will be constantly changing. A similar effect in modes 4-6 starts if R1 is set to 42 or more.

R1 may be used to 'swing' a column of text backwards and forwards. The following sequence repeatedly steps R1 from 77 to 84 to do this. Note that first we program R6 to blank out the bottom two lines of the screen in order to stop these extra characters appearing there:-

```
MODE 0
FOR I = 1 TO 10
PRINTTAB(I, 40) "HELLO"
NEXT
VDU23,0,6,30,0;0;0;
I = 0
REPEAT
I = (I + 1) MOD 8
VDU23,0,1,I,0;0;0;
X = INKEY (50)
UNTIL X = ASC("Q")
```

FOUR SCREENS AT A TIME

My final offering is to program some of these registers to produce four identical screens up on the display, and to discuss what can (or cannot) be done with them. Firstly you should roughly halve the number of characters per line (R0), exactly halve the number of displayed characters per line (R1) and then adjust the horizontal sync pulse position (R2) to make the screen horizontally stable by roughly halving it. Now the screen is vertically unstable, and one way round this is to increase the vertical total (R4) to compensate for this. After a small amount of experimentation, I found that setting R0 to 61, R1 to 40, R2 to 49 and R4 to 40 produces a display consisting of four smaller identical screens in Modes 0-2. If you want a similar effect in modes 4-5, you should set R0 to 30, R1 to 20, R2 to 25 and R4 to 40.

CONTINUED OVER

Note that the screens, and the text they contain, have been reduced to just under a quarter of the normal size and are correspondingly harder to read. Each screen behaves in a manner reminiscent of that discussed earlier (where the horizontal displayed register R1 was halved) and only the top half of the display was shown with each full-length line of text being displayed as two consecutive lines. Furthermore, if you wish to draw any graphics, what would normally appear on the right hand side of the screen is interleaved with what appears on the left. Thus the sequence MOVE100,0: DRAW100, 1280 gives rise to a vertical dotted line which is white on every even text line and black on every odd text line. Should you want to fill in the odd lines, you need to draw another line 640 pixels over to the right by typing MOVE740,0: DRAW740, 1280.

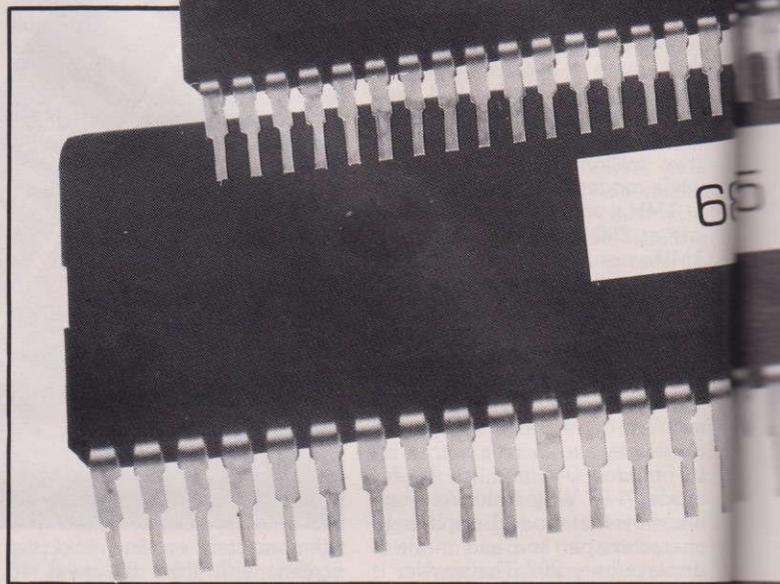
We can take advantage of this to create an unusual effect, and without any further laborious explanation. Program 3 turns the cursor off, sets up four identical screens and keeps drawing stripes on it. I do not believe there is a conventional way of programming this kind of effect to run at the speed that Program 3 runs without directly altering the 6845 registers. Actually, the value in R1 may be modified to create even more interesting effects, but you may need to modify the PRINTTAB command which positions the text.

By applying similar logic, but dividing the initial values of the registers by 3 instead of by 2, it is even possible to generate a display containing nine identical screens! Thus in modes 0-2 simply set R0 to 40, R1 to 30, R2 to 32 and R4 to 41. As we are pushing the whole system further than it was designed to go, there are naturally some problems with the display — firstly the first few characters are lost from the left-most three screens, secondly every now and then a scan line is not displayed (and this is not the same for all screens) and thirdly it is very difficult to read any text

even on a monitor. However, running Program 3 with the above values of the registers still looks very impressive.

TAKING IT FURTHER

If you want to take this any further it gets more complicated. Dividing the initial values of the registers by four we might be able to produce 16 screens! This time we may need to use the vertical adjust register R5 to "fine tune" the vertical stability, but even when we do this there is a great deal of ugly flickering and distortion. To reduce this effect we turn to altering the sync pulse width register R3 which is split into two four bit parts. The bottom 4 bits (or R3 MOD 16) program the horizontal sync pulse width, and is set to eight characters in modes 0-3 and four characters in modes 4-7 which in both cases corresponds to about 6.4 microseconds. The top 4 bits (or R3 DIV 16) program the vertical sync pulse width and is initially set to two scan lines for all modes, and it turns out that setting this value to 4 will stabilise the screen. As a result of this, try running Program 3 with R1=20, R2=24, R3=72, R4=41 and the adjustment



R5=2 (although this may depend on your VDU so start off with zero). Note that any text produced with these settings is almost totally illegible. Finally, for 25 screens try R0=24, R1=20, R2=22, R3=68, R4=40 and R5=5 — I have not yet managed to coerce my system into producing 36 stable screens and would be interested to hear from any reader who does!

We have now reached the point where we have some kind

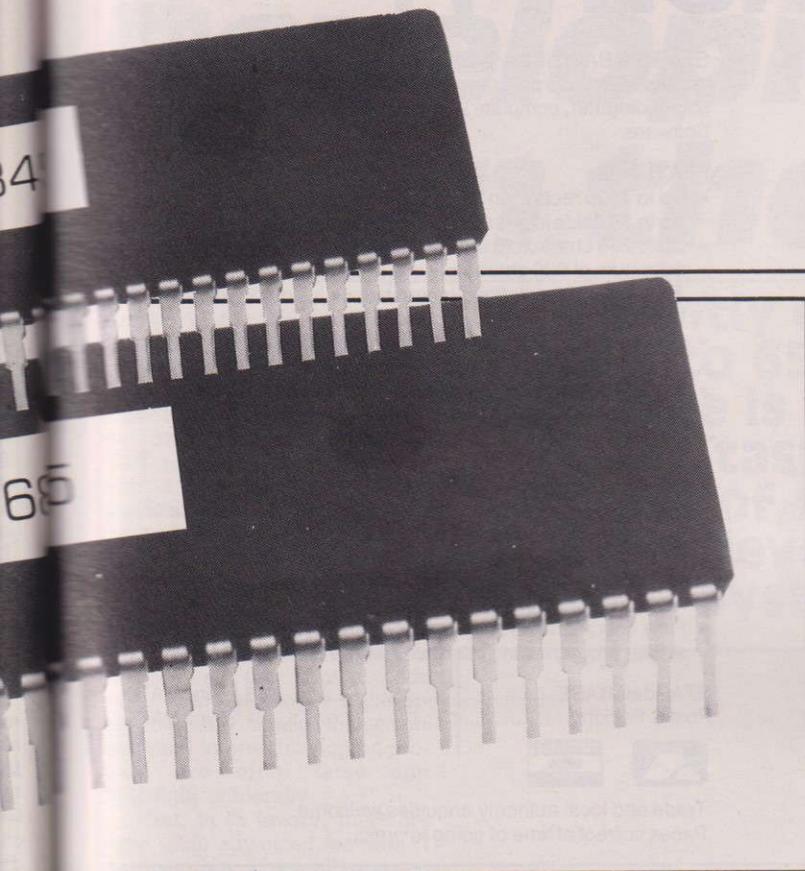
of understanding of the 6845 and how to program it via the VDU23 command. I have not yet mentioned R14 and R15 not have I fully discussed the role of R8. The BBC micro allows such good control of the cursor position that you should never need to program R14 or R15. If you wish to go any deeper into programming the 6845, then I recommend that you consult the 6845 data sheet and spend many happy hours experimenting with all the registers.

Table 1

Initial values set up for the 6845 registers in each graphics mode

Reg.	Function	MODE							
		0	1	2	3	4	5	6	7
R0	Horizontal total (1)	127	127	127	127	63	63	63	63
R1	Horizontal displayed	80	80	80	80	40	40	40	40
R2	Horizontal sync position	98	98	98	98	49	49	49	51
R3	H.& V. sync pulse width	40	40	40	40	36	36	36	36
R4	Vertical total	38	38	38	30	38	38	30	30
R5	Vertical adjust	0	0	0	2	0	0	2	2
R6	Vertical displayed	32	32	32	25	32	32	25	25
R7	Vertical sync position	34	34	34	27	34	34	27	27
R8	Interlace and skew	1	1	1	1	1	1	1	147
R9	Scan lines per character (1)	7	7	7	9	7	7	9	18
R10	Cursor start	103	103	103	103	103	103	103	114
R11	Cursor end	8	8	8	9	8	8	9	19
R12	Start address (H)	6	6	6	8	11	11	12	40
R13	Start address (L)	0	0	0	0	0	0	0	0
R14	Cursor position (H)	6	6	6	8	11	11	12	40
R15	Cursor position (L)	0	0	0	0	0	0	0	0

(1) The actual value is 1 greater than contained in the register.



PROGRAM LISTING 1

```

1000 M=?&355:REM M is current mode
1010 FOR I=0 TO M
1020 READ START, C, L
1030 NEXT
1040 *FX4,1
1050 S=START
1060 REPEAT
1070 B=GET
1080 IF B=136 THEN S=S+C
1090 IF B=137 THEN S=S-C
1100 IF B=138 THEN S=S-L
1110 IF B=139 THEN S=S+L
1120 IF S>&7FFF THEN S=S-&8000+START
1130 IF S<START THEN S=S+&8000-START
1140 IF M<>7 THEN HB=S DIV2048 ELSE HB=S DIV256-84
1150 IF M<>7 THEN LB=S MOD2048 DIV8 ELSE LB=S MOD256
1160 VDU23,0,12,HB,0;0;0;
1170 VDU23,0,13,LB,0;0;0;
1180 UNTIL B=ASC("Q")
1190 *FX4,0
1200 END
1999 END
2000 DATA &3000, 8, 640
2010 DATA &3000,16, 640
2020 DATA &3000,32, 640
2030 DATA &4000, 8, 640
2040 DATA &5800, 8, 320
2050 DATA &5800,16, 320
2060 DATA &6000, 8, 320
2070 DATA &7C00, 1, 40

```

PROGRAM LISTING 2

```

1000 M=?&355
1010 FOR I=0 TO M
1020 READ H, V, RO, R4
1030 NEXT
1040 *FX4,1

```

```

1050 REPEAT
1060 B=GET
1070 IF B=136 THEN H=H+1
1080 IF B=137 THEN H=H-1
1090 IF B=138 THEN V=V-1
1100 IF B=139 THEN V=V+1
1110 IF H<0 THEN H=0 : VDU7
1120 IF H>R0 THEN H=R0 : VDU7
1130 IF V<0 THEN V=0 : VDU7
1140 IF V>R4 THEN V=R4 : VDU7
1150 VDU23,0,2,H,0;0;0;
1160 VDU23,0,7,V,0;0;0;
1170 UNTIL B=ASC("Q")
1180 *FX4,0
1999 END
2000 DATA 98, 34, 127, 38
2010 DATA 98, 34, 127, 38
2020 DATA 98, 34, 127, 38
2030 DATA 98, 27, 127, 30
2040 DATA 49, 34, 63, 38
2050 DATA 49, 34, 63, 38
2060 DATA 49, 27, 63, 30
2070 DATA 51, 27, 63, 30

```

PROGRAM LISTING 3

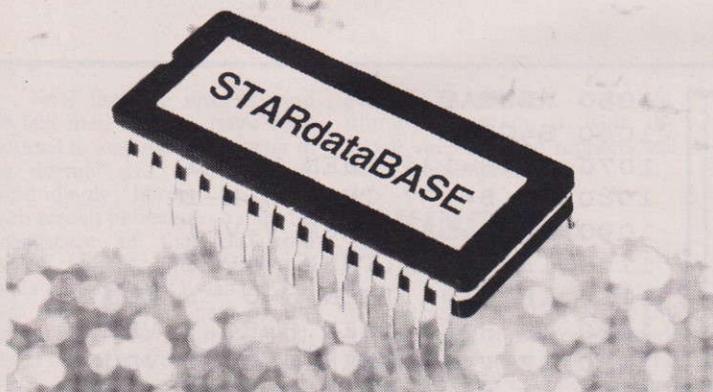
```

1000 MODE1
1010 VDU23,0,0,61,0;0;0;
1020 VDU23,0,1,40,0;0;0;
1030 VDU23,0,2,49,0;0;0;
1040 VDU23,0,4,40,0;0;0;
1050 VDU23,0,10,32,0;0;0;
1060 S%=512
1070 F%=1024
1080 :
1090 REM PRINTTAB(18,8) IN MODE 0
1100 REM PRINTTAB(3,8) IN MODE 2
1110 :
1120 PRINTTAB(8,8)"HELLO"
1130 GCOL3,3
1140 REPEAT
1150 :REM STEP 2 IN MODE 0
1160 :REM STEP 8 IN MODE 2
1170 :
1180 FOR I%=0 TO 1280 STEP 4
1190 MOVE I%,S%
1200 DRAW I%,F%
1210 NEXT
1220 UNTIL FALSE

```

STARdataBASE . . .

The database



STARdataBASE is the fast, machine-code, true random access, database program in 16K ROM for the BBC Microcomputer, complete with over 75K of FREE extension Software.

FEATURES:

- ★ Up to 4096 records in a file.
- ★ Up to 69 fields in a record.
- ★ Up to 255 characters in a field (subject to an overall maximum of 920 characters in a record).
- ★ An entirely User-defined record layout, including a facility for colour.
- ★ Can be used with 40 and 80 track Disk Drives.
- ★ Entirely Menu-driven, extremely User-friendly.
- ★ Extremely fast search – A single record can typically be found in 1 second using the Keysearch facility.
- ★ Search conditions include the following: =, <, >, and "Anywhere in the field".
- ★ Powerful facilities to edit records.
- ★ Mail-merging between documents created on Wordwise or View, and STARdataBASE records.
- ★ Print-out of the whole database or selected Subsets, in the form of Record cards.
- ★ Address label printing – (up to 8 across the page).
- ★ Fully documented routines which can be included in user-written programs and interfaced with STARdataBASE.

STARdataBASE £86.25 inc VAT
Post & Packing £1.75 inc VAT



Trade and local authority enquiries welcome.
Prices correct at time of going to press.

for the BBC



GCC (Cambridge) Limited
66 High Street, Sawston, Cambridge CB2 4BG
Telephone: Cambridge (0223) 835330/834641
Telex: 81594 SAWCOM

RAMROM 15

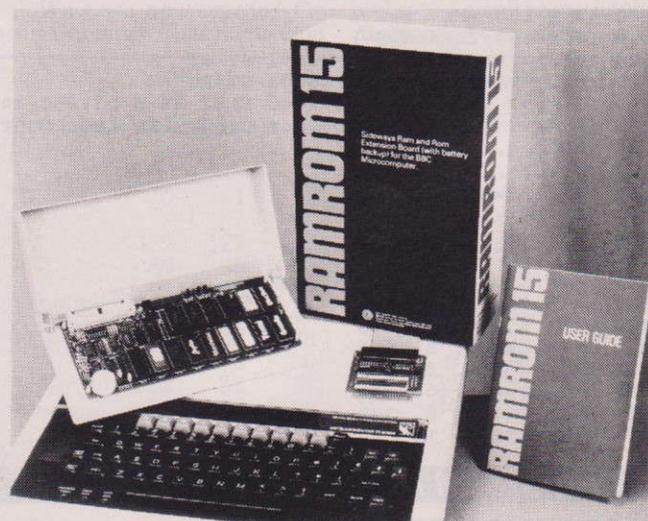
The Sideways RAM & ROM Expansion Board for the BBC

The GCC RAMROM 15 board adds to the BBC Micro another eleven sideways ROM sockets plus the necessary hardware for sideways RAM.

FEATURES

- ★ Fully buffered board.
- ★ Rechargeable battery backup for RAMS provided as standard. Recharging circuitry is included.
- ★ The board can be powered by an external 5 Volt power supply, available as an optional extra.
- ★ The unit comes in a case of its own and resides outside the BBC Micro, giving easy access to the resident ROMS.
- ★ For those involved in development work, most of the 6502 processor signals are made available outside the BBC Micro.
- ★ Priority or selection can be assigned to either RAMS or ROMS.
- ★ ROMS can be used in RAM positions simply by changing two push-on links.
- ★ Simple installation – NO soldering.
- ★ Can be installed together with most other BBC add-on boards.
- ★ ZIF-sockets available as optional extras. Up to 15 may be housed on the RAMROM 15 at any one time.
- ★ All socket positions are software selectable.
- ★ Free Utilities Disk supplied.
- ★ Comprehensive User Manual included.

RAMROM 15 £129.95 inc VAT (P&P £3.50 inc VAT)
EXTERNAL PSU £5.75 inc VAT (P&P £1.73 inc VAT)
ZIFSOCKETS £9.00 inc VAT Free P&P with RAMROM



GCC (Cambridge) Limited
66 High Street, Sawston, Cambridge CB2 4BG
Telephone: Cambridge (0223) 835330/834641
Telex: 81594 SAWCOM



Trade and local authority enquiries welcome.
Prices correct at time of going to press.

Developing Ideas on the 6502

Clive Grace

One of the most endearing qualities of the BBC or Electron for the advanced programmer is the built in Assembler accessed directly from BASIC, but for reasons known only too well to the programmer, delving into 6502 code on the Beeb can be both a source of delight and anguish. Development time is made all the more difficult because one is using an editing system designed for BBC BASIC and all assembly has to be "hand assembled". The object code cannot reside in the same place in memory as the source code unless some juggling is to be acceptable and finally the errors produced in any developing program are often terse and downright unfriendly.

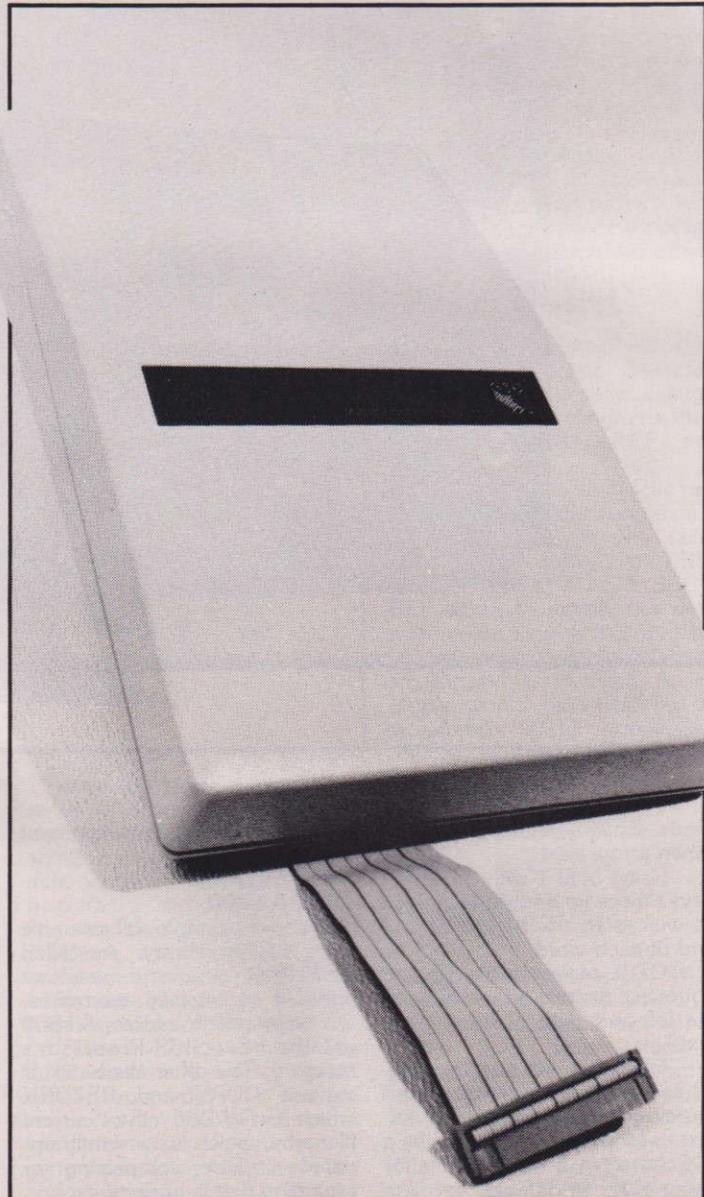
But, in its favour, there are some fairly advanced features in the assembler which allow some respite such as a visible editing option; there are also the facilities to mix BASIC variables with assembler addresses and the like.

With the advent of the 6502 second processor from Acorn earlier this year and the promised wealth of software available in the future to run specifically across the Tube, the release of a full 6502 development system is of considerable importance. It consists of an Editor, a Macro Assembler and a whole host of software tools bundled, such as cross referencers, print utilities and trace packages. They are all included to make an integrated system providing an aid in assembler program development.

WHAT YOU GET

Only disc systems are accommodated by this package as most of the programs would simply be too long to load by cassette and anyway most serious program development is done using discs. At the heart of the system lies MASM, the macro assembler. Using an editor, text can be submitted for assembly whilst any debugging can be handled by a combination of the trace utility and the cross referencer which are then altered using the editor ready for assembly. The whole package is accompanied by a reference card

Efficiently coding your ideas into 6502 assembly language is now a much easier task with the advent of Acornsoft's 6502 Development System.



and a hefty manual with full documentation on each of the system components, which will be described individually.

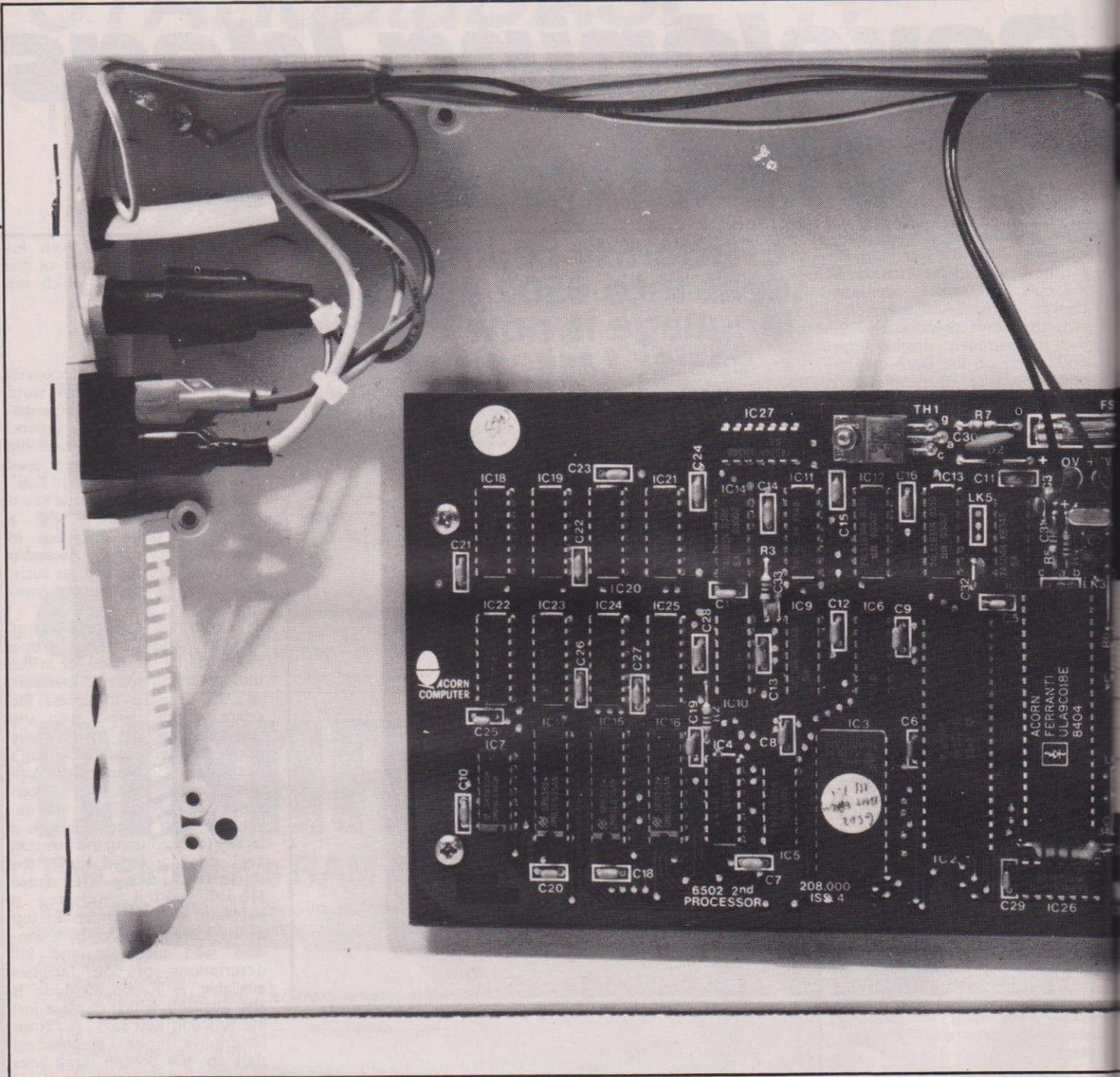
EDIT

This is the rumoured editor which is built around the VIEW word processing package. It is designed to work only in the second processor and understandably the amounts of text composed can be very large indeed. EDIT could be used for general word processing but there are a number of large omissions in preference for better Assembly orientated facilities and, as such, there are no formatting commands.

With the disc installed, all '*' commands not taken up by a ROM will be searched for in the disc operating system, therefore *EDIT is used to access the editor. If this clashes with any sideways ROMs (incidentally mine clashed with Beebug's Toolkit and Computer Concept's Disc Doctor) then the file can simply be *RUN and will execute in 'Edit mode'. There is a facility to avoid using the function key strip provided with the system by entering "Descriptive Mode" which includes a keyboard strip drawn on the top of the screen followed by a window with messages and full descriptions of the facilities available. A 'Keyboard Mode' is also available which displays just the function key strip. A "Non-Descriptive" mode is assumed on start up; the bottom three lines are reserved for messages and prompts outside the descriptive mode and are again easy to read as well as lengthy and accurate.

There are two cursors on the screen, the first being the "end of file cursor" (which indicates where the current file ends) and the current text cursor. Entering text proved to be easy and responsive but the screen scrolling was a little slower than anticipated. There was the initial desire to go back to a more familiar editor, but perseverance gives the user the ability to use an editor which is designed for the

CONTINUED OVER



whole system, and can be called up at an instant.

Both the DELETE and COPY keys are concerned with deleting text on the current line; DELETE erases each character to the left of the cursor and COPY deletes all text from the right going left; movement in the left and right TAB positions is made possible by using the left and right arrow keys and the TAB key; movement up and down a line is

made similarly with the up and down arrow keys.

Using SHIFT with the arrow keys moves up and down a page as well as to the beginning and end of each word.

CTRL moves to the top and bottom of the text and likewise to the left and right of the current text line.

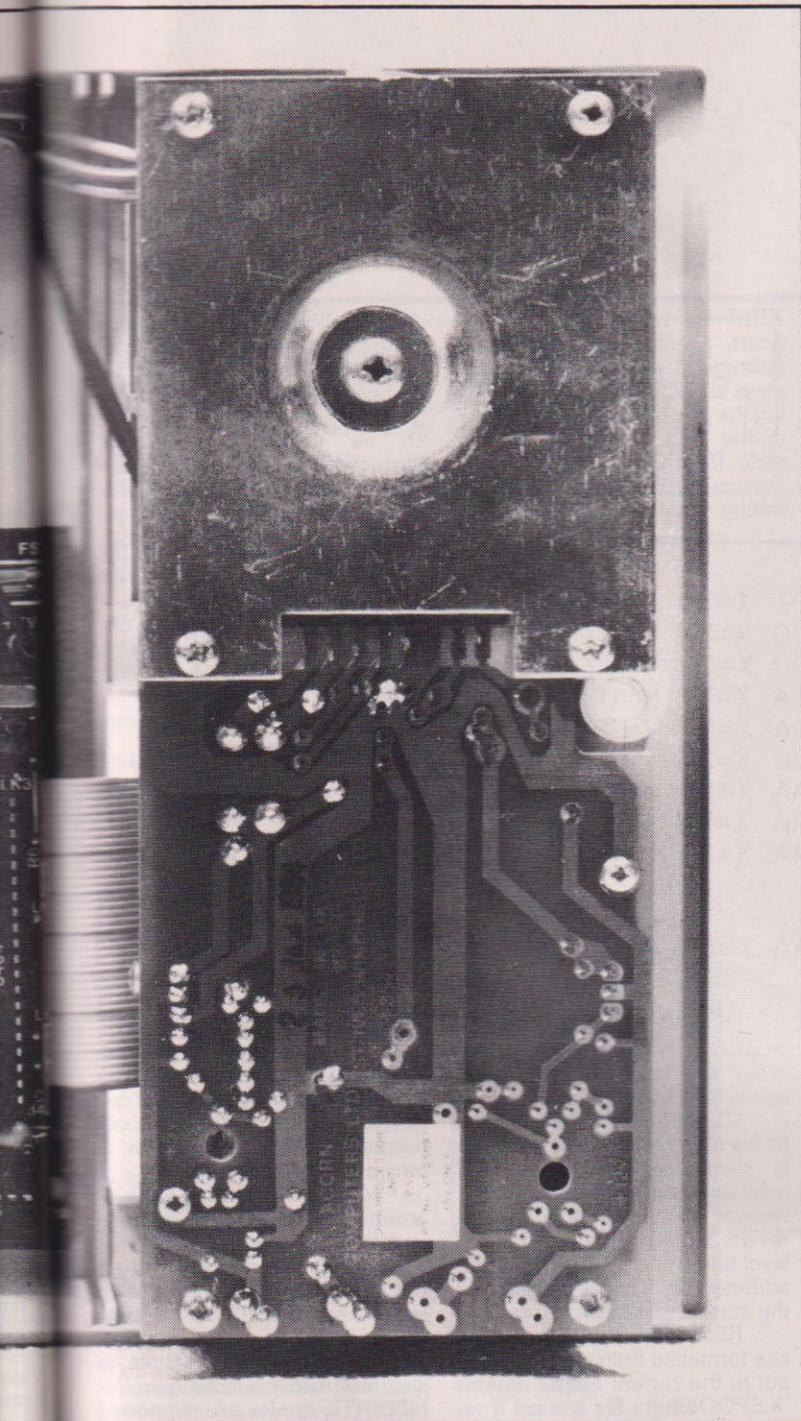
Filenames can be either saved as a reply to a prompt or can more cleverly be included in the text as long as it is preceded by a '>' character. If using the file for submission to MASM the line

must be included as a comment such as:

**>A.TESTPRO
ORG &1B00**

The above example will assemble the file in library A called TESTPRO and the resultant code, if successfully assembled, will be stored in address &1B00 in the Second Processor's memory. The other alternative is to use COPY and RETURN which will load the current filename, which is constantly updated if Disc compacting or renaming files is undertaken.

Control characters can also be inserted in the text by use of the SHIFT f0 key in Edit mode. This has the added advantage of displaying all carriage returns in a piece of text and can be toggled on or off. The control codes are made visible by inverting their equivalent ASCII code: hence RETURN will show as an inverse 'M' in modes 0 to 6 and a white block in Mode 7. f7, SHIFT f7 and f8 are all concerned with moving text about the screen, as well as editing and deleting the text in markers.



There are some very good examples in which repetition is needed in assembler, and block copying is the quickest method available, by setting up markers. Consider the common occurrence:

```
.G-area LDA #24
      JSR &FFEE
      LDA &0
      JSR &FFEE
      JSR &FFEE
      LDA #64 MOD 256
      JSR &FFEE
      LDA #64 DIV 256
      JSR &FFEE
      LDA #1279MOD256
      JSR &FFEE.....
```

The text could be written within a series of Macro markers which can selectively move the text about in various orders, making data entry much quicker and hopefully more accurate. However there are a number of problems when entering 6502 mnemonics, not because of the editor but because of MASM's features, more of which later.

One of EDIT's strong points is its search and replace option which supercedes the method employed in VIEW and other word processors and editors — f4 commands the prompt to 'Find and replace/', which may be

replied to by either a pattern (the 'search' word) followed by RETURN or a pattern followed by a separator '/' and a replacement followed by RETURN. There are a host of special characters used with the search and replace option which include:

```
. match any character
@ match an alphanumeric character (no symbols)
# match any digit
$ match any carriage return character
```

... and so on. EDIT is not as comprehensive as its larger word processing brother but even then it was never intended to be, the search and replace options are excellent as well as the ease of general use, providing your requirements are not too demanding. EDIT should prove a worthy tool among the development packages more useful features.

DEBUGGING

There are three main utilities in the Development System's framework which allow debugging of assembler programs, they are XREF SRCXREF and TRACE.

XREF simply allows the programmer to find the occurrence of various symbols in the failed assembly listing from an XREF file generated by MASM. SRCXREF works in exactly the same manner on source files and not MASM generated ones and is smaller and less detailed. An example would best describe the working of XREF from inside MASM, all keyboard entry is in brackets:

```
Action: (XREF)
Xref output file: (xrerr)
PRINT ON (^B)
Action: (ASM TEST)
```

```
(* XREF)
Action:
```

What happens here is that XREF stores a list of symbols which the user wants to search through by typing 'Add Error' which is greeted by the 'Symbol:' prompt. Pressing the ESC key causes XREF to scan through the cross reference file and will end with 'File'. Naturally 'xrerr' will scan the file and print out more

```
suitable error messages such as:
ERROR defined line 0030 in file TEST
ERROR used line 0017 in file TEST
ERROR used line 0020 in file TEST
```

TRACE can be set up from inside MASM and XREF to trace the paths through which a program is running. The normal * prompt is replaced by a + sign which will selectively execute your source program and display each execution address, reporting information as per level of TRACE:

```
RT ADDR
EN &1900
CO
```

'RT' is an option which Runs Through the program currently in XREF whereas 'EN' provides a suitable entry point for TRACE to work on, in this case &1900. 'CO' continues the stepping-through process from the states entry point and a trace will look something like:

```
1900
1902
1904
```

```
.
.
.
.
```

Until it either reaches a jump or terminates itself or more likely encounters an error, TRACE allows all the paths from within a program to be tested. This replaces the need to draw 'Level Charts' when on large assembler programs, as each branch is labelled and all warnings and errors are displayed with both a report and a dump of the line in question. TRACE will attempt to trace the rest of the program through to the end and then return to the + prompt. Inserting a break-point will halt the execution on a program whilst either XREF or TRACE are executing so the user may examine the state of the stack or the resistors or even change their contents. Break-points may be set by using the 'BS' command followed by a

CONTINUED OVER

hexadecimal number, we may invoke display of the error messages by altering the 'RT' option and on a second TRACE we may wish to dump the results:

**RT ALL
EN &1900
CO**

tion and as we are working with immediate addressing modes, the mnemonics are subtly changed.

Once all the additions are made, the program may be resubmitted to MASM for cross referencing so releasing the breakpoint is vital, otherwise the

XREF file for validity. A single point '.' will revert to level one (command mode). The manual gives an excellent example of using the *BUILD/ *EXEC utility in the DFS to create a symbol table file. XREF may handle a maximum of 1024 symbols, but setting breakpoints and loading

dexed, all Relative and Indirect Addressing modes are supported as well as Absolute Indirect addressing. Incidentally ZAX's Programming the 6502 book proved to be very, very useful throughout the whole course of learning MASM as it explains memory addressing methods

```

1900  A9 00  LDAIM  &00  A=01 X=54 Y=07 P=..1B....  S=E2
1902  85 70  STAZ   &70  A=00 X=54 Y=07 P=..1B..Z.  S=E2
1904  A9 1A  LDAIM  &1A  A=00 X=54 Y=07 P=..1B....  S=E2
1906  85 71  STAZ   &71  A=1A X=54 Y=07 P=..1B....  S=E2
1908  A0 00  LDYIM  &00  A=1A X=54 Y=07 P=..1B....  S=E2
190A  B1 70  LDAIY  &70  A=00 X=54 Y=00 P=..1B..Z.  S=E2
190C  48     PHA    A=AA X=54 Y=00 P=N.1B....  S=E2
190D  A9 AA  LDAIM  &AA  A=AA X=54 Y=00 P=N.1B....  S=E1
190F  91 70  STAIY  &70  A=AA X=54 Y=00 P=N.1B....  S=E1

```

Stopped at break point

```

1911  D9 70 00 CMPAY  &0070  A=AA X=54 Y=00 P=N.1B....  S=E1

```

Where CMPAY compares the contents of the accumulator (which the dump shows to be AA), typing the command PT &70 &71 will print the result:

0070 00 1A

Altering the code can be done from within TRACE by typing:

**PS &191A
D1 +
+
EA**

which will cause TRACE to dump the contents of the location before any change has been made to it. By typing in either + or - the programmer can step forward or backwards byte by byte until 'ESC' is pressed, however great care must be taken as we are working opcode and Operand level and as some opcodes are single byte codes, the user will have to fill these out when replacing single byte to double byte opcodes with NOPs. Also, working at this level requires a good knowledge of MASM's tokens for each instruc-

assembly will halt at a breakpoint and return to command level without even so much as a message. All reporting may be inhibited by the 'TR NONE' command. All the commands for both XREF and SCRXREF are accurately explained in the manual, and even though familiarising oneself with the intricacies of XREF and TRACE may prove difficult at first, the user is allowed far greater freedom compared with other assemblers and tools. There are commands within XREF which can be invoked at the 'Action' level prompt by simply typing in HELP:

**ADD
CLEAR
HELP
INIT
LIST
RESULT
SUMMAR
XREF**

ADD allows the programmer to add symbols to XREF's symbol table and will enter XREF into level two which invokes the prompt 'Symbol' and any reply will be checked with the current

*BUILD files effectively provides an unlimited number of symbols in store.

CLEAR simply clears all the tables set up by ADD or selectively clears the symbol name if followed by a valid symbol. INIT restarts all symbol pointers and reverts to the program's highest level (in most cases the execution address) and LIST will display all the current symbols in store.

RESULT will print the results in a formatted listing and will output to the current output device.

*SPOOLing a file is used if no printer is available, and SUMMAR summarises the symbols and indicates the point in memory where it resides.

THE MASM MACRO ASSEMBLER

Central to the utilities stands MASM which is used essentially to assemble programs created by the text editor. All addressing modes are supported (Implied, Accumulator, Immediate, Absolute, Zero Page) as well as Absolute Indexed and Zero Page In-

clearly — one of the few books which takes the time to include all of the above and although it can never really be used as a self teaching book, its use as a reference text is invaluable.

MASM source files are built around the basic 6502 opcodes and are adapted to suit different addressing modes. In many cases the IMMEDIATE addressing system proved to be the most useful and easy to program around as most jobs written in assembler use this technique. IMMEDIATE modes are supported by the IM extension to the mnemonic, so instructions like LDA, LDY, STA etc are all extended to use the LDAIM, LDYIM... prefix. Many assemblers from the past, running on all types of machine, used this method and I can only assume that this is included for historical reasons. It is easier to change the mnemonics than it is to change the basic assembler to suit addressing modes. Sending a character to OSWRCH will require the use of Immediate mode addressing as the command is to jump into memory with a value freshly stored in its Accumulator, e.g.

```
BEEP LDAIM 7 ;Character code 7 is same as VDU 7
              ;This is a comment line incidentally
JRR          ;oswrch must either be defined as
oswrch       ;&FFEE or simply JSR &FFEE
```

Advanced features of MASM which embrace all addressing modes are expression driven operands which allow the programmer the use of a general expression, such as those found in higher languages. Some valid ones are:

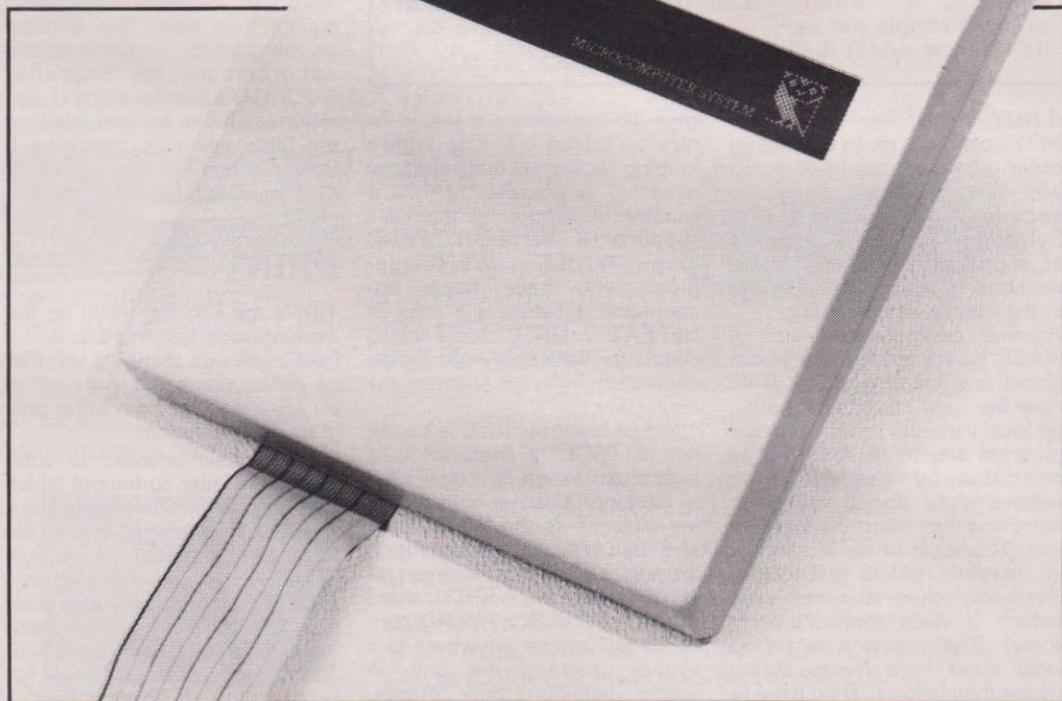
```
LDAIM &F0:AND:&1F
ADCIM &F0:OR:&0F
LDAIM byte/size
```

These symbols, which are used by the utilities XREF and TRACE may be alphanumeric characters which represent variable numbers and constants. They cannot be more than six characters long and, as seen in the simple BEEP example, all the symbols must be pre-defined even if it is with dummy values. Numeric constants may be either in Hex or Decimal allowing for two byte precision (&**** to &FFFF). A string constant may be enclosed within two double quote marks and is equated by any string. This means that tables of words may be set up like:

WORDS = "This is an example"

All arithmetic operators are supported, +, -, *, / and :MOD:; / is an integer division and three logical modes are supported, and OR and EOR, as well as the unary operators LSB and MSB which take the least or most significant byte from an operand. Needless to say that logical expressions such as =, <, >, <=, >=, and <> are supported; the latter may be replaced by a /=.

More advanced features which result in MASM's name centre around Macro Assembly. These are useful when a pattern emerges in a listing and repetitious amounts of typing are encountered. A good example would be:



```
error1 BRK
      = &83
      = "Too Few Arguments"
      = 0
```

The above might be repeatedly copied, but to save time a macro could be set up which merely expands the example to handle any code, a macro with the name of ERROR could be set up as:

```
MACRO
$label ERROR $setnum, $setstr
$label BRK
      = $setnum
      = $setstr
      = 0
MEND
```

Calling ERROR involves including the arguments which set up the macro, so calling up the macro ERROR involves including 'err1', &83 and "Too Few Arguments" if we wanted to return the error message. Default values in a macro be entered via the assembler.

Macro calls may be nested and may contain a reference to another macro, which may be further linked within an assembly structure. Libraries may be set up of macros and each macro library can be joined together using the LNK directive. MASM will

assemble as many files as it can store or until an END directive is met.

Conditional assembly is made possible by use of the directives [and]. These can be likened to the IF...ENDIF construct in older macro assemblers. This is particularly useful when considering macro assembly as assembling all the macro library would be wasteful and slow if only a few definitions were needed. Short of editing the macro library, assembling only certain parts would provide benefits such as a dramatic saving in potential assembler size. All code ignored in conditional assembly is ignored unless the command TERSE is included. [] is extended to include ! or ELSE which allows MASM to take two logical paths

CONTINUED OVER

dependent on an expression. Relational logical expressions are specified by combining them with Boolean logic to form the operators :LOR: :LEOR: :LAND: and :LNOT:. Order of precedence is such that:

**A + B < = add1 :LAND: add1 < > start
or more simply put as:
(a + b) < = add1) :LAND: (add1 < > start)**

:LNOT:, the Boolean logical NOT operator is given the highest order of precedence in common with ordinary unary operators, second only to :NOT:. Subroutines and local labels are all supported along with global variables, both within macros and in the main assembly listing.

Another exceptional feature of MASM is in its ability to store both global and local variables. Until now the only method of setting up local variables in an assembler program was to set them up by conditionally assembling a routine whilst storing values on entry and then returning these on exit. This leads to stack overflow in no time, unless the routine clears the values after each pass (which is even more cumbersome). The answer is to set up local areas in a Macro library where they belong. They have to be declared at first using the directives LCLA, LL, LS which Define local arithmetic, logical and string variables. Needless to say, GBLA etc handle all Global calls. The variable name has to obey all the rules set up by their macro parameters since a global variable is in fact a parameter which sets up that macro defined by the SETA, L, S commands.

STRUCTURED ASSEMBLER

Anyone familiar with writing Assembler programs on eight bit processors will realise that the code can become all too easily cluttered up and unstructured. Spaghetti programming as it is called can make even the best programmer throw a listing away

in disgust and start from scratch (it has happened to most of us, myself included) and care must be taken at every step in a program's design and development.

When assembling a program which requires a repetition of

over 10 instructions it would be nice to set up a macro with a looping facility so that repetitive assembly is possible. MASM is capable of supporting this as it supports a WHILE...WEND loop. WHILE...WEND for those who have never encountered it before is a form of REPEAT...UNTIL loop which checks for the validity of a logical expression before it attempts the instruction.

For instance, while a condition is TRUE (it conforms to a logical expression directly related to the loop) it carries on assembling code up to the WEND loop and then repeats the loop, upon a result being FALSE the next instruction after the WEND is acted upon. A WHILE...WEND construct can appear anywhere in a source program, not only in macro definitions and libraries, but they are best suited to generating a number of instructions which vary according to some macro parameter, making repetitious typing a thing of the past.

Ultimately when a macro does not seem to be working properly, but working none the less (aren't they the worst errors?) it would be good to check macro parameters by setting up test data and reading the results returned. Formerly this was achieved by dry-running a section of a program or even a whole program, on paper.

For those who either can't afford the wallpaper or who haven't the patience, the ASSERT command would come in very useful. It sets up values prior to assembly and will only continue whilst the value returned is TRUE. An example would read:

ASSERT:LEN:"\$text" > 4

In this example assembly would only occur when the length of a data area called \$text is greater than four characters long. If, for instance, the value returned is three then the assembler halts with the message: "Assert Failed at line XXXX". The directive ! has a similar effect but works on arithmetic Boolean expressions greater than zero. This is more revealing as the message returned not only gives the "Stopped at line XXXX" but the string is also returned. It can be evaluated on multipass assembly providing it does not contain any references to data areas later in the program.

PRINT

This is the smallest utility on the development system's disc and it centres around dumping text files of either assembled code or of dumps called up from other programs in the system.

The user is asked to enter any single letter command which is acceptable until terminated by a R which will immediately load the file ready for printing. Normally it would be well to set this up as a !BOOT file so that the user does not have to retype in each command after a BREAK is pressed. The commands are all single letters followed by either a parameter or simply a RETURN. If a RETURN is keyed in on a command which requires a parameter, the default values are assumed to be accepted. Commands such as W, L, T, and H define the scale of the Width, Line, Title and Page Heading whereas the commands N, A, P and E indicate whether the user wants to number each page, output into assembler-compatible fields, terminate printing or output to the Econet printer — spooled in the usual Econet-compatible parameters. Finally R executes the PRINT program.

THE DEVELOPMENT PACKAGE IN USE

With such a large package as this, the only way to effectively test it is

with some examples. Although the initial reaction is to use familiar tools for a while, I resisted the urge and got straight into writing with the development pack's facilities and was impressed by the ease in which I could write more and more ambitious code. Within two weeks I was using macros as if I had used them since buying a Beeb.

The screen editing facilities are second only to VIEW and with a far superior Find and Replace option. I was able to swap datanames and whole macros in a matter of minutes where a similar operation in other tools would have taken half an hour and still be prone to errors. The utilities such as XREF and TRACE were invaluable and although terse in places, I found them to be far superior to any development system yet.

Using the development system in a professional environment has, in the long run, increased the amount of code written to the point where Assembler is no longer a daunting task. Still the problems of actually solving the problems in assembler occur, but the process of text entry and debugging is made easier by a host of well crafted software tools, all beautifully interacting and augmented by an excellent manual. If you find you need to write large pieces of assembler using the 6502 Second Processor I would heartily recommend this package from Acornsoft. There are also versions included which do not require the use of the Second Processor and are exactly the same but smaller.

All in all I found the package easy to use and more importantly free from serious bugs. There were none that I could find in the assembler although time will tell; but I get the feeling that Acornsoft products are actually written using this package. It isn't often that one comes across a package like this which is so well endowed with tools and utilities. When one considers the price of £49.85 inc VAT for six programs, it does look to be an expensive product but one which will find a great deal of use if you write large assembler programs to run both across the Tube and the I/O Processor.

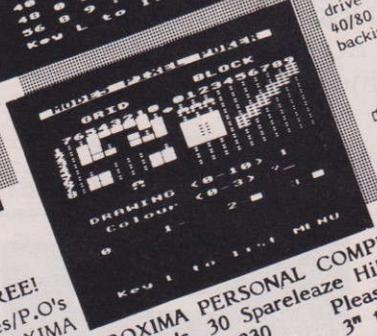
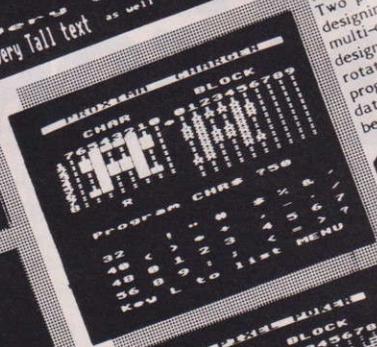
PERSONAL
COMPUTER
SOFTWARE

Proxima

See us on
Micronet 800

BEEB-TEXT
A sophisticated and unique machine-code program which allows virtually unlimited variation in the BBC's text display. The user has the option of varying character thickness, italic, style, height, width, colour combinations, etc. Up to 8 different fonts can be displayed in one page including shadowed and outlined types. Beeb-Text displays text in proportional spacing too however the user can also control character and line spacing independently.
Disc £15.00

▲ Prices are fully inclusive, no extra to pay.
▲ P&P on all orders is FREE!
▲ Please make cheques/P.O.'s payable to PROXIMA SOFTWARE.



THINK BIG *
A highly effective machine-code program for displaying any dimension text. Can be incorporated into other programs.
Cassette £5.95
Disc £8.95

PIXEL PACKAGE *
Two programs are supplied for designing single colour and multi-colour characters and designs can be mirrored, inverted, rotated and duplicated. The programs even store the resulting data in program lines ready to be used.
Cassette £7.95
Disc £10.95

DISC TOOLS The complete utility disc for twin 80 track drive users and includes a 40/80 or 40/40 or 80/40 backing up facility.
Disc £10.95

ROBOBRAIN Arcade fun. Disable the robot's positronic brain but watch out for its self defence.
Cassette £7.95
Disc £10.95

TWO PLAYER GAMES *
Two 2-player games including 4Line and Frustration, joystick compatible.
Cassette £6.95
Disc £9.95

PROXIMA PERSONAL COMPUTER SOFTWARE, 1G10 1BT.
Newlands, 30 Sparelease Hill, Loughton, Essex, IG10 1BT.
Tel. 01-502-0230
Our FREE program special offer continues. Contact us for details!



The SOURCE

THAT'S WHERE TO GET IT!

SERIOUS SOFTWARE SOURCE CATALOGUE

Software to do a job - not to play with! Our new catalogue not only lists but gives a description of each program. Business, Education, Scientific, Engineering, Radio Computing, Statistics and many other subjects.
FREE

BOOK SOURCE CATALOGUE

From Artificial Intelligence to Xenix! If you need to know more about almost any subject to do with Computing then this is for you. Perhaps the most comprehensive specialist book catalogue ever compiled.
FREE

C/PM & MS-DOS SOURCE CATALOGUE

A range of professional software from some of the worlds most experienced software houses, for the new operating systems now available on the BBC B.
A description is given of each program.
FREE

GIFT VOUCHER SERVICE

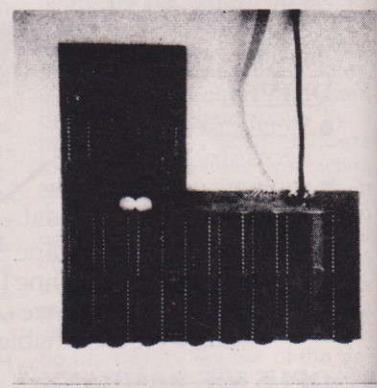
Do you know exactly what to buy as a gift? Why not give one of our Gift Vouchers? - Vouchers start at just £10 - then they can choose their own gift from any of our comprehensive catalogues!

Send your name, address and requirement, plus £ 1 (to cover postage) - For your free catalogue.

16 SOCKET ROM/RAM EXTENSION BOARD

Fully buffered the board offers the following features:

- All 16 sockets may contain 8K or 16K roms.
- Up to two pairs of sockets may be configured to accept 8K eproms to simulate a 16K eprom without the expense of a 27128.
- Up to 16K of CMOS RAM type 6116LP (made up of 8 2K ram chips) may be fitted to 8 of the available sockets leaving 8 free for roms.
- or 2 8K Ram chips (6264) leaving 14 available sockets.



The advantage of sideways ram is twofold:

1. Programs can be assembled directly to hex 8000 and debugged before being committed to eprom.
2. Programs intended for sideways roms may be stored on disc and downloaded into ram. Many more programs may be kept on disc allowing the extension board to be fitted only with roms that need to be resident.

This is a high quality PTH board and plugs into the extreme right hand rom socket. 4 wires to the paging register and one lead to the R/W line have to be connected.

Separate power leads for the board

are used to eliminate possible crashes that may occur due to trying to draw up to 650mA from a sideways rom socket. Board fully assembled and tested complete with full installation and operating instructions.

Cost £34.50 + VAT, £1.00 P&P

HCR ELECTRONIC SERVICES
THE INDUSTRIAL UNIT, PARKER ROAD
CHELMSFORD, ESSEX CM2 6ES
Tel: Chelmsford (0245) 350188



The Computer Mail Order People

David Winrow Marketing, Unit 3 PO BOX 9,
Northwich, Cheshire CW9 7TP.

ROM Report

Trevor Attewell

With many extension boards groaning under their burden of ROMs it was inevitable that someone would produce one more to help organise the others — hence ROM MANAGER. It responds to 18 commands, of which no less than eight are concerned directly or indirectly with passing ROM commands. Of these, *DIRECT and *VECTOR are two names for the same operation, namely passing a command to a specified ROM. The reason given for the duplication is that it doubles the odds against some future ROM beating the system by using one of these names. *FILE effectively does the same thing as *DIRECT and *VECTOR, but addresses only "external" (ie ROM-based) filing systems such as the DFS or NFS. If a RAM-based ROM filing system (see below) is in use, then *RAM replaces *FILE.

*DEFAULT is used in conjunction with *SPECIFY — the latter designates a ROM to which subsequent commands will be passed directly by *DEFAULT. Confused? — you won't be when you discover that whereas *DIRECT can address only one ROM, *DEFAULT will also try (if necessary) all ROMs of lower priority than the one designated by *SPECIFY. The latter does not survive even a soft BREAK, and must be redefined after it. The last two are *STOP and *START, which disable and enable a specified ROM, respectively, so that it will be ignored (or not) by the operating system. All these commands (except *SPECIFY) hold good only for the current operation. I have to admit that I would gladly have settled for just three — *START, *STOP and *DIRECT, having found the remainder rather a bother, especially when forgetting to reallocate *SPECIFY after a BREAK resulted in an error. It is also unfortunate that *D. is recognised as DIRECT, *DIS. becoming the minimum abbreviation for disc selection. Minimum abbreviations for ROMs should be longer than comparable OS commands, and preferably not less than three characters.

*CHECKSUM finds the

Beeb ROMs scrutinised: Watford Electronics ROM Manager.

cyclic redundancy checksum for a named ROM. The result is unique for practical purposes, and any change with time indicates trouble, though this is very rare except through physical ill-treatment. *EXAMINE lets you

Which socket?13 Copying

```

8000 C9 1 F0 1F 60 EA 60 E |||||£||£||
8008 3 42 41 53 49 43 0 28 ||BASIC||
8010 43 29 31 39 38 33 20 41 C>1983 A
8018 63 6F 72 6E A D 0 0 corn|||||
8020 B8 0 0 A9 84 20 F4 FF ||||| |||
8028 86 6 84 7 A9 83 20 F4 ||||| ||
8030 FF 84 18 A2 0 86 1F 8E ||||| |||
8038 2 4 8E 3 4 CA 86 23 ||||| ||#
8040 A2 A 8E 0 4 CA 8E 1 ||||| |||
8048 4 A9 1 25 11 5 D 5 ||||| |||
8050 E 5 F 5 10 D0 C A9 ||||| |||
8058 41 85 D A9 52 85 E A9 A|||R|||
8060 57 85 F A9 6 8D 2 2 W||| |||
8068 A9 EC 8D 3 2 58 4C F8 ||||| ||X||
8070 C2 41 4E 44 80 0 41 42 ||AND|||AB
8078 53 94 0 41 43 53 95 0 S|||ACS|||
8080 41 44 56 41 4C 96 0 41 ADVAL|||A
8088 53 43 97 0 41 53 4E 98 SC|||ASN||
8090 0 41 54 4E 99 0 41 55 ||ATN|||AU
8098 54 4F C6 10 42 47 45 54 TO|||IBGET
80A0 9A 1 42 50 55 54 D5 3 |||BPUT|||
80A8 43 4F 4C 4F 55 52 FB 2 COLOUR|||_

```

The start of a ROM listing produced by ROM MANAGER.

```

*H.ROM M.

Watford Electronics ROM MANAGER 1.00
CHECKSUM <rom>
DEFAULT <command>
DIRECT <rom> <command>
EXAMINE <rom> (<start addr>)
EXPLAINFX (<FX number>)
FILE <command>
FUNCTION (<key number>)
INCLUDE <start addr>
MODIFY (<start addr>)
NAMES
RAM <command>
REMOVE
SPECIFY <rom>
START (<rom>)
STATUS <rom>
STOP <rom>
VALUES
VECTOR <rom> <command>

DS 1.20
>_

```

ROM MANAGER command list.

read the contents of any ROM, including BASIC. It is in standard HEX and ASCII format, and the cursor can be wound down to the bottom of the screen to scroll the data upwards, and vice versa. The cursor also moves sideways between the two formats (using TAB), but you can't actually do anything with it. *NAMES lists all ROMs present, revealing their names, socket numbers, and whether they are active or disabled.

YOU NEED ONLY ASK!

Several commands produce miscellaneous information. *VALUES tells you which

CONTINUED OVER

***NAMES**

```

A> 14 = BASIC
A> 13 = BASIC
A> 12 = GRAPHICS EXTENSION
A> 11 = WORDWISE
A> 10 = DISC DOCTOR
A> 9 = DUMP/OUT
A> 8 = PRINTMASTER (Epson)
A> 7 = CARETAKER
A> 6 = ROM MANAGER
D> 5 = EXMON
A> 4 = DFS, NET
A> 3 = EPROM
A> 2 = GREMLIN
A> 1 = TOOLKIT
>_

```

ROM MANAGER tells you which ROM is in which socket, and whether each is (A)ctive or (D)isabled.

socket ROM MANAGER is in, how many ROMs are active with higher priority, the name of the current filing system, whether the DEFAULT option is active (and if so the default socket number), and whether any RAM-based ROM is in use (and if so the service entry address). Further information is available from *STATUS <ROM> — namely the ROM socket number, its title and copyright message, its nominal length (ie 8K or 16K), whether it has language and/or service entries and whether it is active or not. If you have forgotten your FX calls (and are too lazy to look in the UG) *EXPLAINFX gives a brief rundown on the first twenty-two, and *EXPLAINFX n gives more details about *FXn (n = <22). Finally, *FUNCTION merely follows a long line of utilities in listing the contents of any one or all of the soft keys for possible editing.

NOT SO MUCH RAM AS ROM

If you are thinking of putting some of your own programs into ROM it is useful to be able to get them running properly in the correct format before actually blowing an EPROM. *INCLUDE lets you use the Beeb's RAM for this. Your program can be assembled anywhere within the normal RAM area, and it will be included in the ROM list until you issue *REMOVE or press BREAK. Your routine must conform with the RM protocol given in Chapter 15 of the Advanced User Guide. When finalised the routine can be moved to the appropriate location (generally starting at &3000 or thereabouts) ready to be blown into an EPROM. Absolute ad-

resses must be changed appropriately, of course. This, and other editing, can be done using *MODIFY — a standard memory editor. It displays 128 bytes at a time in the usual format, and the cursor moves as in *EXAMINE, but this time amendments may be made in either Hex or ASCII. The single-speed scrolling is slow, but you can always ESCAPE and call for a new start address.

CONCLUSION

It is ironic that the actual 'management' part of ROM MANAGER's functions would be

***VALUES**

```

Watford Electronics ROM MANAGER 1.00

ROM Manager socket number = 6
Number of active higher ROMS = 8

Filing system: Floppy disc(s)

Default ROM is not selected

RAM vector is not selected
>_

```

unnecessary if all suppliers of ROMs supported the simple and sensible convention agreed (and used) by Beebug and Computer Concepts, whereby an optional 'house' letter can be added to the front of any command name to avoid clashes unambiguously (it is up to every supplier to avoid duplication among his own products). Where it does become necessary to route commands to particular ROMS it is easier to do with ROM MANAGER than by

disabling an interfering ROM by poking its page two flag directly. Users will also find some or all of the general utilities handy. Perhaps the most useful feature is the ability to develop programs in the Beeb's RAM which will subsequently be put into EPROMs. The manual eschews any example, referring readers to an Acorn Application Note or the Advanced User Guide. Unfortunately ROM programming is not the easiest exercise for the beginner.

***EXPLAINFX**

```

0 - Print OS version number
1 - User expansion
2 - Select input stream
3 - Select output stream
4 - Enable/disable cursor editing
5 - Select printer destination
6 - Select printer ignore character
7 - Set RS423 receive speed
8 - Set RS423 transmission speed
9 - Set flash period for colour 1
10 - Set flash period for colour 2
11 - Set keyboard repeat delay
12 - Set keyboard repeat speed
13 - Disable specified event
14 - Enable specified event
15 - Flush selected class of buffer
16 - Select highest ADC channel
17 - Start an ADC conversion
18 - Reset the soft keys
19 - Wait for screen sync
20 - Explode user character allocation
21 - Flush specified storage buffer
>_

```

Forgetful and bone idle? ROM MANAGER lists the commoner *FX calls.

Buggy Briefing

Dave Carlos

During the first series of the "Computer programme" many people were fascinated by the little buggy that was demonstrated solving mazes and following black lines. This is that same buggy which has been available for some time now but which has recently had a much needed enhancement. The addition of the pen mechanism turns the buggy into a viable turtle substitute but with a much greater flexibility than the normal turtle can offer.

The buggy is constructed from "fischertechnik" parts and comes in a pack ready to assemble. The use of a standard technical building system means that those who want to modify, extend or adapt the design can do so with relative ease and without ever damaging the buggy in any way. The only tool that you need to construct the buggy is a screw driver as all the other

The Economatics Buggy becomes more versatile with a pen kit add-on.

parts are made to simply push together. The instruction book is well written and gives all the details required to build the buggy fairly quickly. The only criticism that I would make is that it would have been nice to have had a fold out, or indeed loose, parts list and diagram so that you weren't constantly referring to that section in the front of the manual. The buggy is built by constructing a number of sub-assemblies each with a diagram so explicit as to make mistakes almost impossible.

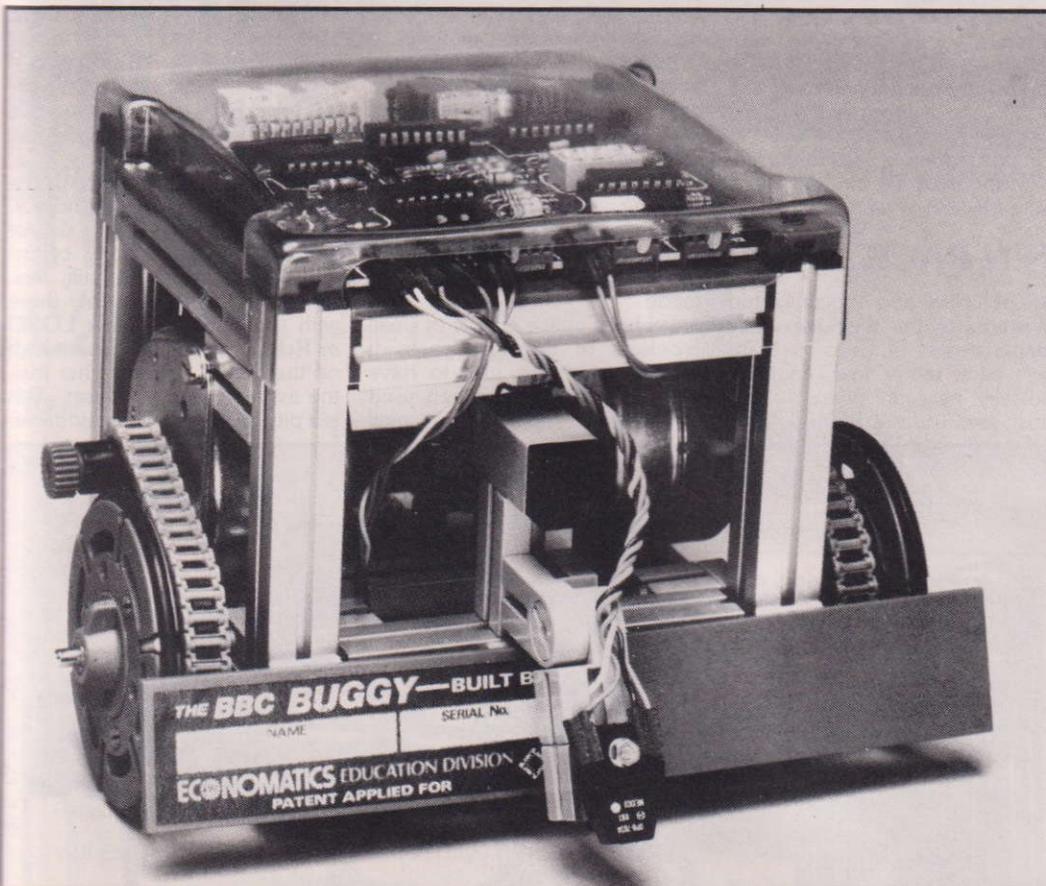
If you are using the pen kit too then a supplementary manual is supplied and it is important that you read this first as it can save you having to take the buggy apart again after building just to fit the pen kit. I doubt whether anyone will find the building of the machine difficult for although it looks a little daunting the instructions are excellent and success is easy to achieve.

The kit also includes the ready built control circuits and all the cables that you require. The buggy seems to fit into almost

every socket on the BBC computer! It uses the 1 MHz bus, the analogue port (Joystick) and the output socket from the power supply. This last requirement is a little unfortunate, but keeps the cost of the kit down. It means that the buggy can only be used with cassette based software, as it is inadvisable to remove the disc power plug whilst the BBC is switched on. Those with self powered discs will experience no difficulty but you need to consider the purchase of a power supply you want to use BBC driven discs with the buggy.

Also included is tape containing 13 programs to drive the buggy in different ways. The first of these is the most vital after building for it gives you a full test routine for the machine. There are both straight line and rotational tests and a full suite of sensor tests. It is in the area of sensors that the BBC Buggy differs from so many of the other turtles that you can buy for the computer to control. Yes, the BBC can control this buggy in just the same way as most other turtles but this is a buggy with a mind, or rather senses, of its own. When I explained it to the children at school I showed them its "feet and legs", two stepper motors; its "hands", two front bumpers and both its "eyes", a light sensor and a barcode reader. This means that the buggy can be used in a whole variety of ways that a normal turtle cannot. The other programs in the software package illustrate the use of these sensors in an automatic or demonstrative way.

Starting with the simple SWITCH program which allows you to control the buggy by means of the cursor keys but which is really provided for those who want to study the control software in detail, you will find yourself progressing quickly to the MEMORY SWITCH and ROUTEPLANNER routines. In the first of these you set up a route using the cursor keys which is remembered and can be replayed again and again. The latter program involves your planning the route in advance on



CONTINUED OVER



the screen and the buggy tries to follow your plan. It is worth mentioning at this stage that ideally your buggy should have a "park" in which to play! Far from being frivolous this is a very serious suggestion and could prevent your buggy from coming to any harm. I recently used the buggy on a table top and I soon lost count of the number of times that disaster nearly struck. The "park" has an edge to stop any such problems and can provide a good walking surface too, so I would recommend the construction of such an item and details are given in the software notes.

EXPLORATORY SOFTWARE

There are then other variations on the plan-a-route-and-walk theme before we come into the exploratory software. I have found that both children and adults find these programs utterly fascinating and will watch them for hours "just changing this" or "altering that" to see if the buggy will perform better or can be fooled in some way. The simplest program involves the buggy finding its limits using its bumper sensors. There is a program that causes the buggy to try to find and then measure an object that is placed in its path. The object has to be heavy enough to stop the buggy — a gold brick would

be superb — perhaps the editor will lend me one!

Using the two "eyes" that are supplied, the buggy will go looking for a light with the program SUNSEEKER. The children at school thought of this as magic but this program, like all the others, is fully listable and therefore you can both try to understand the method used and modify it to be more to your liking if you wish. The other "eye", a barcode reader, is used in the line following program and this too is quite magical to watch.

PEN PACK

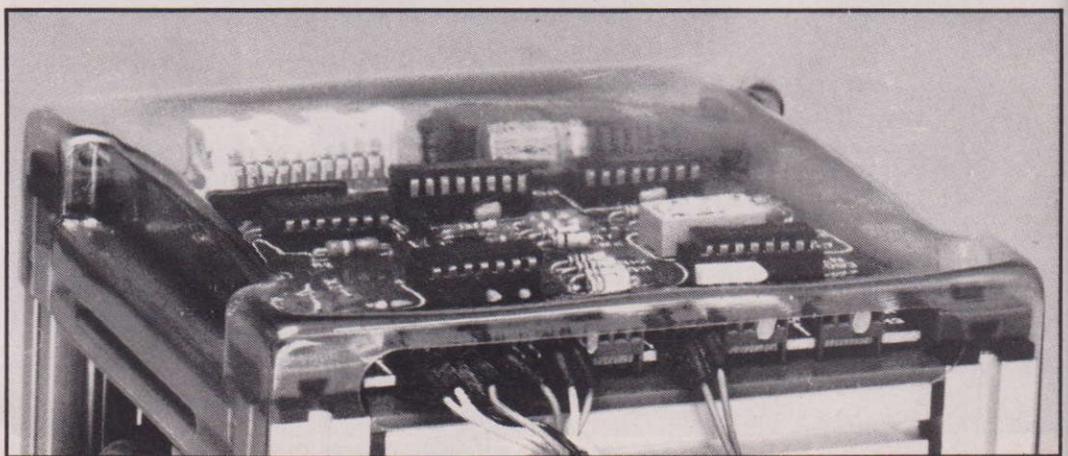
The pen pack also contains a trio of programs but they are really adaptations of those in the standard pack rather than anything radically new or different. The most useful is the PSNAIL pro-

gram which can be used to draw mathematical shapes and even name writing given enough time. The other program, TEST being the first, is a buggy command editor which allows you to develop a "movement vocabulary" and print out successful routines for use again. It would have been nice to have been able to write these to cassette or disc too. The pen is very simple to use and can be either up or down when movement occurs. If it is located exactly in the centre of the wheel axles then corners are very neat and crisp, otherwise they show all the movements that the buggy has made.

I have only a couple of small criticisms of the pen pack. It would have been nice to have had full details of the pen used and a list of suppliers or a mail

order form for replacements. Secondly the pen down command doesn't seem to work on occasions due to the guide rails being a little too tight. Both are minor niggles however and don't really detract from a useful addition to the system. There is a grab arm planned too but this hasn't been released yet.

Overall this is a very interesting and instructive add-on to the BBC computer and although the price is likely to inhibit a number of users from buying it (£189 for Buggy and £30 for Pen Kit), those who do are assured of a number of interesting activities. I still feel, however, that it is mainly those with an interest in either LOGO or Robotics who will have it high on their list of desires rather than the average computer user. This is a pity but quite understandable.



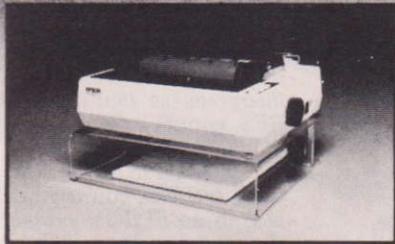
NEW!

from

Viglen

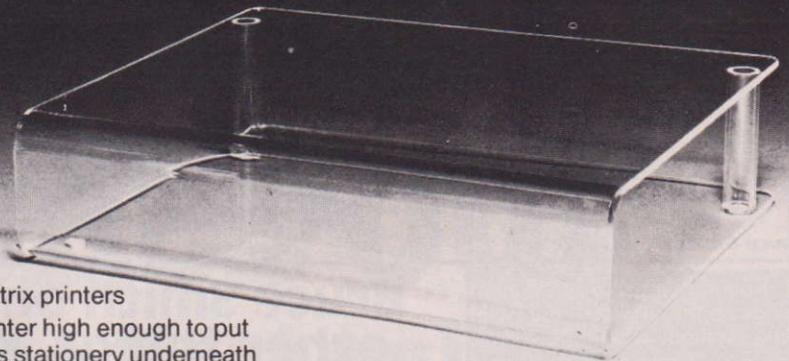
COMPUTER SUPPLIES

A PRINTER STAND



Printer Stand

£12.95 INC. VAT
Carriage & Packing £2.00



- For dot matrix printers
- Raises printer high enough to put continuous stationery underneath
- Beautifully finished in clear perspex • Viglen quality every time
- Will accept paper up to 12½" wide • Non slip rubber pads

Dimensions: 15" (380mm) wide 12½" (320mm) deep 4" (90mm) high

COME TO VIGLEN FOR A FAST, FRIENDLY, PERSONAL SERVICE

To order, complete and send form, or ring
VERONICA, SYLVANA OR CATHY Now on 01-843 9903

Post to: VIGLEN COMPUTER SUPPLIES, UNIT 7, TRUMPERS WAY, HANWELL, LONDON W7 2QA.

AB1

Please send me _____ (qty) PRINTER STANDS at £14.95 each. I enclose Cheque/P.O. for £ _____ made out to

VIGLEN COMPUTER SUPPLIES or debit my ACCESS/BARCLAYCARD No. _____

Name _____



Signature _____

Address _____

PHILIPS 14" COLOUR TV/MONITOR

£235 inc VAT

TV/Monitor (resolution better than 585 x 450 pixels. Dot-to-dot distance .65mm)

(TV only: £185 inc VAT)

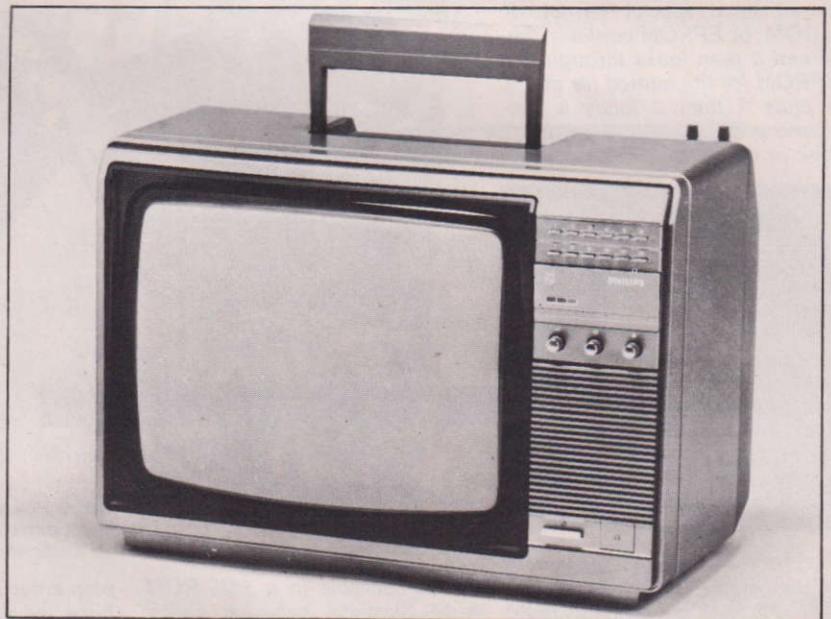
Plus £8 carriage and packing

Viglen

COMPUTER SUPPLIES

Personal Service & Quality coupled with Wholesale Prices, Unit 7 Trumpers Way, Hanwell, London W7 2QA. Telephone: 01-843 9903.

For special attention to your orders or enquiries concerning MONITORS, PRINTERS, COMPUTERS, DISC DRIVES, ring VERONICA, SYLVANA or CATHY on 01-843 9903 NOW or fill in the coupon below.



- Easy to carry • Lightweight • Sparkling picture in seconds • Reliability and performance excellent • Headphone Socket can also be connected to tape recorder • Loudspeaker mute switch • Retractable carrying handle
- Metallic silver finish with restful dark picture surround • Includes RGB lead connecting direct to your BBC Micro. • Philips Model No. 14CT 2006/05T

Post to: VIGLEN COMPUTER SUPPLIES, UNIT 7, TRUMPERS WAY, HANWELL, LONDON W7 2QA.

AB1

Please send me _____ (qty) Philips TV/Monitor at £243 each. I enclose Cheque/P.O. for £ _____ made out to

VIGLEN COMPUTER SUPPLIES or debit my ACCESS/BARCLAYCARD No. _____

Name _____



Signature _____

Address _____

Questions Answers

Bruce Smith

Q: Robin Sydney from Penrith brings up the subject of the ROM filing system when he (she?) writes. . . "I have read in my User Guide about a filing system called the ROM filing system. However there seems to be very little to read elsewhere about this system unlike the cassette filing system and disc filing system. Is this because I am plain ignorant or as my friend suggests, it was never actually implemented on the BBC micro?"

A: Well the answer is that it does indeed exist, though there are only a few items of software in ROM filing system format available for use with it.

To initialise the system the command *ROM is entered. Now when any loads are performed the MOS looks in its sideways ROM area for programs stored in a special format. If a ROM or EPROM contains this format it then looks through the EPROM for the named file and if it finds it then it loads it into memory as if it were coming from tape or disc.

Q: Mr. Wilde of Letchworth writes. . . "I have had my BBC micro for over a year and feel that I have mastered BASIC. I am now keen to take up the challenge of a new language and I was wondering if you could provide me with some details of suitable languages that are available for the Beeb. I am not particularly interested in learning machine code and the language should be ROM based as I do not use disc."

A: There are quite a large variety of languages available for the BBC Micro at present with more in the pipelines. Luckily most of these take advantage of the ROM paging facility of the Beeb and are available in the form of a plug in EPROM. Unfortunately though quite a few require the use of a systems disc, so unless you can persuade the supplier to transfer it onto tape for you your choice is limited.

My favourite "other" language is FORTH. There are several standards available at present but the latest standard, Forth

Bruce Smith on, among other things, the ROM filing system and how to save a few quid when upgrading to disc.



Micro Power's extension ROM adds extra language commands to make the most of BASIC.

83, is available in a 16K ROM from Skywave software, called Multi-FORTH 83. This is interesting in that it allows multi-tasking — in other words the FORTH interpreter can run several programs, or more correctly tasks, at once.

Acornsoft have recently released ISO Pascal in ROM, from which BBC BASIC borrows many of its features. Also new from Acornsoft is LOGO, which is crammed into two 16K EPROMs. Even so the 32K of code is not a complete im-

plementation, though it does have the software to control externally attached buggies or turtles.

Another interesting language is BCPL though at £99.00 this is a somewhat expensive purchase for a language learning tool.

The RFS format is almost identical to that used by the Cassette filing system, though there are minor differences. The EPROM containing the FS must contain a ROM header in the first dozen or so bytes so that the MOS can recognise it as such,

and must also contain a mini-interpreter so that it can handle RFS service calls issued by the MOS.

If you wish to construct your own RFS files you will need access to an EPROM programmer so that the completed files, called ROM images, can be blown into place. Alternatively the images could be saved on disc and loaded into any sideways RAM and used in a similar manner if need be.

Q: Mr. Andrews from Colney Heath raises a very interesting point, he asks. . . "I have a Model B BBC micro. I am considering upgrading to discs so I will therefore need to have a DFS fitted to my machine — from what I have seen this will cost me about £100. However I see that the 6502 second processor contains a DFS, so it seems to me that for £200 I could have a DFS and lots more memory. Is this indeed the case or have I overlooked something?"

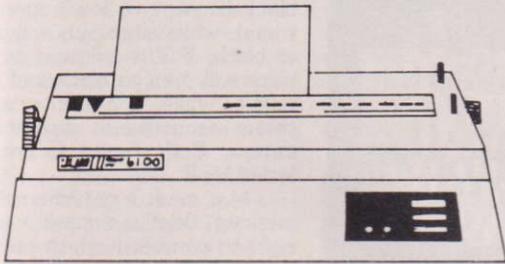
A: As I said, very interesting. Mr Andrews seems to have hit on an idea here, although he is not entirely correct. If you are thinking in terms of upgrading to discs and second processors then doing both at once could save you about fifty quid!

The second processor comes equipped with a DNFS chip, or Disc Network Filing System chip. It does not supply the disc interface kit — this is a handful of chips that control the hardware associated with the disc filing systems, the drives in other words. On their own these chips cost about £50-£60, but the kit suppliers normally add the DFS chip to make up the complete package. All you need to do is find someone to supply just the interface kit minus the DFS chip; buy the second processor and use the DNFS chip from here and save 40-50 quid! No doubt Acorn will have a moan about this idea — but what about giving us a rebate on our redundant DFS chips lads?! Me especially as I have both the Z80 and 6502 and therefore two DNFS chips but only one Beeb — what about it Chris?

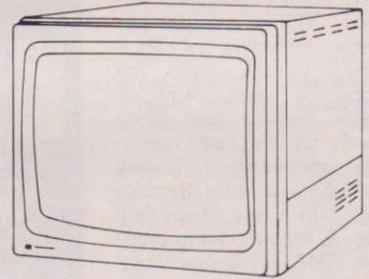
VIGLEN

branches out

to offer the best value in monitors & printers



**NEW
SPECIAL
OFFERS**



Dot Matrix Printers

Epson RX80/FT **£269.00**
Uncler Epson RX80 **£269.00**
80 cps with friction and tractor feed. A reliable printer competitively priced.
Epson FX80 **£379.00**
Canon PW 1080 A **£309.00**
160 cps with near letter quality printing including friction and tractor feed.
Shinwa CP80 **£199.00**

Colour Monitors

Microvitec standard 1431 **£199.95**
Microvitec medium 1451 **£315.00**
Microvitec high 1441 **£442.00**
Philips 14" TV/monitor **£235.00**
(RGB Input)

Daisywheel Printers

Juki 6100 **£375.00**
Epson DX100 **£450.00***
SAN PLE 2000 **£299.00**
* Previously £499.00 ** Limited Stock

Monochrome Monitors

Philips 12" Green V2001 **£75.00**

1½ metre length leads for BBC Micro £8

ALL prices include VAT
Please add £8 for carriage.
We also stock other computer peripherals, accessories and complete work processor systems at unbelievable prices.
Please call for our latest offers.
You may also purchase these items direct by calling at our factory/showroom in Hanwell, London.
Prices correct at time of going to press and offers subject to availability.

Post to: VIGLEN COMPUTER SUPPLIES UNIT 7, TRUMPERS WAY, HANWELL W7 2QA

Telephone: 01-843 9903. Personal Callers Welcome.

Please send me (state number required)

I enclose Cheque/P.O. for £

I prefer to pay ACCESS/BARCLAYCARD (Delete whichever is not applicable)

Card No. _____

Signature _____

Name _____

Address _____

Incl. £8 carriage. Cheques payable to Vigen Computer Supplies.

Credit cards valid if agreed by card holder. Address below must be the same as card holder.

ROM Report

Trevor Attewell

DUMPOUT 3 from Watford Electronics follows and improves upon their earlier EPSON DUMP and DUMP OUT 2 ROMs. The basic purpose is similar — to provide screen printer dumps for any Mode, with a number of options such as variable dump size and proportions, colour masking, choice of positive or negative dump and so on. Two new OSWORD calls are also implemented. There are six star commands, including *HELP DUMPOUT, which gives the command list, and *HELP PRINTERS, which lists those recognised. Of the four operational star commands only one (*GIMAGE) is used for graphics dumping, which we shall deal with later. A second dump command (*TIMAGE) is used for a fast, text-only dump in any mode using the normal printer characters, any graphics characters being printed as asterisks.

Dumps can be from a text window, or the whole screen, and *TWINDOW provides an easy way to specify the former. It causes the four characters in the screen corners to "flash" (actually they alternate with the next higher ASCII code, a blank producing an exclamation mark). This indicates the corners of a window, which can be manipulated by the cursor, TAB and SHIFT keys, the last increasing the speed of movement. Pressing P at any time reveals the window coordinates, including any previous change in origin. RETURN and ESCAPE both terminate the process and D defaults to full screen. *GWINDOW is used similarly for the graphics window, but actually draws the window outline. The same keys are used with the addition of V, which displays the coordinates at the graphics cursor.

PARAMETRIC PERMUTATIONS

The flexibility of the graphics dump is obtained by using no less than 15 arguments, of which 14 are optional. The mandatory argument is the printer type

Dumpout 3 is the latest helpmate from Watford Electronics for those who want to do just that bit more with a printer.



Showing the effects of the (E)mphasis parameter — Mode 7 letters and separated graphics are in black or white, but background and contiguous graphics are dumped normally.

```
*H.DUMPOUT
Watford Electronics DUMPOUT 3.0m
DUMPOUT
  GIMAGE <printer> (P) (T) (G) (M<mask>>
  (F) (L) (H<scale>) (V<scale>) (R<0-3>)
  (X<min><max>) (Y<min><max>) (I<indent>)
  (C) (E)
  GWINDOW
  TIMAGE (X<min><max>) (Y<min><max>) (I<
  indent>)
  TWINDOW
OS 1.20
>_
```

which, for most of us, is extremely unlikely to change, and a default to Epson would have helped the majority without making things any more difficult for the others. The remaining arguments each require a letter prefix (we will call this the parameter) followed, where appropriate, by one or two numbers. Five parameters must be in a specified sequence (if used), though not necessarily contiguous. However, it makes sense to stick to the order given for all parameters — this minimises unconsidered side effects and helps to guard against accidental omissions. Where numbers are needed they can be in binary, hex or decimal if prefaced by an ap-

propriate symbol.

The first optional parameter is P, which gives a physical colour dump. By default logical colours are used, and the shading patterns automatically give the maximum contrasts possible — which may not be the case with physical colours.

T forces a two-tone dump in inverse tones, black printing as blank (ie paper colour, normally white), while all colours will print as black. If T is followed by G, black will print as black and colours as white. G also inverts the colour sequence in multicolour dumps. Both T and G are affected by P.

M < mask > provides colour masking. Briefly, < mask > is an eight-bit number in which each bit corresponds to one colour. If a bit is set the corresponding colour in a multi-tone dump will print normally, but if the bit is clear it will be printed as white. The result also depends on P, T and G, but G is not needed if M is used, since its effect can be duplicated by changing the mask. This facility will not often be needed, but calls for logical thinking if it is! F is used to select a higher printer speed, if available.

SIZING UP THE SITUATION

The screen area to be dumped is set by X<min><max> and Y<min><max>, which are the screen coordinates, not taking account of any shift in origin. If this area is larger than that set by *GWINDOW, then only the

*H.PRINTERS

```
Watford Electronics DUMPOUT 3.0m
PRINTERS
SEK Seikosha GP80/100
SEK2 Seikosha GP250
TND Tandy LPVII/DMP100
DMP Tandy DMP120/200
NEC PC8023
EPSON FX/RX/MX
SHINWA CTI CP80
```

```
OS 1.20
>_
```

part within the latter is dumped. Total default is to the whole screen. Four inter-related parameters deal with the size and proportion of the actual printer output, and these require some care in use. The manual tries to be helpful, but is likely to succeed best with lateral thinkers.

The basic size parameters are $V < \text{scale} >$ and $H < \text{scale} >$, for vertical and horizontal scales. Although decimal arguments can be declared, the ROM works in hex, as do the minimal examples given.

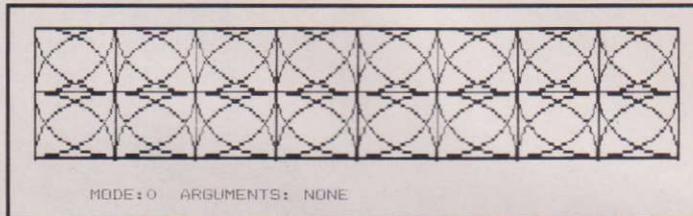
Inverse functions are used, so that doubling $< \text{scale} >$ from $\&100$ (=256, the default) to $\&200$ (=512) halves the corresponding dimension. The scale arguments determine the number of printer dots used to represent each pixel (or number of pixels/dot), and fine control of the dump size and proportions is possible, including very small dumps as well as large ones. The snag with fine size control, found in every printer dump, is that the screen image is made up from rectangular pixels of fixed size, which the printer can only reproduce as dots in a different, equally fixed pattern. Hence if the dot/pixel ratio is not integral, some pixels must inevitably be omitted in small dumps, or represented by more or less dots than average in large ones. This happens in so-called "plotter scaling", the ratio being such that geometrical outlines are reproduced with undistorted shapes by a particular plotter. On the other hand it may be important to use an integral dot/pixel correspondence to avoid missing or oversized pixels, for example in line drawings. DUMPOUT3 does this with another parameter (L). If this is used, V and H should only be multiples or factors of 256 (&100).

It is also possible to use more than one V and H in succession! The manual invites misunderstanding about their interaction by referring to "the product of all scale parameters acting in that direction". It is the scaling factors that must be multiplied — thus successive scale parameters of 512 and 128 (taking easy numbers) would give an overall

scale factor of $(256/512) \times (256/128) = 1$, ie same (default) size.

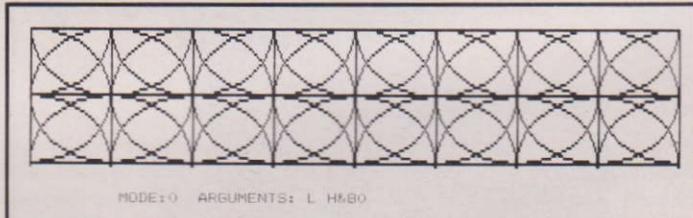
THIS WAY UP

Next we meet R, followed by a number from 0 to 3, which sets the dump orientation on the paper to be 0, 90, 180 or 270 degrees. If R precedes V and H their directions are interchanged, and if L follows them then they are reset to their default values. The parameter E gives some contrast expansion which can sharpen the appearance of Mode 7 characters and separated

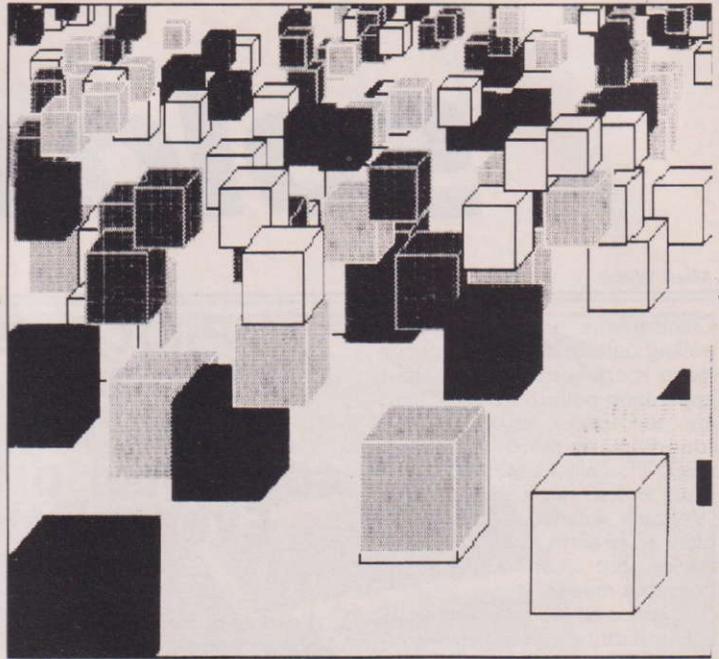


Above: Default dump of circles and squares shows varying line thicknesses (see text for explanation).

Below: (L)inearising parameter ensures consistent thickness desirable in line drawings.



graphics. It changes the foreground colour of text or separated graphics to white if it was lighter than the background, and to black if it was darker, but does not affect the background or contiguous graphics foreground colours. The illustration shows the effects of this command. The parameter C prints all Mode 7 graphics as contiguous. This is mainly to improve the accuracy of small dumps, in which separated graphics can be somewhat lost in the "noise". If E and C are used together all graphics are contiguous, but only text is subjected to contrast expansion. Finally, it specifies an indent from the left paper margin from which the dump is to start, in tenths of an inch.



A typical graphics dump (arguments were V&EF R1). The original was produced by "Cubes", one of many elegant programs listed in "Creative Graphics", by John Cownie, published by Acornsoft.

umn and row, the character code at that position prior to the call and the X and Y position of the pixel within a cell are returned. The colour cannot be pre-ordained, but must be that produced by the control codes in force in the region. An example is given of the latter call. These additions will be very useful to experienced programmers exploiting Mode 7 graphics.

CONCLUSION

DUMPOUT 3 provides very useful and comprehensive facilities for graphics dumps, to the extent that its use can be complex, though most users will seldom need all of the many options. It also has one limited text printing capability, plus two new OSWORD calls that should be useful in graphics production. If you are considering DUMPUT 3 and PRINTMASTER (reviewed in October) as possible alternative purchases, note that they are basically different animals — the one concentrates on graphics dumps, while the other looks after the whole range of printer applications, of which dumping is only one. Both include a simple, fast text transcription, but whereas PRINTMASTER reproduces user-defined characters, DUMPOUT 3 does not. In terms of graphics dumping DUMPOUT 3 is slower but more comprehensive and flexible, and extends to smaller printed sizes. It is, of course, the only choice for printers other than Epson or compatible makes, and is certainly good value.

The last commands to be considered are not star commands, but are implementations of two new OSWORD calls, &89 and &8A, applicable to Mode 7. OSWORD with &89 reads a pixel status at a given graphics coordinate. A 16-byte parameter block is required, and information is returned about the colour of the pixel and background, the control codes in use, whether flash is on or off, whether the pixel is on or off screen and whether or not it is in a separation gap, together with the text coordinates of the character containing the pixel and the latter's vertical position within a cell. OSWORD with &8A is used to plot a pixel, using an 11-byte parameter block. After the call the character col-

Solo Pilot

Mark Webb

Pilot One's digital interface opens up an exciting world of computer driven devices. Ever wanted to be a crane driver?

A variety of model vehicles can be controlled by your BBC.

Cracking the problems of controlling outside devices with your micro is not currently the easiest application path to follow. There are too many mysteries surrounding memory locations, OSBYTE calls, enabling, interrupts and so on. The 6522 VIA (Versatile Interface Adapter) is often referred to as a "powerful" device, but what in real terms does that mean?

Amongst the now numerous bits of hardware designed to link your BBC via its user port to some outside device is the offering from Pilot One. The team that devised their interface, software and a ready prepared range of applications, came directly from teaching teachers about using this kind of equipment in schools. They have a close acquaintance with just what is required at this early stage.

GETTING TO GRIPS

It is very easy to be overwhelmed by the sort of data sheet tutorial which some books give on the user port and to decide that this is beyond your programming capabilities and to leave it to the experts. In fact programming the user port can turn out to be very simple indeed once you have grasped the fundamental aspects.

This is where Pilot One fair especially well. The booklet which accompanies each module, the interface, crane, alarm kit and so on, is not a comprehensive treatment but clearly explains exactly what is going on as each programming step is carried out. The software is a new idea, a combination of teaching examples and utility aids to individual programming.

HARDWARE

The initial piece of hardware essential to the Pilot One system is their interface box, not a black one this time but a smart white one with colour coded input and output plugs. It has its own power supply so no worries about the auxiliary power plug. A five volt power supply is available on the box for connection to a motor or

buzzer. The relays which are connected to the output lines of the BBC's user port via the digital interface are simple electrical switches. When the output is off the centre socket (yellow) is connected to the bottom. When the output is on the connection is made with the top. Thus the switches can control a simple circuit to turn a motor on and off. In reverse, microswitches, photo-diodes and so on can be used to complete circuits and change the state of the input lines, which are then read by the BBC.

SOFTWARE

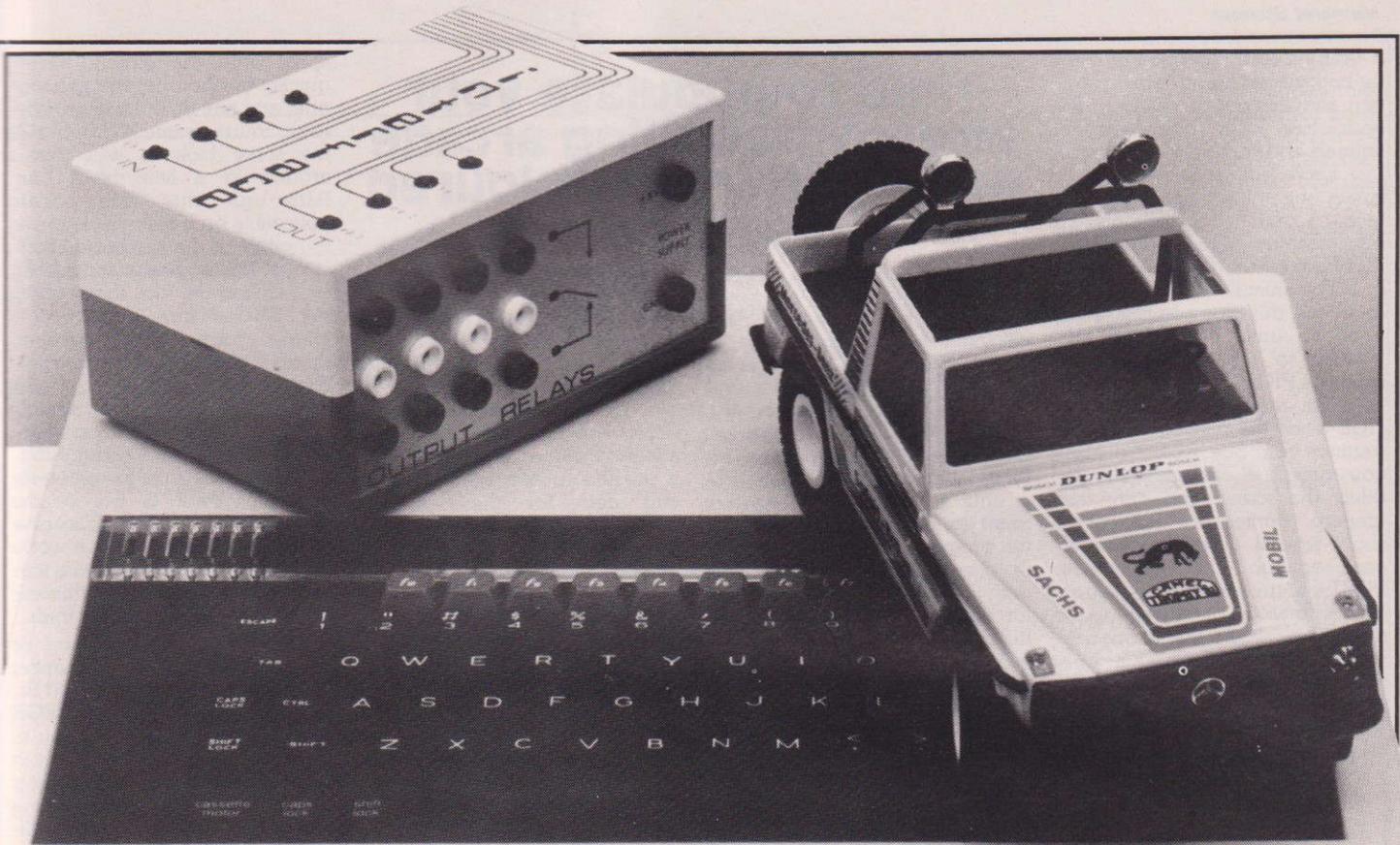
The software that drives the interface and the applications on the far side of it comes on disc or cassette. All the information you will require to exploit the digital interface with your own applications is included in the interface manual. Appropriate software to set up the interface, choose input or output functions, switch or toggle individual lines and multiple lines is supplied. If you then go on to purchase one of Pilot One's own projects, a further manual and software comes with it.

All the programs are written in the form of procedures with one or two parameters being passed to them by the user's call. For instance, PROCswitch ("OFF",2), turn off line two, PROCToggle(0), if line 0 is on then turn it off, if it's off then turn it on.

When it comes to driving a car around or turning the crane then Procedures are available to write combinations of on and off to the user port and thus control the switching of the relays on the application side. The two motors of the car drive the front and back wheels. A bit pattern on lines 0, 1, 2, 3, can provide all the necessary on/off combinations to steer (and stop!) the car. Delay loops have to be employed within a driving program to achieve measured distances.

The utility programs are all in BASIC with plenty of meaningful names for the variables concerned so they should not prove too difficult to understand.





At the same time trial and error is quite fun when it involves driving a car around the lounge or picking up your glass with the crane featured on the front of this month's **A&B!**

The software controls rotation, jib in and out and hook up and down. A multi-purpose procedure once again writes the appropriate bit pattern to the user port. The crane is especially interesting because, as well as controlling it with output from the BBC, it is possible to monitor its position. A sensor beneath the driver's cab detects light and dark as the black bands of a rotation disc pass between light source and detector. The utility function FNtest can count the changes from the sensor and judge the current position. Feedback control can be used to program a

series of crane operations, rather than the crude delay loops necessary with the car.

GOING SOLO

If you intend to enter the fascinating world of computer control then the Pilot One package is an excellent first stop, if a little pricey! The interface and software are well thought out and intended for the beginner to the subject. They make an ideal teaching package. The software makes it possible for an individual to sit down and write personalised software for a control application. It does not have to be a car or a crane that is being switched by the relays of the digital interface, it could be a light show or a drum synthesiser — try

the Amdek drum synth, it works.

The software sets up the function keys to generate the commonly used Procedures and all you have to do is fill in the parameters. FOR...NEXT and REPEAT...UNTIL do the rest. Within the programs the writers have sensibly used the official OSBYTE call to access the registers of the user port. This involves calling the operating system with the accumulator, A% holding the relevant OS number, with X% and Y% holding the offset within SHEILA. In the cause of simplicity, the manuals give examples of reading and writing directly with the indirection operators.

Getting to know the user port and getting a feel for how the BBC can be used to influence and program external devices, or

receive information from them (the alarm kit is an ideal example) is turned into a relatively simple exercise by the Pilot One interface and software. I personally would consider the car and crane to be a bit on the expensive side for Christmas presents but they do provide vivid and entertaining examples of what is going on at the program level. More comprehensive and better presented documentation would make a great difference to the amount of use you could get out of the kits without having to go and search out further ideas. The software compensates for this gap because it makes having a go so easy.

If you fancy having a go yourself then Pilot One can be found at Victoria House, 46 St. Augustines Road, Bedford MK40 2ND.

Bouncer

Margaret Stanger

Time to populate your already bounding arcade game with multicoloured fruit and animals.

If you successfully typed in and de-bugged last month's program, you should now be ready to fill your tree with miscellaneous animals and fruit.

Each fruit is defined as a sprite, one unit wide and one unit high. A unit being eight pixels. The machine code routine SPIC POKes the fruit onto the screen.

The animals are also defined as sprites, this time one unit wide and two units high. They are POKed to the screen by the routine LPIC.

The machine code routine HUE alters the palette, and calls routines from SOURCE 1 (which you typed in last month), to select the screen and print the scenery. Sprites are defined to show several different views of each animal. The sprites are POKed to the screen in sequence with a small delay between each one. This allows the animal to move by fewer pixels at a time than the eight pixels it would move if it were PRINT TABbed. The overall effect is to create the illusion of smooth movement.

The delay routine WAIT, also included in this section, is used between frames. Time is set to minus 2.56 seconds using OSWORD 2 (i.e. CALLing the routine OSWORD with the accumulator containing 2). The time is then read using OSWORD 1 until it reaches zero. At this point the delay is terminated and the program continues. The area of memory between &8B and &8F is reserved for the data used for reading and writing TIME as described above. The lowest address of this parameter block is written to during the program to allow fine adjustment of the delay produced by WAIT.

The interval timers could be

used for this function but then the program would not run on the Electron which does not have the necessary hardware.

The routines for the sound effects and their parameter blocks are also included in this section. It is possible to alter the envelopes and data for these sounds without disturbing the rest of the program if you wish to experiment.

MONKEYING AROUND WITH THE COLOURS

One method of displaying the sprites would be to POKe the

sprite onto the screen, having quickly blanked out the previous one, and tidy up the scenery after each fourth frame. This makes the sprite look as if it moves around in a little black box. Although this was barely noticeable on a plain background the effect of the kangaroo climbing the ladder was unacceptable.

One of the nice things about the BBC Micro is that some clever person has already thought about the self same problem. To facilitate complex graphics manipulation several options are provided for combining foreground and background.

The most suitable option for this application is use of the logical operator EOR (Exclusive Or). To understand how it works it is necessary to delve into a little logic theory. Believe me, this isn't going to be as bad as it sounds.

You will, I am sure be familiar with the way a number can be represented by 1s and 0s, i.e. in binary. All the EOR operator does is to allow you to combine two binary numbers in such a way that the resulting bit is 1 only when the corresponding bits of the two numbers are different.

e.g.	1000 = 8
EOR	0011 = 3
RESULT	1011 = 11

The beauty of EOR is in the result of reEORing the numbers. I'm sure you will be able to see that 11 EOR 3 = 8. In other words you have the number you started with. By now you may be wondering what use is it. Consider a background of colour 3. If we EOR an object of colour 8 onto it we will get colour 11 where they overlap. To remove the object, we only need to reEOR it in the same place and the background will return.

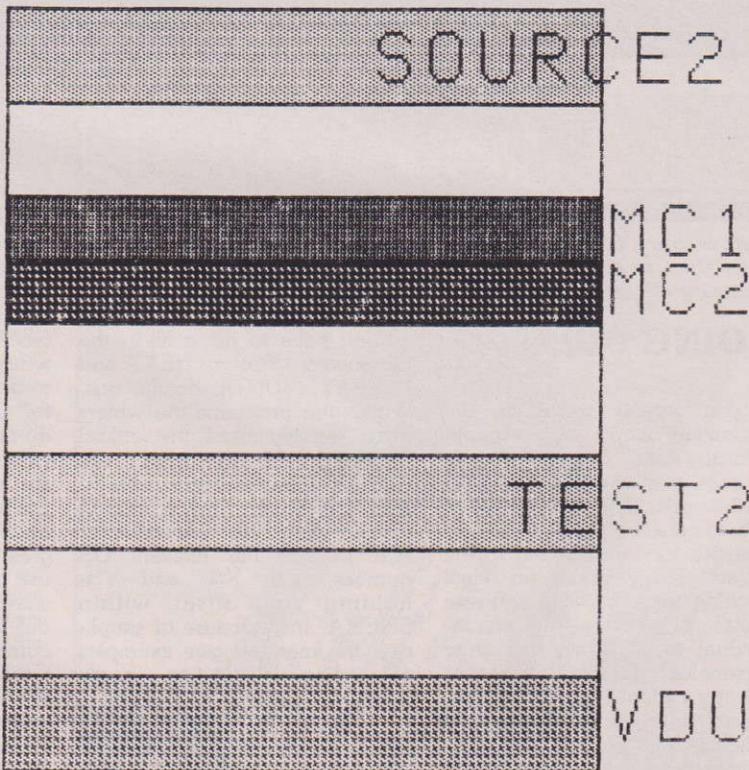
By carefully selecting and redefining some of the colours the idea can be extended to allow the foreground object to move over a multicoloured background. The "spare" colours were redefined so that the kangaroo remained yellow during its movement over the ladders etc. Colours 8,9,10 and 11 are all redefined to be yellow and

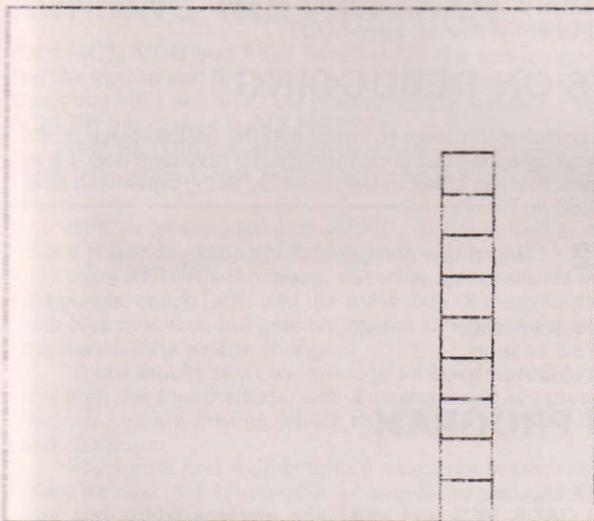
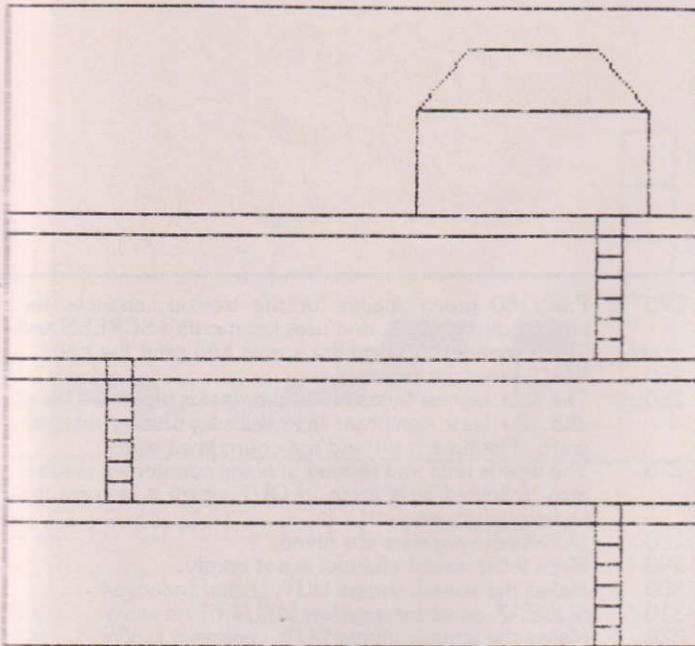
Bouncer Memory Map

&5000
&2FFF
&2800
&22F0

&1900

&CFF
&C70





Screen One

the kangaroo designed using colour 8. For the mathematically minded of you, the logic is as follows:-

```

Kangaroo(8)EOR Tree(1) =
Yellow(9)
Kangaroo EOR Leaves(2) =
Yellow(10)
Kangaroo EOR Ladder(3) =
Yellow(11)
    
```

The magenta monkeys were mainly climbing down the red tree, so colour 4 was redefined to be magenta for the monkeys, i.e.

```

Monkey(4) EOR Tree(1) =
Magenta(5)
    
```

The red apples and red and white cores were in front of red bran-

ches, so colours 12 and 13 were redefined as red and 14 and 15 as white so that:-

```

Apple(12) EOR Tree(1) =
Red(13)
Core(14) EOR Tree =
White(15)
    
```

SOUNDING IT OUT

The machine code for the sound effects is in SOURCE2, but they will remain silent without the envelopes in TEST2. Each noise makes use of OSWORD 7, and the parameter blocks are entered as DATA on line 1650.

The routine SQUEAK makes SOUND2,2,100,30. The

eight byte parameter block starts at &2B88. WHEEE makes SOUND1,3,150,10 in a similar way. The block starts at &2B90.

The other two sounds are only made when the sound buffer is empty, to avoid the pictures getting out of step with the sound. In BASIC the negative ADVAL commands would be used but *FX128 is an alternative which is easily translated into machine code as an OSBYTE call.

*FX128,250,255 will return 15 in X% if sound channel 1 is empty.

Similarly *FX128,248,255 will return 15 in X% if channel 3 is empty.

BOING makes SOUND 1,1,50,5 only if channel 1 is empty and SCUTTLE makes SOUND3,4,100,1 if channel 3 is empty.

NOW FOR THE TEDIOUS BIT

The source program SOURCE2, which is listed, is typed in at PAGE=&5000 as before, to allow space for the machine code and data to be stored from &2800 to &2FFF.

Remember to set PAGE=&5000 and type in NEW (RETURN) before typing in the program. If NEW is omitted, the computer will "hang up" at the end of the first line.

When you have typed SOURCE2 and saved it, RUN the program to save the machine code and data as MC2.

Before typing in TEST2 set PAGE=&1900 (RETURN)

NEW (RETURN).

Run TEST2 to check that the machine code and data from SOURCE2 are correct. Remember that TEST2 needs to load in not only MC2 but the machine code and data, MC1, and user defined characters, VDU, from SOURCE1 in last month's magazine.

SOURCE2

Variables

I% Loop variable
 K% Data item to be stored
 P% Program pointer
 X% Loop variable
 K\$ Data item in string form

Labels

```

OSWRCH      &FFEE
OSWORD      &FFF1
OSBYTE      &FFF4
TREE        &22F0
SCREEN      &2357
    
```

MAIN PROGRAM

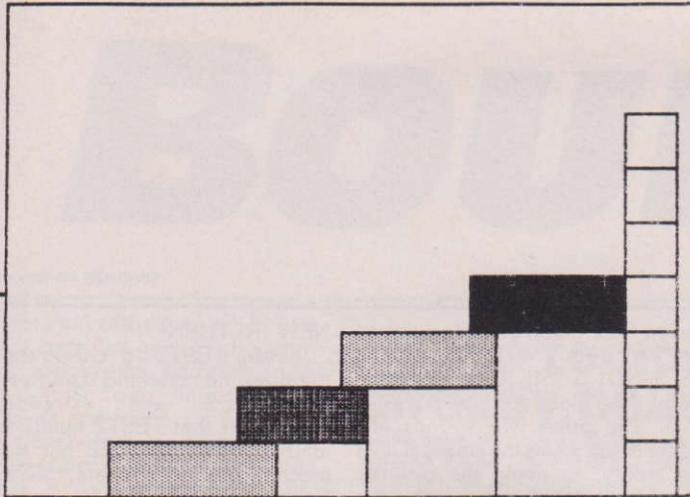
```

Line
20 Reads kangaroo data in a
   string, uses PROCHEX
   to convert it to the correct
   value, and stores it in
   memory.
30 Reads in data for HUE
   routine.
40 Puts "A&B COM-
   PUTING" in memory for
   use in high score table.
50 Puts "PRESS RETURN
   TO CONTINUE" into
   memory.
60 Reads and stores
   monkey and fruit data.
70 Assembles machine
   code.
80 Saves machine code and
   data as MC2.
    
```

DATA

Line	Item	Stored From
390	Kangaroo,left position1	&2800
480	Kangaroo,left position2	&2840
570	Kangaroo,left ducking	&2880
660	Kangaroo,left dead	&28C0
750	Kangaroo,right position1	&2900
840	Kangaroo,right position2	&2940
930	Kangaroo,right ducking	&2980
1020	Kangaroo,right dead	&29C0
1110	Joe(baby)left position1	&2A00

CONTINUED OVER



Screen Two

1200	Joe(baby)left position2	&2A40
1290	Kangaroo,ladder, pos1	&2A80
1380	Kangaroo,ladder, pos2	&2AC0
1470	Joe right position1	&2B00
1560	Joe right position2	&2B40
1650	Sound parameters	&2B80
1660	Data for HUE routine	&2BA0
1690	Monkey,left position1	&2C00
1780	Monkey,left position2	&2C40
1870	Climbing monkey, position1	&2C80
1960	Climbing monkey, position2	&2CC0
2050	Monkey,right position1	&2D00
2140	Monkey,right position2	&2D40
2230	Dead monkey	&2D80
2320	Rescued Joe	&2DC0
2410	Strawberry	&2E00
2460	Tomato	&2E20
2510	Cherry	&2E40
2560	Pineapple	&2E60
2610	Apple	&2E80
2660	Core	&2EA0

PROCEDURES

Line	PROCHEX
110	Goes to ENDPROC if there are more than two items in the string.
120	Adds "&" to the beginning of the string, and evaluates the string. The data can then be entered without typing the ampersand every time.
130	PROCAS
150	Defines labels, sets the assembly options.
160	SPIC saves the registers on the stack.
170	This routine pokes a sprite 1 unit wide and 1 unit high on to the screen in front of the scenery. 32 items of data starting from the base in &70 and &71, are poked to the location in &80 and &81.
180	Pulls back the registers from the stack.
190	LPIC saves the registers.
200	Pokes the top 32 characters of a sprite 1 unit wide and 2 units high.
210	Adds 32 to the base and 640 to the location before jumping to SPIC2 to poke the lower half of the sprite.
220	HUE performs nine VDU19 commands to change the palette, using the data from line 1660, then clears the screen and changes the background colour using data from line 1670.
230	

240	Prints 80 green spaces for the treetop, changes the background to black, and uses last month's SCREEN and TREE routines to select the screen and print the tree.
250	WAIT saves the registers.
260	The four highest bytes in the parameter block are set at 255, the least significant byte will vary during the program. The time is set and the countdown starts.
270	The time is read and re-read until the countdown reaches zero, followed by a jump to OUT where it restores the registers and returns.
280	BOING the registers are saved.
290	Skips if the sound channel is not empty.
300	Makes the sound, jumps OUT.
310	SQUEAK saves the registers.
320	Makes the sound, jumps OUT.
330	WHEEE saves the registers.
340	Makes the sound, jumps OUT.
350	SCUTTLE saves the registers.
360	Skips if sound channel is not empty.
370	Makes the sound, jumps OUT.

HINTS ON DEBUGGING

It may be useful at this stage to check that the data is stored in the right place using a machine code monitor. To save time later it is as well to check that the labels in the assembly listing agree with lines 270 and 280 in TEST2.

TEST2

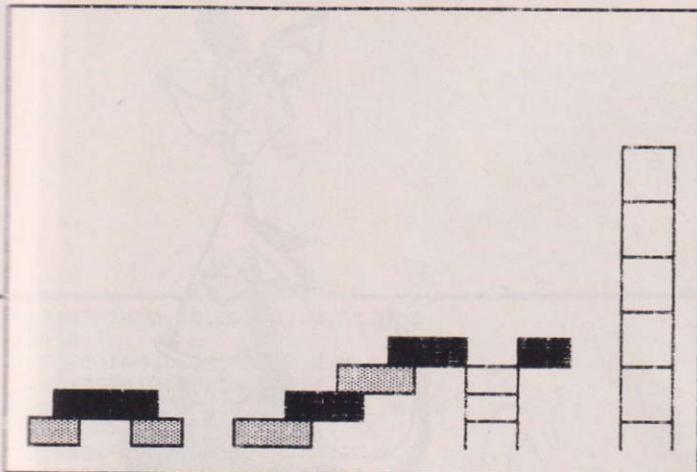
Variables	
X%	loop variable
ROW	row of sprite
COL	column of sprite

MAIN PROGRAM

Line	Defines the envelopes.
20-50	LOADS MC1 and VDU (the machine code, data and user defined characters from SOURCE2, last month).
60-70	LOADS MC2 from SOURCE2.
80	Selects mode, accesses initialisation routine.
90	Calls the routine to redefine the palette, and print the scenery.
100	Puts the six fruits along the top branch, and waits for key to be pressed.
110	Pokes the first three kangaroo sprites.
120	Pokes the right hand kangaroo sprites.
130	Pokes Joe and the climbing kangaroos.
140	Pokes the monkeys.
150	Pokes the two dead kangaroos, each as 2 side by side sprites 1 unit high.
160	Prints message.
170	Sets least significant byte of WAIT parameter block to zero, and delays 2.55 seconds.
180	Deletes the message when delay is complete.
190	Calls each sound, with a message and key press between each one.
200-230	

PROCEDURES AND FUNCTIONS

260	PROCIN defines labels.
310	PROCRET
320	Prints the message stored at &2BE7, and empties the



Screen Three

keyboard buffer.
 330 Waits for RETURN to be pressed.
 340 Wipes message.
 360 FNP(ROW,COL) works out the screen location of the row and column for the sprite.

RUNNING THE PROGRAM

After MC1, VDU and MC2 have loaded the screen should clear and the treetop and first screen printed, otherwise check HUE, and check that MC1 and VDU are present, and the labels for TREE and SCREEN are correct in SOURCE2.

After RETURN is pressed, the fruit should appear. If not, check SPIC and its label. If the fruit is odd looking, check the data.

SPIC is an essential part of LPIC, so it is as well to make sure that it is working properly before going any further.

After RETURN is pressed, the other sprites should be printed. If this fails, check LPIC and the sprite data. If the colours are odd, with blue monkeys and green/magenta kangaroos check HUE and the data for the palette changes.

There should be a new message for the duration of the delay, and then the sound effects, with a message and key press between each. If any are missing, check the relevant machine code, data and envelope.

The sprites and sounds should now all be present and correct, ready for next month when the sprites will be moving in response to keys and joysticks.

PROGRAM LISTING 1

```

10REBOUNCE SOURCE2 BY M.STANGER
20FORIX=0TO14*64-1:READK$:PROCHEX:?(2800+IX)=K
X:NEXT
30FORX%=0TO88:READB%:?(2880+X%)=B%:NEXT
40$&2BD9="A&B COMPUTING"
50$&2BE7="Press RETURN to continue"
60FORIX=0TO11*64-1:READK$:PROCHEX:?(2C00+IX)=K
X:NEXT
70PROCAS
80*SAVE MC2 2800+7FF
90VDU7:END
100:
110DEFPROCHEX
120IFLEN(K$)>2 K%=0:ENDPROC
130K$="&"+K$:K%=EVAL(K$):ENDPROC
140:
150DEFPROCAS
160OSWRCH=&FFEE:OSWORD=&FFF1:OSBYTE=&FFF4:TREE=&
22F0:SCREEN=&2357:FORPASS=1TO3STEP2:P%=&2EC0:[OPTP
ASS
170.SPIC PHA:TXA:PHA:TYA:PHA
180.SPIC2 LDY#31:.LOOP LDA(&70),Y:EOR(&80),Y:STA

```

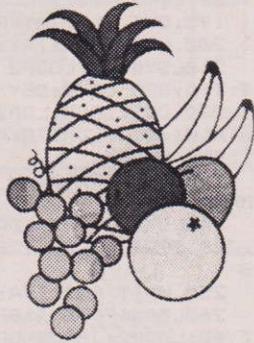
```

(&80),Y:TYA:BEQ OUT:DEY:JMPLOOP
190.OUT PLA:TAY:PLA:TAX:PLA:RTS
200.LPIC PHA:TXA:PHA:TYA:PHA
210LDY#31:.LOOP2 LDA(&70),Y:EOR(&80),Y:STA(&80),
Y:TYA:BEQ OUT2:DEY:JMPLOOP2
220.OUT2 CLC:LDA&80:ADC#128:STA&80:LDA&81:ADC#2:
STA&81:CLC:LDA&70:ADC#32:STA&70:LDA&71:ADC#0:STA&7
1:JMP SPIC2
230.HUE LDX#0:.H LDA&2BA0,X:JSR OSWRCH:INX:TXA:C
MP#57:BNEH
240LDX#79:.H2 LDA#32:JSR OSWRCH:DEX:BNEH2:LDA#17
:JSR OSWRCH:LDA#128:JSROSWRCH:JSRSCREEN:JSRTREE:RT
S
250.WAIT PHA:TXA:PHA:TYA:PHA
260LDA#&FF:STA&BF:STA&BE:STA&BD:STA&BC:LDX#&8B:L
DY#0:LDA#2:JSROSWRCH
270.STAY LDX#&8B:LDY#0:LDA#1:JSROSWRCH:LDA&BF:BN
ESTAY:.F1 JMP OUT
280.BOING PHA:TXA:PHA:TYA:PHA
290LDY#&FF:LDX#250:LDA#128:JSROSBYTE:CPX#&0F:BNE
F1
300LDA#7:LDY#&2B:LDX#&80:JSROSWRCH:JMPF1
310.SQUEAK PHA:TXA:PHA:TYA:PHA
320LDA#7:LDY#&2B:LDX#&8B:JSROSWRCH:JMPF1
330.WHEEE PHA:TXA:PHA:TYA:PHA
340LDA#7:LDY#&2B:LDX#&90:JSROSWRCH:JMPF1
350.SCUTTLE PHA:TXA:PHA:TYA:PHA
360LDY#&FF:LDX#248:LDA#128:JSROSBYTE:CPX#&0F:BNE
F1
370LDA#7:LDY#&2B:LDX#&9B:JSROSWRCH:JMPF1
380J:NEXT:ENDPROC
390DATA0,0,40,40,0,11,33,33
400DATA0,3E,95,C0,14,14,62,62
410DATAC0,80,80,80,94,3C,80,80
420DATA0,0,0,0,0,0,0,0
430DATA33,11,0,0,0,0,0,C0
440DATA62,C0,C0,C0,C0,C0,C0,C0
450DATA80,C0,C0,C0,C0,40,40,40
460DATA0,0,0,0,0,0,0,C0
470:
480DATA0,0,40,40,0,11,33,33
490DATA0,3E,95,C0,14,14,62,62
500DATAC0,80,80,80,94,3C,80,80
510DATA0,0,0,0,0,0,0,0
520DATA33,11,0,0,0,0,40,C0
530DATA62,C0,C0,C0,C0,C0,80,0
540DATA80,C0,C0,C0,C0,40,40,0
550DATA0,0,0,0,0,40,C0,80
560:
570DATA0,0,0,0,0,0,0,0
580DATA0,0,0,0,0,0,0,0
590DATA0,0,0,0,0,0,0,0
600DATA0,0,0,0,0,0,0,0
610DATA40,40,3D,6A,C0,0,0,40
620DATA40,68,68,68,40,40,40,C0
630DATAC0,C0,C0,C0,80,80,80,80
640DATA0,80,80,80,80,80,80,C0
650:
660DATA0,0,0,80,80,80,C0,C0
670DATA0,0,0,0,0,0,C0,C0
680DATA0,0,0,11,33,33,33,91
690DATA0,0,0,C0,62,62,62,C0
700DATA0,0,0,80,C0,C0,C0,C0
710DATA0,0,0,0,0,80,94,94
720DATA15,2A,15,0,40,40,C0,C0
730DATA2A,15,2A,0,80,80,80,C0

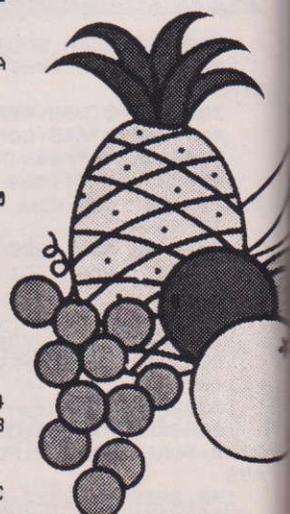
```

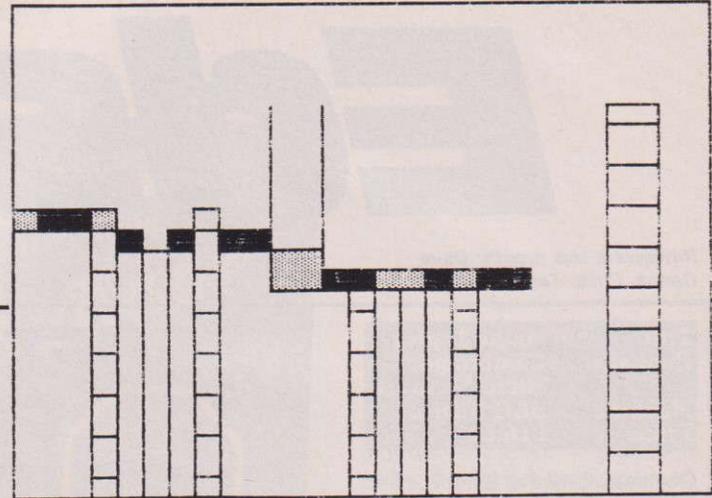
CONTINUED OVER

740:
 750DATA0,0,0,0,0,0,0,0
 760DATAC0,40,40,40,68,3C,40,40
 770DATA0,3D,6A,C0,28,28,91,91
 780DATA0,0,80,80,0,22,33,33
 790DATA0,0,0,0,0,0,0,C0
 800DATA40,C0,C0,C0,C0,80,80,80
 810DATA91,C0,C0,C0,C0,C0,C0,C0
 820DATA33,22,0,0,0,0,0,C0
 830:
 840DATA0,0,0,0,0,0,0,0
 850DATAC0,40,40,40,68,3C,40,40
 860DATA0,3D,6A,C0,28,28,91,91
 870DATA0,0,80,80,0,22,33,33
 880DATA0,0,0,0,0,80,C0,40
 890DATA40,C0,C0,C0,C0,80,80,0
 900DATA91,C0,C0,C0,C0,C0,40,0
 910DATA33,22,0,0,0,0,80,C0
 920:
 930DATA0,0,0,0,0,0,0,0
 940DATA0,0,0,0,0,0,0,0
 950DATA0,0,0,0,0,0,0,0
 960DATA0,0,0,0,0,0,0,0
 970DATA0,40,40,40,40,40,40,C0
 980DATAC0,C0,C0,C0,40,40,40,40
 990DATA 80,94,94,94,80,80,80,C0
 1000DATA80,80,3E,95,C0,0,0,80
 1010:
 1020DATA15,2A,15,0,0,0,40,C0
 1030DATA2A,15,2A,0,C0,C0,C0,C0
 1040DATA0,0,0,0,0,40,68,68
 1050DATA0,0,0,40,C0,C0,C0,C0
 1060DATA0,0,0,80,91,91,91,C0
 1070DATA0,0,0,22,33,33,33,62
 1080DATA0,0,0,0,0,0,C0,C0
 1090DATA0,0,0,40,40,40,C0,C0
 1100:
 1110DATA0,0,0,0,0,0,40,40
 1120DATA0,0,0,0,0,3C,3C,68
 1130DATA0,0,0,0,C0,28,80,80
 1140DATA0,0,0,0,0,0,0,0
 1150DATA0,0,0,0,0,0,0,0
 1160DATA40,C0,C0,C0,C0,C0,C0,C0
 1170DATA80,80,80,C0,C0,C0,40,40
 1180DATA0,0,0,0,0,0,0,80
 1190:
 1200DATA0,0,0,0,40,40,0,0
 1210DATA0,0,0,3C,3C,68,40,C0
 1220DATA0,0,C0,28,80,80,80,80
 1230DATA0,0,0,0,0,0,0,0
 1240DATA0,0,0,0,0,40,0,0
 1250DATAC0,C0,C0,C0,C0,80,0,0
 1260DATA80,C0,C0,C0,40,40,0,0
 1270DATA0,0,0,0,0,0,80,0,0
 1280:
 1290DATA0,0,0,0,0,40,80,80
 1300DATA40,40,40,40,0,C0,C0,40
 1310DATA0,C0,C0,80,80,C0,C0,C0
 1320DATA0,0,40,40,80,80,0,0
 1330DATA0,0,0,0,0,0,0,0
 1340DATA40,40,40,40,40,40,C0
 1350DATAC0,C0,C0,0,0,0,0,0
 1360DATA0,80,80,80,80,C0,0,0
 1370:
 1380DATA0,0,80,80,40,40,0,0
 1390DATA0,C0,C0,40,40,C0,C0,C0
 1400DATA80,80,80,80,0,C0,C0,80



1410DATA0,0,0,0,0,80,40,40
 1420DATA0,40,40,40,40,C0,0,0
 1430DATAC0,C0,C0,0,0,0,0,0
 1440DATA80,80,80,80,80,80,C0
 1450DATA0,0,0,0,0,0,0,0
 1460:
 1470DATA0,0,0,0,0,0,0,0
 1480DATA0,0,0,0,C0,14,40,40
 1490DATA0,0,0,0,0,3C,3C,94
 1500DATA0,0,0,0,0,0,80,80
 1510DATA0,0,0,0,0,0,0,40
 1520DATA40,40,40,C0,C0,80,80
 1530DATA80,C0,C0,C0,C0,C0,40
 1540DATA0,0,0,0,0,0,0,80
 1550:
 1560DATA0,0,0,0,0,0,0,0
 1570DATA0,0,C0,14,40,40,40,40
 1580DATA0,0,0,3C,3C,94,80,C0
 1590DATA0,0,0,0,80,80,0,0
 1600DATA0,0,0,0,0,40,0,0
 1610DATA40,C0,C0,C0,80,80,0,0
 1620DATAC0,C0,C0,C0,C0,40,0,0
 1630DATA0,0,0,0,0,80,0,0
 1640:
 1650DATA1,0,1,0,50,0,5,0,2,0,2,0,100,0,30,0,1,0,3
 0,150,0,10,0,3,0,4,0,100,0,1,0
 1660DATA19,8,3,0,0,0,19,9,3,0,0,0,19,10,3,0,0,0,1
 9,11,3,0,0,0,19,4,5,0,0,0,19,12,1,0,0,0,19,13,1,0,
 0,0,19,14,7,0,0,0,19,15,7,0,0,0
 1670DATA12,17,130
 1680:
 1690DATA10,34,30,0,0,10,10,10
 1700DATA30,3A,30,35,35,70,F0,F0
 1710DATA0,0,0,0,3F,30,80,80
 1720DATA0,0,0,0,0,2A,35,30
 1730DATA10,10,10,10,30,20,2A,2A
 1740DATAF0,70,35,20,20,35,15,0
 1750DATA80,3A,0,0,10,10,15,15
 1760DATA30,30,20,20,20,0,0,0
 1770:
 1780DATA10,34,30,0,0,10,10,10
 1790DATA30,3A,30,35,35,70,F0,F0
 1800DATA0,0,0,0,3F,30,80,80
 1810DATA0,0,0,0,0,2A,35,30
 1820DATA10,10,10,10,30,2A,2A,0
 1830DATAF0,70,10,10,10,10,0,0
 1840DATA80,35,3A,0,10,10,3F,2A
 1850DATA30,30,20,20,20,0,0,0
 1860:
 1870DATA0,0,0,0,0,10,AB,AB
 1880DATA10,30,30,10,74,74,74,74
 1890DATA20,30,30,20,88,88,AB,88
 1900DATA0,0,54,54,20,0,0,0
 1910DATA0,0,0,0,0,0,0,0
 1920DATA54,10,10,10,10,10,FC
 1930DATA88,20,0,0,0,0,0,0





Screen Four

```

1940DATA20,20,20,20,20,FC,0,0
1950:
1960DATA0,0,AB,AB,10,0,0,0
1970DATA10,30,30,10,74,74,54,74
1980DATA20,30,30,20,88,88,88,88
1990DATA0,0,0,0,0,20,54,54
2000DATA10,10,10,10,10,FC,0,0
2010DATA74,10,0,0,0,0,0,0
2020DATAAB,20,20,20,20,20,20,FC
2030DATA0,0,0,0,0,0,0,0
2040:
2050DATA0,0,0,0,0,15,3A,30
2060DATA0,0,0,0,3F,30,70,70
2070DATA30,34,30,3A,3A,80,F0,F0
2080DATA20,3A,30,0,0,20,20,20
2090DATA30,30,10,10,10,0,0,0
2100DATA70,35,0,0,20,20,2A,2A
2110DATAF0,80,3A,10,10,2A,2A,0
2120DATA20,20,20,20,30,10,15,15
2130:
2140DATA0,0,0,0,0,15,3A,30
2150DATA0,0,0,0,3F,30,70,70
2160DATA30,35,30,3A,3A,80,F0,F0
2170DATA20,38,30,0,0,20,20,20
2180DATA30,30,10,10,30,2A,2A,0
2190DATA70,35,10,10,10,10,0,0
2200DATAF0,80,3A,0,10,10,3F,2A
2210DATA20,20,20,20,20,0,0,0
2220:
2230DATA0,0,0,0,0,0,30,20
2240DATA0,0,0,0,0,0,0,0
2250DATA0,0,0,0,0,0,15,2A
2260DATA0,0,0,0,0,0,2A,15
2270DATA20,20,20,20,20,30,30,30
2280DATA0,0,0,0,30,30,30,30
2290DATA15,0,0,0,10,30,30,30
2300DATA2A,0,0,0,20,30,30,30
2310:
2320DATA0,0,0,0,0,0,0,0
2330DATA0,0,0,0,0,C0,40,40,40
2340DATA0,0,0,0,0,0,C0,68,C0
2350DATA0,0,0,0,0,0,80,80
2360DATA0,0,0,0,0,0,0,40
2370DATA40,40,40,C0,C0,C0,80,80
2380DATA80,C0,C0,C0,C0,C0,C0
2390DATA0,C0,0,0,0,0,0,80
2400:
2410DATA0,0,1,1,0,0,0,0
2420DATA8,4,3,2B,17,3,1,1
2430DATA4,8,3,2B,3,2B,2,2
2440DATA0,0,2,2,0,0,0,0
2450:
2460DATA0,0,4,1,1,1,1,0
2470DATA4,C,6,6,3,3,3,3
2480DATA8,8,6,3,3,3,3,2
2490DATA0,0,0,0,0,0,0,0
2500:
2510DATA4,C,0,1,3,3,3,1
2520DATA8,5,A,2,3,3,3,2
2530DATA8,3,3,3,1,0,0,0
2540DATA2,3,3,3,2,0,0,0
2550:
2560DATA0,0,5,1,5,0,0,0
2570DATA4,E,7,B,7,B,F,5
2580DATA0,A,7,B,7,A,A,0
2590DATA0,0,0,0,0,0,0,0
2600:
2610DATA0,0,0,50,50,50,0,0
2620DATA0,50,F0,F0,F0,F0,F0,50
    
```

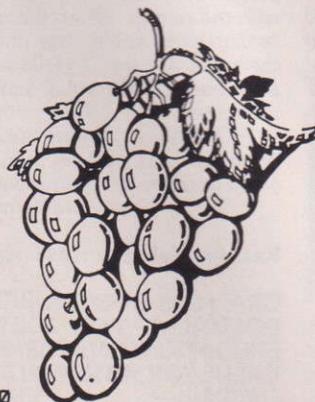
```

2630DATA0,A0,F0,F0,F0,F0,F0,A0
2640DATA0,0,0,A0,A0,A0,0,0
2650:
2660DATA0,54,0,0,0,0,54,0
2670DATAF0,FC,FC,54,54,FC,FC,F0
2680DATAA0,FC,AB,0,0,AB,FC,A0
2690DATA0,0,0,0,0,0,0,0
    
```

PROGRAM LISTING 2

```

10REBOUNCE TEST2 BY M. STANGER
20ENVELOPE1,5,1,4,1,255,255,255,120,0,0,-120,120,0,120
30ENVELOPE2,2,-1,-1,-1,255,255,255,120,0,0,-120,120,0,120,0
40ENVELOPE3,2,4,-1,-2,-10,20,20,126,0,0,-5,126,0
50ENVELOPE4,2,0,0,0,1,1,1,120,-120,-120,120,120,0
60*LO."MC1"
70*LO."VDU"
80*LO."MC2"
90MODE2:PROCIN
100?&DBE=1:CALL HUE:PROCRET
110FORX%=0T05: !&70=&2E00+32*X%: !&80=FNP(7,1+2*X%)
:CALL SPIC:NEXT:PROCRET
120FORX%=0T02: !&70=&2800+64*X%: !&80=FNP(13,1+2*X%)
:CALL LPIC:NEXT
130FORX%=4T06: !&70=&2800+64*X%: !&80=FNP(13,1+2*X%)
:CALL LPIC:NEXT
140FORX%=0T05: !&70=&2A00+64*X%: !&80=FNP(20,4+2*X%)
:CALL LPIC:NEXT
150FORX%=0T07: !&70=&2C00+64*X%: !&80=FNP(27,1+2*X%)
:CALL LPIC:NEXT
160FORX%=3T07STEP4: !&70=&2800+64*X%: !&80=FNP(14,5+2*X%)
:CALL SPIC: !&70=&2800+32+64*X%: !&80=FNP(14,1.5+2*X%)
:CALL SPIC:NEXT
170PRINTTAB(0,0); "WAITING"
180?&8B=0:CALL WAIT
190PRINTTAB(0,0); SPC(7)
200CALL BOING:PROCRET
210CALL WHEEE:PROCRET
220CALL SQUEAK:PROCRET
230CALLSCUTTLE
240END
250:
260DEFPROCIN
270SPIC=&2EC0:LPIC=&2EDA:HUE=&2F0B
280WAIT=&2F34:BOING=&2F5C:SQUEAK=&2F7A:WHEEE=&2F8B
:SCUTTLE=&2F9C
290ENDPROC
300:
310DEFPROCRET
320PRINTTAB(0,0); $&2BE7:*FX15,1
330REPEAT:UNTILGET=13
340PRINTTAB(0,0); SPC(30):ENDPROC
350:
360DEFFNP(ROW,COL)=HIMEM+32*COL+640*ROW
    
```



Edsoft

Reviewers this month: Dave Carlos, Philip Tayler, Des Thomas

Title Maths Topics
Publisher Cambridge
Machine Micro Software
Price BBC B Disc
£16.04

Obviously aimed at schools, I find this package a disappointment coming from a software house of such good repute. That is not to say that it isn't useful or that there are problems in the programs, it simply seems to be a large price to pay for what are basically very simple programs and concepts. The package covers two topics likely to be of use to the 11 to 14 age range. The first of these is vectors and this is the better part of the package without a doubt.

Vectors are a way of recording movements in space and in this case we are restricted to two dimensions only. As is common with a number of the programs from this publisher, the program starts with an "animated" learning section in which the first concepts of the subject are introduced and explained. This can be used to teach or revise the concept before going onto the more interesting sections of the games. The three games included have a graduation in difficulty which is a nice touch and can lead to growing skill on the pupils' behalf. The first is a navigation game in which you have to pilot your craft from harbour to harbour using vectors. The game is easy to use and the real challenge is to reduce the journey length to a minimum and to do so you need to navigate as close to the islands as possible.

The next game is rather like a simplified game of battleships but with just one prize. Called "Treasure Hunt" you travel around a grid watching a "thermometer" showing how warm or cold you are. As in the previous program there is a grid which tends to make the vector planning a little easier. One feature of all the programs is the ability to use decimal vector quantities which can extend their life beyond initial teaching use.

The final game is called "Racing Driver" and involves a nearly circular track around which you move and around which you can race another

SOFTWARE FOR STUDENTS

pupil. This time there is no grid to assist, just a scale, and this makes it that bit more difficult. The booklet provided has all the information you are likely to need on running the program including worksheets to be reproduced for students. All told the programs work well enough but there is nothing in this package that cannot be done on paper or blackboard just as well, so why use a thousand pounds of computer equipment?

The other program in this set can only be described as a "make weight" in my opinion. It works well enough and might be said to be interesting but to claim that it is really more than a toy picture drawing package is a little too much. The theme is 'Symmetry' and in part one you can build up triangles and then show the different orders of point or rotational symmetry line after drawing a shape on the screen. I could buy a whole pack of mirrors and paper to do the same thing with a complete class for just a fraction of the cost of this package. The end of term report for this collection of maths topics must read, should try harder and cover more area! **D.C.**

Ratings Table:

SOUNDS	N/A
GRAPHICS	70%
DOCUMENTATION	60%
VALUE FOR MONEY	40%
OVERALL	50%

Title Junior Maths
Publisher Micro Power
Machine Electron, will work on BBC Model B
Price £6.95

The usual Micro Power loading screen this time moves onto a menu for three totally separate programs, all three being aimed

at junior age children, and all three naturally having a mathematical theme. Here the similarities cease, for each has a totally different function, one being based on number facts, the second on co-ordinates and the last being a rather clever attempt to use a one-armed bandit to teach addition and subtraction.

Having given this brief introduction, I can add little about their educational value, as they don't appear to have much. It is true that they do attempt to teach mathematics, but I found children to have almost no interest or enthusiasm in Lander, the first program. I've seen several very similar programs, and this one has little to recommend it.

Moving into the Treasure Search program, this one attempts to introduce co-ordinates. When an input has been made, an arrow is printed which shows the direction in which the child should now head. This *did* interest the children much more, and it became quite challenging.

The best program in my view was Number Spin. A three cylinder fruit machine has numbers printed on it, and a pay out results from having two or three identical numbers. There is a simple hold feature, but the program comes to its best point with the nudge. When the nudge facility is available, the children can enter a + or -, followed by a number to allow the match to be made.

Overall a competent program, but with nothing to make it good enough to recommend. **P.T.**

Ratings Table:

GRAPHICS/SOUNDS	70%
DOCUMENTATION	65%
EDUCATIONAL VALUE	70%
VALUE FOR MONEY	70%
OVERALL	65%

Title Picture Builder
Publisher Hill-MacGibbon
Machine BBC Model B
Price £9.95 cassette, £12.95 disc

"Many objects are really made up of a few basic shapes added together in different ways. Your first task is to experiment with how these simple shapes may be combined." And so one enters this delightfully simple program. Simple? Well in the sense that it is simple to operate and that your children will be creating recognisable pictures and patterns in a very short time and, in doing so, will begin to explore "shape and colour" in a very effective and meaningful manner. But to think of it as just a simple program because it can be used by these youngsters is to underestimate its potential. Experienced students will be made aware of and appreciate many of the qualities of a shape within a short time of working with the program.

After the program has been loaded, the user is permitted to choose a background and three other colours from the palette. Once this is done, the "drawing board" plus the outline shapes — five basic shapes and a line — appear. The selection of colours and shapes is achieved by using the SPACEBAR and RETURN key. One further option available is LABEL, which permits text to be printed at any point on the "board". Unfortunately, labels cannot be coloured, rotated or distorted.

The selected shape appears at the centre of the drawing board. It can be moved around the screen using the cursor keys, or made smaller or bigger, turned, stretched or squashed using the function keys. Once a shape has been coloured — selected by function key, SPACEBAR and RETURN — nothing more can be done with it. The screen can be cleared at any time using CTRL and C or a shape rubbed out by repeating the shape and using the background colour, and the picture sent to the printer (EPSON) at any time by typing D — one has to be patient!

The handbook is beautifully

produced in glorious technicolour, and takes the user carefully through the facilities available in the program, although with this program the discovery method is very appropriate. Many of the pages have little text, the graphics doing most of the explaining. And as the booklet ends: "Now it's over to you".

There are still a few spare function keys free, and I would have liked to see a REFLECT and COPY command. But that's nit-picking, it's still a delightful program worthy of a place in any young computer user's Christmas stocking and all primary schools' software collections. **D.T.**

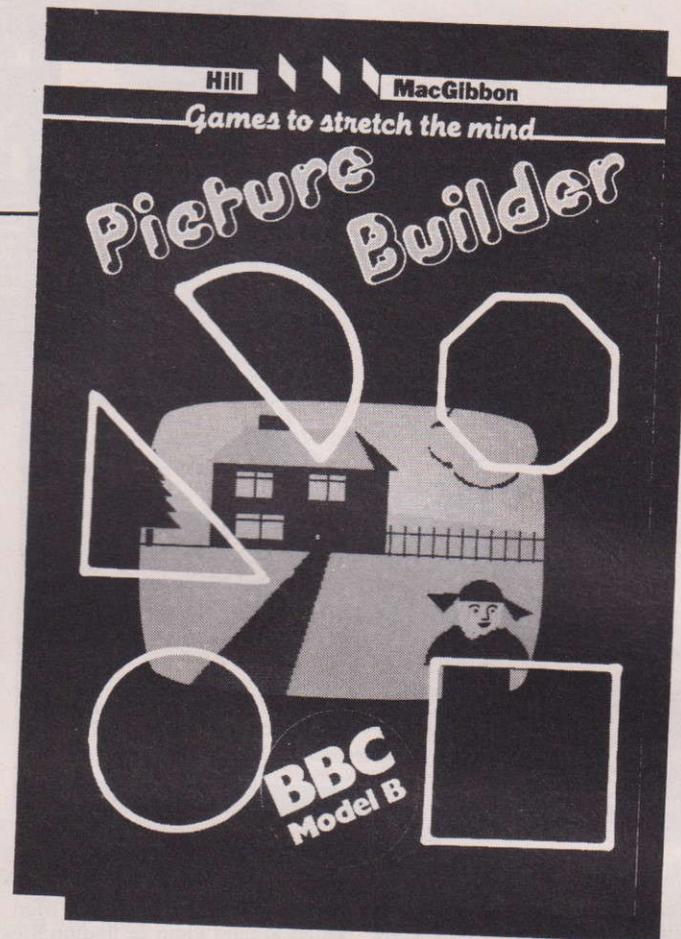
Ratings Table:

SOUNDS	N/A
GRAPHICS	95%
DOCUMENTATION	100%
EDUCATIONAL VALUE	90%
VALUE FOR MONEY	80%
OVERALL	90%

Title	Population Growth
Publisher	Cambridge Micro Software
Machine	BBC B Disc
Price	£16.04

This is an interesting package of programs which might be used by a number of departments in a secondary school for a variety of purposes. The uses within biology and geography are the most obvious but there is also the flexibility to make them useful to historians and those involved in teaching wider social awareness courses.

The programs have three options, you can study the growth of populations in an unlimited way, a limited fashion or the growth of human populations. The basis of the programs is a graphical representation of the populations against time. In the first two options we also see the actual organisms in a little circle on the screen. In option two the size of the colony is restricted so that after a short while there is an increasing death rate and a diminishing birth rate, both of which are displayed on the



screen.

It is the third option that is likely to be of most interest however and here there are another three options to choose from. You can display either genuine data from 1700 to 1980 in England and Wales, hypothetical data stored within the program or you can enter your own data (the rates for Sri Lanka are included in the manual). This makes the program very flexible and it might be possible to use it for forward planning in a hypothetical situation.

It has to be admitted that this program is little more than a moving graph drawer or animated blackboard but I feel that a number of schools will find its facilities attractive and will use it over a number of curricular areas. The booklet provided has reproducible worksheets and full program information. **D.C.**

Ratings Table:

SOUNDS	N/A
GRAPHICS	85%
DOCUMENTATION	80%
VALUE FOR MONEY	75%
OVERALL	80%

Title	Your Adventure
Publisher	LTS
Machine	BBC B
Price	£10.95 (retail)
	disc or cassette
	£7.95
	(educational)

It is, perhaps, unfortunate that this program arrived shortly after I'd finished reviewing TOMBS OF ARKENSTONE, which also "allows children and adults to create their own adventure games". There the similarity ends, no exciting story book, not much strategy to be evolved, and little role-play. It is soon obvious that they are very different creatures, and YOUR ADVENTURE is really a vehicle for the application of questions and answers on any subject.

One of my colleagues said recently, that if the program required a large handbook, then it wasn't for him. Well, this program is very easy to get into, and little reference is needed to the documentation for the first option, although it offers very clear step-by-step instructions for all the facilities offered throughout.

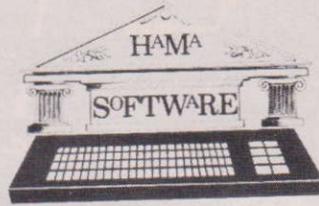
The program follows the popular adventure game format in which the user embarks on a journey in an attempt to reach a cave containing treasure. On the journey, the child is presented with a number of problems, and in solving them he is allowed to pass to the next stage and, in doing so, increases the treasure in the cave. Clues are available to assist in solving the problems, but if a solution cannot be found the child must buy his way past the obstacle with treasure from the cave.

An overall map is provided — not very inspiring! — which the program returns to after every problem, and the user can plot his progress on a printed copy. Those who have not taken the trouble to read the documentation first will think that the locations are almost random and the progress towards the cave haphazard. However, there are four lists, which indicate the order of the scenes, in each route. Obviously, this information is more important when using the MAKE AN ADVENTURE option, although the more discerning user will soon want to know why he has no control over the route unless he rewrites the game — which he can do, of course!

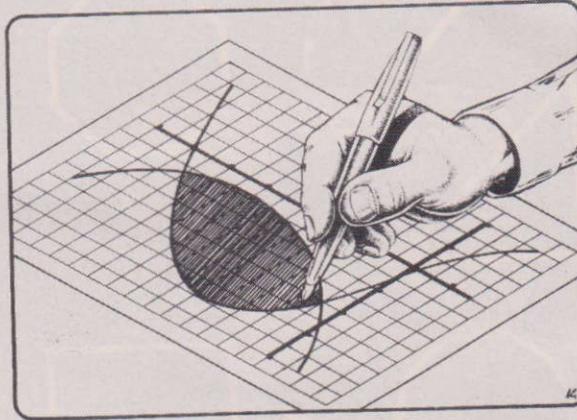
The program comes with two sample adventures — GAMES 1 & 2. The introductory page in GAME 1 sets the scene in Animal Land, and all the problems and puzzles to be solved are linked with animals. Initial problems are accompanied by a larger picture of the obstacle encountered. Maybe I tried the program too late at night, but I found some of the problems set to be ambiguous, and not all the clues were particularly helpful; maybe it was a deliberate ploy on the part of the creators to illustrate the need for unambiguous questions and clues which give a lead — to a reference book, perhaps! It is unfortunate that not enough care has been taken with the punctuation — not a good example for children.

It is the second option, MAKE AN ADVENTURE, which I feel really makes this a worthwhile

CONTINUED OVER



GRAPH-EASY



COMPUTER ASSISTED LEARNING FOR THE ACORN 'B' AND BRITISH BROADCASTING CORPORATION MICRO-COMPUTER SYSTEM

package. Here children can really pit their wits in producing puzzles and problems and, although it is described as a language adventure game, its use need not be restricted to this area — indeed it is open-ended. Group use is to be encouraged, thus stimulating discussion and co-operation — the competition can come later when one group tries out an adventure created by another.

MAKE AN ADVENTURE permits the making of a new adventure or the editing of a previously written adventure. Again, the second option is particularly valuable as it enables the users to revise their questions, answers, clues or advice as a result of feedback when others have used the game. In this way the "polishing process", which we so often ignore, or don't make time for, is possible. To assist in the creation of the 15 scenes available, the publishers provide a proforma, which indicates the screen format, maximum number of characters available etc. Like the first option, this is very user friendly and the creation of an adventure is straightforward — once the questions and clues have been formulated!

My first impressions of the package were not very favourable, and I think the creator's choice of sample games was largely responsible for this. The more the program is used, the greater the potential becomes evident, and at £7.95 (educational price), it must be considered a good buy. **D.T.**

Ratings Table:

SOUNDS	30%
GRAPHICS	60%
DOCUMENTATION	80%
EDUCATIONAL VALUE	70%
VALUE FOR MONEY	70%
OVERALL	70%

Title	Graph Easy
Publisher	HAMA Software
Machine	BBC B Disc
Price	£24.50 + VAT

If you are using graphs as a student of some kind — 'O' level, 'A' level or Business studies — then

this is the package for you. Designed with students in mind it is really more than a simple graph drawing program. It can cope with most mathematical formulae including polynomial equations, quadratic equations, trigonometry and differential calculus, in fact almost anything that can be turned into a line graph can be used in this program.

The documentation provided is also a little out of the ordinary in that it is more of a text book than program documentation. Approximately one third of the 60 page booklet is a step by step "how to use it" section, the rest of the book being devoted to a discussion of the maths involved and giving example exercises for you to try. These range in difficulty from co-ordinates and scales to correlation and regression. There are even self assessment questions given so that you can check your knowledge as you go along. I wish other publishers of programs would take a look at this book and try to bring their documentation up to this standard.

The program itself is simple to use and comes with the function key strip that you need to operate it. The basis of the program is two curves, blue and red, which you can program independently to whatever func-

tion you desire. There is also the option of entering up to thirty pairs of data points and then either joining them or finding the line of best fit. You can modify the length of the scales and even measure the area under a curve, a very powerful feature. There are a number of features that would have made the package better, the ability to load and save data and the ability to screen dump the graphs being the most obvious. These don't detract however from a very well organised and attractive package for anyone who likes to see

graphs in action rather than read about them in their text books. **D.C.**

Ratings Table:

SOUNDS	N/A
GRAPHICS	90%
DOCUMENTATION	100%
VALUE FOR MONEY	95%
OVERALL	95%

Title	Telebook
Publisher	4 Mation Educational Resources (formerly 4 MAT)
Machine	BBC Model B
Price	£15.00 plus VAT cassette, £17.65 plus VAT disc

Those who have been enchanted by Mike Matson's adventure programs will expect the same high quality package in this venture into the world of teletext. I don't think they'll be disappointed because, like the earlier programs, it's been tried and tested in a number of schools and comes complete with an excellent handbook — if only all educational software showed such consideration! — a set of laminated "help" cards, page planning sheets, a function key strip and a second disc containing eight sample "books". In other words, it's more than just a computer program, it's an educational package.



View

software

Page 5



FLOWERS OF CRYSTAL

an amazing adventure for children
it contains adventure, story book,
audio cassette, map and worksheets.

please ask for - FLOWERS OF CRYSTAL

ESCAPE exit + turn page P print

I say this despite Mike's remarks about "reviewers who haven't a clue what education is all about"! (Readers wishing to appreciate this will have to buy the program to see some of the amusing — some may say funny ha, ha; some funny peculiar! — pages in the sample books.)

I like the remarks near the beginning of the handbook — "Please don't think you need to work though this book from cover to cover before you can use Tele-Book... keep the manual handy... and refer to it only when necessary." This shows considerable confidence that the program is "user friendly" and indeed, with the help cards to hand it isn't long before the screen is full of coloured text, doodles etc. — not great creations, perhaps, but a start.

If you can suppress your creative urge for a few minutes, it's helpful to have a look at the sample "books", which give a very clear and colourful impression of what it's all about — class magazines, project work, stories, puzzles, illustrations. These can be seen through the "Load a Book" option, which allows the user to look at or edit a book, and has a manual or automatic page display, the latter with a time setting option — ideal for Open Days.

"Writing a Tele-Book" permits up to 15 pages to be created. Four modes, changed by a touch of the TAB key, give:

1. TEXT — elementary text-handling facilities with white text only.
2. OVERWRITE A — the default mode with normal cursor movement, any text already on the page will be overwritten.
3. OVERWRITE B — the cursor remains static (unless moved with the cursor keys or RETURN) and is very useful when selecting colours and graphic shapes.
4. SHIFT — text not overwritten

in this mode; useful when blocks of text or graphics need to be moved.

Teletext features are added by the use of function keys combined with CTRL or SHIFT, and lower case letters, numbers or punctuation marks give the graphic characters when the graphic colour codes are used. Using these features, imagination is the only limiting factor, and children will begin to appreciate that they have a new and exciting way of presenting their work, and at the same time gain an insight into the idea of electronic mail. Other features in this option permit editing and copying of pages, changing page numbers and saving the book.

Disc versions have two additional programs:

DISC UTILITY, which permits the merging of books, cataloguing and titling a disc, locking, deleting or renaming a book, and dumping pages to a printer.

SEARCH, which is a very useful, easy-to-use database to store information about a software library — a bonus!

I've seen teletext simulators which allow the background colour to be added to the whole screen at one go and also a flashing background. Both these would be useful additional facilities but, it appears, could only be achieved by reducing the 15-page book length in memory or require disc access for each page. Some might think it unfortunate that every page must have a title and that there isn't the option to remove screen instructions when viewing. Personally, I find it easier to create graphics if six adjacent keys have been programmed to represent the six pixels making up a graphics character, which is then created "off-page" by pressing the individual keys "on" or "off", rather than having 64 additional characters to remember to look

up on a help card.

However, these last few remarks should not deter prospective purchase from seriously considering this first class package, which really should encourage teachers (and those using it at home) to do something in a new way.

D.T.

Ratings Table:

SOUNDS	N/A
GRAPHICS	90%
DOCUMENTATION	100%
EDUCATIONAL VALUE	90%
VALUE FOR MONEY	90%
OVERALL	90%

Title	Guided Discovery
Publisher	Etna Software Ltd
Machine	BBC/Electron
Price	£9.95

This is an unusual package, comprising as it does a cassette of illustrative programs and a large (A4) booklet of accompanying notes.

Actually, I am not sure whether the booklet I had was in its final form, or whether the final version will be more substantially bound, but mine looks distinctly dog-eared after review, and a stiffer cover would be a welcome addition. The pages are single pages, printed out on a dot-matrix printer, and bound by attaching the left edges in a plastic binding strip. The pages of fairly tightly packed typing look a little off-putting, but the use of diagrams etc has been ignored. Fortunately the spacing on the children's pages is more generous than on the parent's page, which is a great relief!

You have probably gathered by now that the guided discovery is within the BASIC language, and this is really an alternative scheme of work for the beginner. It lacks the appeal and colour of many books on the market which would probably be a better bet for any young enthusiast, but for a more mature learner it does indeed represent good value, by covering all the main areas of programming with accompanying listings, as well as those programs on the cassette.

I enjoyed the author's style, giving good advice, but then stopping short of actually giving answers. In this sense, the title is a good one. However, I would suggest the author build better error trapping into the cassette listings, as "experimentation" should not really cause "confusion"!

All in all, a good try, but I would still suggest that there are better books around to help, and even the User Guide! Perhaps a little more time spent in the planning stage would have produced a tidier and more useful end result.

P.T.

Ratings Table:

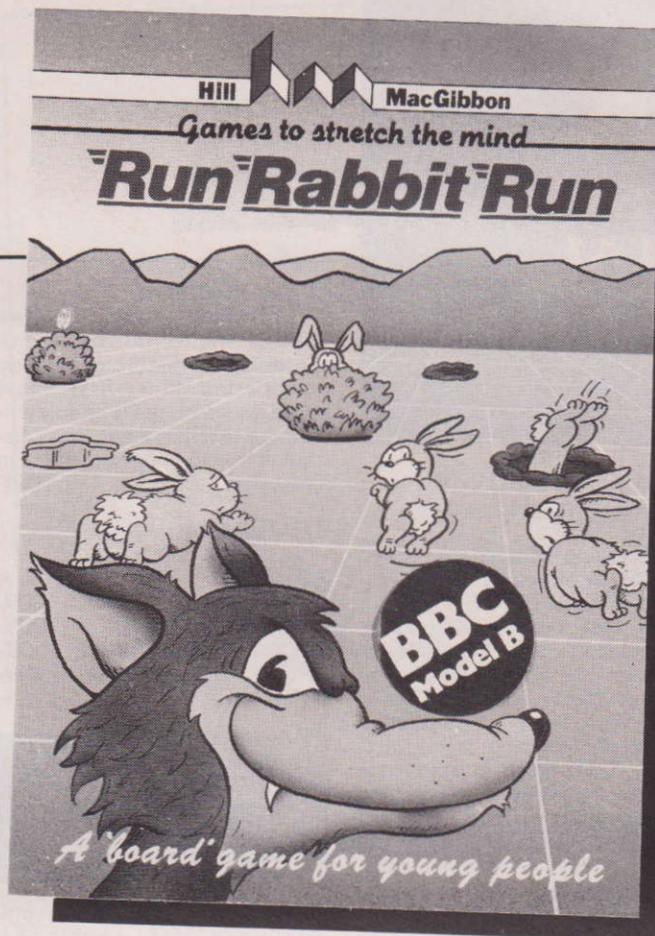
SOUNDS	70%
GRAPHICS	65%
DOCUMENTATION	75%
EDUCATIONAL VALUE	75%
VALUE FOR MONEY	50%
OVERALL	70%

Title	Where?
Publisher	Micro Power
Machine	Electron
Price	£6.95

Micro Power are well known for their superb high speed, full-of-action arcade type games for the Acorn machines. After this tape, I feel they will continue to be known for precisely the same features, but not sadly for the originality or educational value of this tape. It could easily have been produced by any other, less competent company, for it bears none of the hallmarks of Micro Power's usual games offerings.

It isn't so much that the tape is badly programmed, on the contrary it is as fully error-trapped as it is possible to be, and no spurious input is allowed. Indeed, should an answer be indicated before the end of a (short) delay loop, a message is printed in the centre of the scene that the child should stop merely hitting the keys and should try again! No, my reservations are twofold, it just isn't an original and stimulating use of the micro in the classroom, and secondly the educational value is blunted by the correct answer being im-

CONTINUED OVER



mediately given in the event of a mistake. In my experience, that is not how children learn.

A well-detailed map of the mainland of Britain is drawn in a few seconds, and then a question is posed of the multiple choice kind. These questions concern towns, rivers or other landmarks such as mountains, moors etc.

Actually, I put the program into the school micro, a BBC, and was impressed with the very rapid drawing of the outline map on the screen. On the Electron this is of course a little slower. The number of questions possible is quite large, and covers a wide range of possible options. Upon a correct answer, one of a series of totally ridiculous comments is made, ranging from "You won't get the next one so easily" (I wonder why not?) to "I hope this wasn't a lucky guess"! I found these totally out of place in a program of this kind. **P.T.**

Ratings Table:

SOUNDS	80%
GRAPHICS	60%
DOCUMENTATION	55%
VALUE FOR MONEY	80%
OVERALL	70%

Title	Run Rabbit Run
Publisher	Hill-MacGibbon
Machine	BBC B
Price	£6.95 cassette, £9.95 disc

"Will the rabbits reach their burrows before the fox eats them?... RUN RABBIT RUN has been designed to promote thinking skills in children between five and nine, although adults will also find the program challenging." It also needs a warning, "Beware, this program is addictive!" Many mums, dads and teachers are going to be tearing their hair out trying to beat the fox in this splendid game. Like the Picture builder program from Hill-MacGibbon, this one has also been developed at Newman College and one can immediately appreciate how important it is to have educationists involved in the production of programs intended for the education market

— be it home or school. The game is played on a 10 x 10 grid. There are four types of square: open ground, ponds, bushes and burrows. The user is allowed to choose if he wants two, three or four rabbits and whether the fox is to be controlled by the computer or not, so it can be used by one player alone against the computer or by two players (or teams) against each other. Adults are strongly recommended to try it against the computer when the children are in bed before uttering hasty challenges to son or daughter.

The number of moves allowed to the rabbits is random (between two and 12) and will depend on the number of rabbits and, since they are a team, they share the given number of moves. All the moves must be used and each rabbit is only allowed to move in the direction it started during that turn. The fox, on the otherhand, will always have between three and eight moves and can change direction as often as he likes during his turn.

Each rabbit is trying to find its home burrow, where it is safe for the rest of the game, so a certain amount of recording is required to keep track of each bur-

row that the rabbit visits. A rabbit can hide in a bush or another burrow, and both rabbit and fox will drown if they go into a pond or the water that surrounds the board.

All moves are made via the function keys and information regarding which rabbit is to be moved — it changes to green on the "board" — and how many moves are allowed/left is displayed at the bottom of the screen.

A very clever game — it really does get you thinking ahead — which I thoroughly recommend. **D.T.**

Ratings Table:

SOUNDS	Beeps!
GRAPHICS	80%
DOCUMENTATION	95%
EDUCATIONAL VALUE	90%
VALUE FOR MONEY	75%
OVERALL	85%

Title	Archaeology
Publisher	Cambridgeshire Software House
Machine	BBC Mode B (disc only)
Price	£13 plus VAT

I expect there are many teachers who, having used one of the Holmes/Whittington simulations such as MARY ROSE or SAQ-QARA — two programs that have already become "classics" — have wished that they'd been based on a site near their school or perhaps a site they intended using for a visit during a school journey. Well, here's the program you've been waiting for, an open-ended simulation which allows you to create a datafile on any site you wish.

Before Archaeology can be used, information on the chosen site must be plotted on an 80 x 60 grid. First, the walls are mapped on each of three levels, secondly, areas of flooring eg mosaics are plotted at each of the levels and, finally, the position of the artifacts are marked. Using the first program, SITE PLAN, the details are entered and saved as a datafile, while in the second program, EXCAVATION, groups of children can excavate the site to map the buildings and floors, and identify and research any artifacts which they may discover.

Both programs are very "user friendly", and mainly operated at the touch of a single key — the commands available being only the H for Help key away. The site plan is transferred to the screen using the cursor keys in conjunction with Position, Build and Erase, and at all times the position of the cursor is monitored at the bottom of the screen, eg P. (for position) E40 N30 Level 3. A maximum of 10 groups may use the EXCAVATE program at any time and the teacher may stipulate the number of digs each group is allowed to make during one session and then define the areas of the site in which the group may dig.

I was fortunate enough to visit Barry Holmes's school when they were trying out the program, and ever since I've been impatiently waiting for its publication. A couple of days before the visit, a group from the third year class had mapped the school as part of a maths topic, and while I was there the fourth year class were commencing

their excavation — not knowing the origin of their site, of course! They tackled their task in a very methodical manner, and discussed their findings with an air of authority — they're old hands at the game!

Teachers and parents of young children may find the title, Archaeology, off-putting. Don't, because at a simple level this program can produce, for example, grids for treasure hunts, and children will be able to develop some of the skills which will benefit them when they come to tackle the more complicated sites later. I'm sure enthusiastic teachers will come up with ideas for using the program which were never envisaged by the authors, but that's what being "open-ended" is all about!

The suggestion of approaching the secondary school to cooperate in producing some reproduction artifacts seemed to be an excellent idea, not only for helping the whole project come to life, but also to encourage some joint ventures — the history and geography departments might like to set up some sites — and they'll begin to appreciate some of the exciting work being done in the primary schools with computers. Of course, parents with expertise will enjoy becoming part of the project too.

In an article on the program in the T.E.S. (24.8.84) it is suggested that this type of program will encourage the pooling of resources — "the information and disc containing data on a particular site can be lodged at a teachers' centre and loaned to other schools". Unfortunately, in my opinion, none of the sites mentioned in the handbook were included as a sample datafile. I thought my review copy had something missing, but it seems they wanted to emphasise the open-ended nature of the program, so thought it best not to include one. I've started using the program with a group of teachers and everyone said they would have welcomed a sample file — particularly the Fishbourne one as we live nearby! — and they thought the handbook, as good as it is, would have been enhanced considerably if a copy of the grids used in one of the datafiles mentioned had been incorporated. But, that is the only criticism I would make of a super program . . .!

If you believe in taking children out and about, be it parents from home or teachers from school, then I think this program is a must; if you don't, then this might encourage you to do so. It's certainly a significant step in the right direction as far as computer programs are concerned, and at the price, even the smallest school should be able to afford it. **D.T.**

Ratings Table:

SOUNDS	Beeps!
GRAPHICS	90%
DOCUMENTATION	80%
EDUCATIONAL VALUE	100%
VALUE FOR MONEY	100%
OVERALL	95%

Title	Picture Book
Publisher	LTS
Machine	BBC — disc only
Price	£14.95 (retail), £11.95 (educational)

This is a suite of five programs developed by M.E.P. for use in developing skills in reading, sentence construction, description and spatial awareness.

My first comment has nothing to do with the program, but on the copyright note on the first page of the handbook: "The program may only be copied by the original purchaser for use within the purchaser's school, training centre or home." While appreciating that it is almost essential to copy the master programs onto other discs in order to create new scenes, this wording is a significant step in the right direction as far as copyright is

concerned. Hopefully other publishers will follow suit.

BOOK 1. The initial menu provides options for selecting the relationship for which the exercises are to be provided, eg near, next, far, away, etc and a record is kept of the child's responses. The program presents pictures containing two or more parts with a table of words underneath. The child is required to select words from this table to compose a sentence describing the picture. Operation is simple using SPACEBAR and RETURN key. If the first attempt is incorrect, a second try is allowed; if this is wrong, the correct sentence will be displayed for the child to copy. The graphics are very good and would be motivating, and the vocabulary used would fit in with the early stages of most reading schemes.

BOOKS 2 and 4 are designed for use in creating scenes and word tables for use in **BOOKS 3 and 5** respectively. While these would be for teacher use in most infant classes, older children and/or young computer buffs will enjoy creating their own scenes, and for them the program offers useful experiences in spatial awareness.

In **BOOK 2** the picture is created before the sentence, in **BOOK 4** the reverse happens. The programs allow the construction of up to 15 scenes composed of up to five characters chosen from a table of 12. In the case of four of the pictures — boy, girl, and two cars — there is a very clever large or small scale option. The creation is very easily achieved as a result of the thirteen screen positions and, depending on the size of the character, some overlap to give the impression of one object being behind another. Unfortunately, sentences are limited to nine words/38 characters, but you can type in a different arrangement of the same words if this is appropriate.

BOOKS 3 and 5 work in a similar way to **BOOK 1**, except that in **BOOK 5** the text appears before the picture. A report and text printout facility are available, the latter allowing close type, half or full-page spacing. The last two allow the child to add pictures in

the spaces above the sentences.

Reception class teachers will regret the fact that the program doesn't offer double-height text, which is more appropriate for youngsters just starting to read, and I would consider it essential if it is used as suggested for group work. Likewise, I would have liked a printout option for the drawings, as this would give the children the chance to create their own sentences on the scenes away from the computer. While the 12 pictures give a large number of combinations, hopefully, it might be possible to extend the options by producing alternative sets.

This is a program which should find its way into all infants' schools.

P.S. Do make a back-up copy as suggested — the illustrative examples for Books 3 and 5 won't load with the write protect label in situ! **D.T.**

Ratings Table:

SOUNDS	N/A
GRAPHICS	80%
DOCUMENTATION	85%
EDUCATIONAL VALUE	80%
VALUE FOR MONEY	90%
OVERALL	85%

Title	Language Development Pack
Publisher	LTS
Machine	BBC Model B
Price	£12.95 (retail), £9.50 (educational) disc or cassette

This pack of three programs has been developed by the Micro-electronics Education Programme to encourage children to think about what they read or write on the screen and aid the development of alternative forms of expression. It is intended for the 9-15 age range.

All three programs run from a very similar menu. Option 1 allows the use of the program with the examples provided, Option 2 permits the user to specify

CONTINUED OVER

new words/sentences or edit existing ones, Option 3 makes use of the new material provided by Option 2, and Option 4 sets up the printer — second program only.

When using the first option of SENTENCE CORRECTOR, a sentence is displayed in which one word is incorrect — wrongly spelt, out of context, over-used, or imprecise word, or a false statement. In some of the examples it is possible for two or even three words to be considered incorrect, and the sentence put right by substituting any one of them. The documentation suggests that this will "force the child to re-examine his original hypothesis if he is not right" first time. I suspect many children might be led to thinking that the computer is always right, and they're just being mind-readers — not an attitude I'd want to encourage!

Each of the examples has five alternative words, and the user is given the opportunity to add his own choice or to try to match up with one of the program's alternatives. Option 2 allows the teacher/parent to type in up to 15 sentences with as many as 19 alternatives for each sentence. There is also a report section which displays one page of results for each sentence and has a useful facility which enables the teacher to edit the new words which might have been introduced by the user.

WORD STOPPER is a simple word processor, which generates similes for overused, incorrectly used or misspelt words. The program allows the user to type stories or other passages of text — maximum 18 lines of 40 characters wide — and prompts the use of alternatives when words previously specified by the teacher/parent are typed. Up to 120 words may be "stopped" and a facility to specify up to five alternatives for each word is available. The program also provides a report and allows a printed copy of the text.

When the program is used with Options 1 or 3 and a stopped word is typed in, the micro

bleeps and the word vanishes from the screen. Some suggested alternatives can be seen by pressing the SPACEBAR, or the original word may be replaced in the text by pressing RETURN. The touch I particularly liked was in Option 3, where the message "Sorry, can't help you with this one" will appear if suggestions are requested when the teacher has not specified alternative words. Hopefully, this will send the child racing for the Thesaurus! Young children will find the programming of the DELETE key to remove the letter immediately above the cursor rather than the one before very helpful.

If sparks of creativity are not to be extinguished by interruption, it is particularly important to make a draft then use this program for the polishing process, a fact that is mentioned in the handbook.

SAY THAT AGAIN presents a sentence on the screen and prompts the user to read and then retype the sentence using different words. If more than three words from the original sentence are used, the program will request the user to try again. Bearing in mind the age range the program is intended for, I think it unfortunate that one cannot stipulate the number of words that could be reused. For many children three will be too few. While there is a report facility available, a print-out would be valuable.

The introduction to the handbook states, "The three programs contained in this pack offer a fresh approach to the acquisition and development of language skills." If by "fresh" it refers to the use of the computer, then one cannot disagree; if it refers to the materials, it proves that there is very little "new". Which programs are selected for use on the computer depends on the priorities the school has for its use. I tend to look for more creative uses than those offered by SENTENCE CORRECTOR and SAY THAT AGAIN, both of which could be created with pencil and paper. WORDSTOPPER gives a useful introduction to the wordprocessor incorporating a

Thesaurus, which provides a very promising use for the computer in language work, and is worthy of further development. This program makes the package worthwhile for use in the home or at school.

Perhaps the proof reader should use the SENTENCE CORRECTOR. There were at least four spelling (typing?) errors plus two incorrect cross

references in the handbook, which mar an otherwise clear and comprehensive piece of work.

D.T.

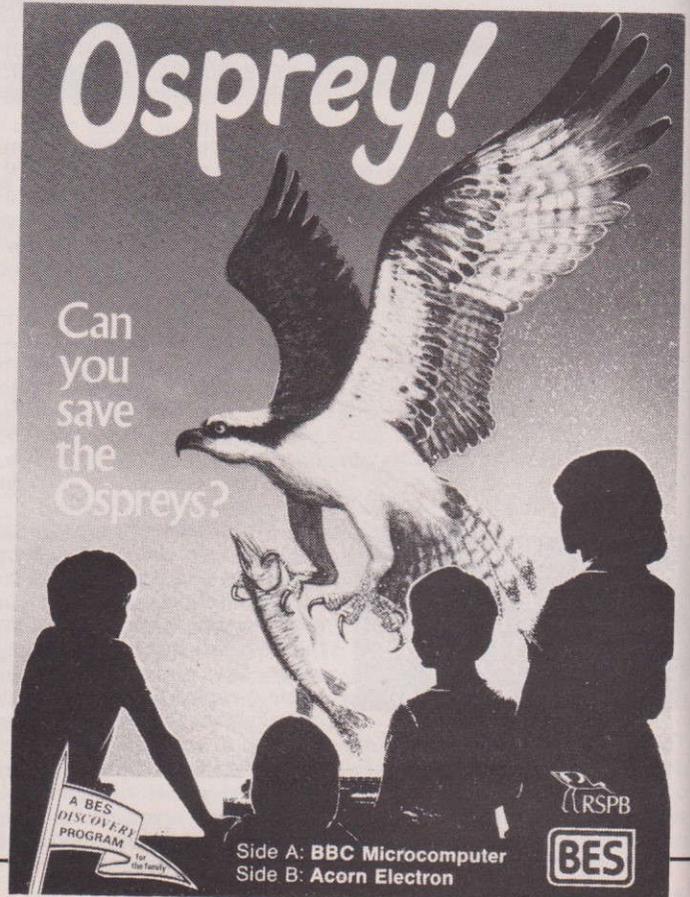
Ratings Table:

SOUNDS	N/A
GRAPHICS	70%
DOCUMENTATION	70%
VALUE FOR MONEY	65%
OVERALL	68%

Title	Osprey
Publisher	Bourne Educational Software
Machine	BBC B/Electron
Price	£9.95 cassette, £11.95 disc

I have to admit that I am more than a little disappointed by this program. Being sponsored by the RSPB and involving the vital area of conservation, I expected to be enthralled by a simulation game of real interest. Instead I feel that it can only be described as a watered down version of a dictator type game. In these games you are allowed to select how resources should be used and then see the results of your action on screen. The program has taken this idea and then applied it to the RSPB's Osprey conservation project.

One area where this program scores over the others of its type is



in the quality of the graphics which are well drawn and move in attractive ways, but these don't make up for the lack of interest that I found in the rest of the program. Each season you are told how many osprey are nesting and how many wardens you have available. They can be used in the following ways. Looking after the main site and therefore being on hand to prevent the tourists disturbing the birds. They might be assigned to the educational aspects of the work, making sure that people know about the osprey and the best ways to look after them. Finally they can be assigned to stop egg stealing and therefore allow more eggs the chance of hatching. These three options are all that you can select from and that is the whole of the variety that you have to play with. There is no allocation of money, no building of physical defenses and little chance to change public opinion, which I feel might have been included to make the game more realistic and interesting.

Yes, I am aware that this is a game/educational package for children, but if they are old enough to appreciate the complexities of resource management then I'm sure that they could cope with more variables than this program gives. Any child who has played the game of this type on the BBC Welcome tape (Yellow River Kingdom) is likely to find this game very tame indeed.

After you have made your decisions you see the effect of your action in moving graphics. This is all very good but there is still too little motivation to keep you trying new combinations of options. The weather and other variables are beyond your control, of course, and whilst this should act as an added interest, I found that it tended to make the effect of your decisions even more difficult to understand.

The one part of the package which is superb is its 32 page, full colour booklet of instructions. This is packed with interesting information about the birds and the RSPB, and has a number of excellent colour photographs too. This certainly sets the project into its context and contains a full bibliography for those who want to know more.

If you need a simple computer based support to other school work on this subject, then this might be of use to you but I still cannot help feeling cheated by the simplicity of the package. **D.C.**

Ratings Table:

SOUNDS	70%
GRAPHICS	90%
DOCUMENTATION	100%
VALUE FOR MONEY	50%
OVERALL	60%

Title	Harlequin
Publisher	LTS
Machine	BBC (disc only)
Price	£14.95

Harlequin allows the screen to be used as a work surface on which to create pictures of various degrees of complexity. Using a range of grids and block compositions, the child can create his own pictures or the teacher can make pictures and "hide" parts of the completed shape for the child to "find", encouraging him to develop problem solving strategies to achieve the objects or "lock" parts of the shape in order to impose a basic framework around which to

work. It can be operated from a QWERTY or CONCEPT keyboard.

I spent several hours working the program before I felt I'd really got to grips with it and appreciated its possibilities. Despite the "comprehensive handbook", I didn't find the program easy to get into. Busy class teachers might not have the time — or the patience — to persevere. Please do, because I'm sure you'll feel your efforts rewarded.

Although the handbook is comprehensive — 27 pages plus a supplement — one doesn't reach the Tutorial for Harlequin A for 15 pages. Even then one has to delve into previous pages

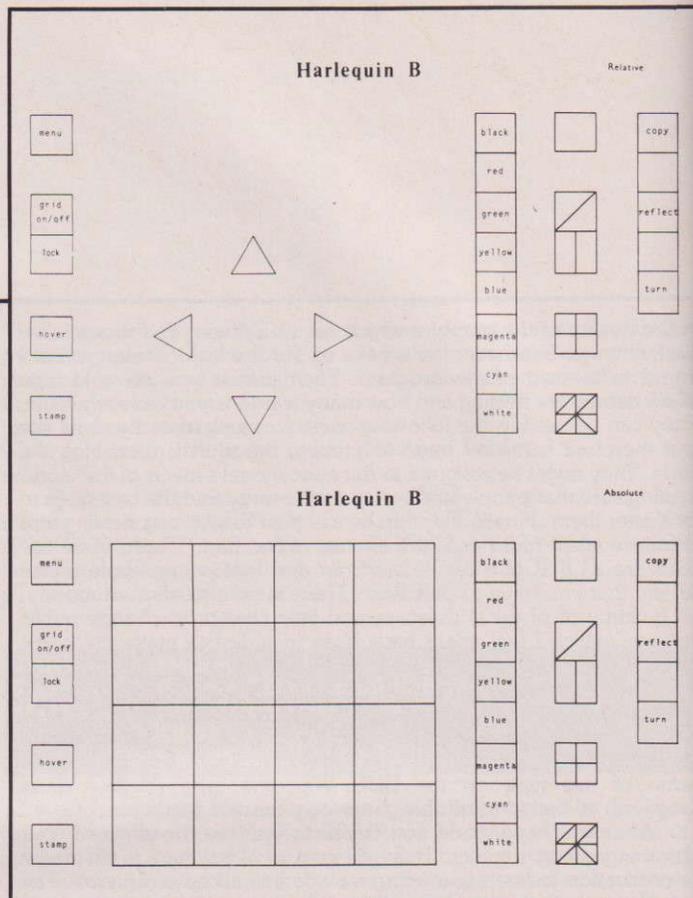
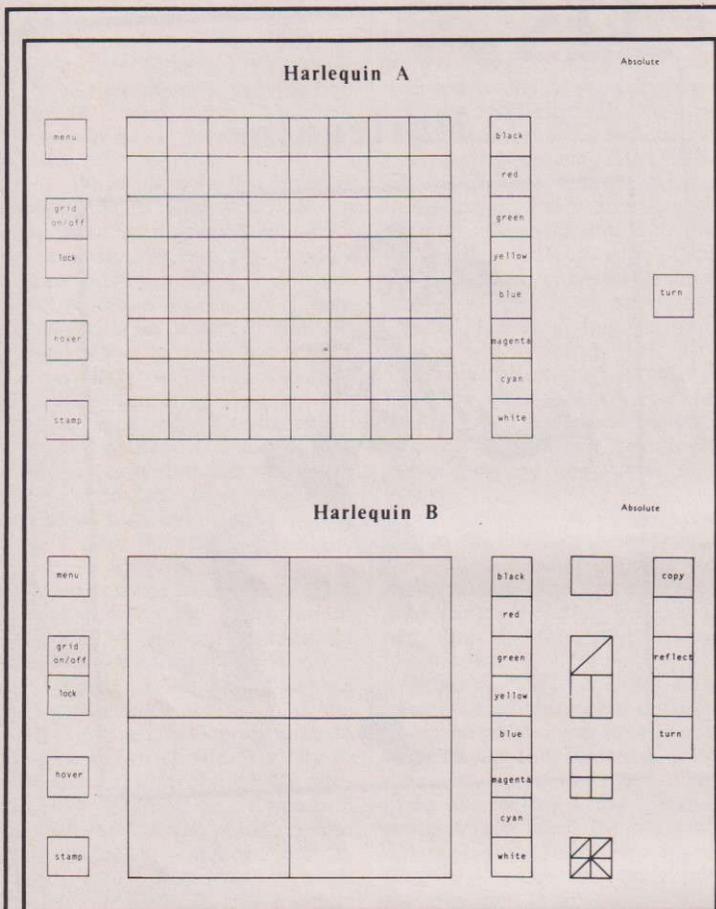


to find the Password, which is required all too frequently for my liking. "Try the exercise again using the tractor picture", and it's not until the pictures are listed or the last page of the supplement is reached that one realises that this is no longer in the program, as the samples have been "up-dated to reflect more effectively the scope of Harlequin". If you wish to use a Concept Keyboard, don't phone Star Microterminals and ask how you know whether you've got a RELATIVE or ABSOLUTE model — references always refer to the overlays *not* the keyboard! I'm sure this could be made far more user-friendly with a few corrections, a little reordering and some cross

references.

The suite of programs is on two discs and both programs share many basic features, eg four different size grids, eight colour options — function key strip provided. Harlequin A is the simpler of the two and allows the hiding of blocks, one or two piece blocks, the number of pieces in the block to be selected by the teacher and the TURNING of a block. Harlequin B has one, two, four or eight piece blocks, can TURN a block, REFLECT a block in the vertical axis, can COPY a block, but cannot HIDE a block. These are set from the SPECIAL MENU, which is one of the op-

CONTINUED OVER



tions available on the MAIN MENU. This also permits, among other things, the loading and saving of pictures, and access to the work surface. Pressing G places a GRID over the surface, and one or two of the function keys give a copy of the coloured block selected on the right-hand side of the screen. This can be changed or turned before it is placed in position (selected by moving the cursor) on the grid. In Harlequin B, the number of pieces in the block is selected using the numeric keys before the colours are selected.

And so a picture is created or completed and the users will have explored relationships between colour and shape and developed a range of spatial skill such as rotations, reflections and translations. With a good group demonstration as a starting point, even young children should gain

from using these programs. The graphics, with "the deliberately 'poor' resolution and symbolic nature of Harlequin pictures" are first class and limited only by the imagination of the user. The language potential is considerable — imaginative interpretation of the pictures, writing of clear instructions for reconstruction of the child's own creations. I feel this might be enhanced if the program had a facility for a printout of the shape outlines — perhaps in place of the sound, which added little to the program. **D.T.**

Ratings Table:

SOUNDS	20%
GRAPHICS	90%
DOCUMENTATION	50%
EDUCATIONAL VALUE	75%
VALUE FOR MONEY	70%
OVERALL	70%

Title Which Salt?
Publisher Micro Power
Machine Electron
Price £6.95

I suppose that long ago, before the education cuts, the cost of chemicals themselves for use in the science syllabus was a minor item, causing no feeling for conservation of stocks among staff. Now, sadly, the raw materials themselves are in shorter supply, and therefore an alternative would be welcomed by science staff. The micro offers one such viable alternative, and more regular and mundane tasks can now be simulated within it. The original experience of using the substances themselves, of course, is vital, but in revision it would be handy to be able to give the results of some of the standard tests, without having to perform them. When it comes to exams, this is vital, and this program would come into its own on the family Electron, or on the school's BBC machine.

A salt is decided upon by the micro, and the student can then determine by the use of various standard tests (limewater, kindling a glowing splint etc) which compound it is. The element is first determined, and clues can be obtained such as the colour it burns in a flame. Once the answer is correctly given, the various salts of that element are considered. I didn't do tremendously well at Chemistry at school, although I reached the 'A'-level class, but I found myself quite taken with this program. I couldn't discover any glaring errors, although I would hardly expect to find any in a Micro Power tape. I didn't remember there were quite so many permutations of salts, though, and I needed to resort to a pencil and paper on many occasions. Colour is used sparingly, but when needed, and there are no distracting raucous sounds. I feel it will sell well as exams loom nearer on the horizon! **P.T.**

Ratings Table:

SOUNDS	75%
DOCUMENTATION	75%
EDUCATIONAL VALUE	85%
VALUE FOR MONEY	80%
OVERALL	80%

Create Your Own Adventure World

Melvyn Wright

Last month I concentrated my attention on the desirable qualities of a good adventure master program. This month I will look at the second aspect of any adventure game, namely the story itself. The requirements here are much more difficult to define but they are just as important as the actual adventure program. You must place the player in an interesting environment, give him an objective to fulfil and provide a set of logical and inter-related puzzles for him to solve. You should also provide a reason for the player being in the situation that you have placed him, but this is not often done, and it doesn't seem to bother most people. They are not really interested in the past, all they want to know is how to escape in the future!

OBJECTIVES

Broadly speaking, the objective of most adventure games falls into one or more of the following categories. The player has to a) collect various items of treasure, possibly storing them somewhere along the way; b) score a minimum number of points, usually achieved by solving all the puzzles; c) get to a certain location or find a certain object; d) kill a certain creature, or perform some heroic act, like rescuing a damsel in distress.

Many games incorporate more than one of these ideas, ie the player may have to get to a certain location in order to perform the heroic act, collecting and storing treasures along the way!

The setting for an adventure game is one of the first things that an adventure writer must decide upon when writing a new game. Many types of settings have been used but there is little doubt that the most popular type of environment, and the one favoured by the majority of adventurers, consists of a world which is as far removed from the present world as possible. Adventuring is a form of escapism and the player enjoys being the king of his own world in which he can forget the day-to-day troubles of reality.

This explains why the majority of adventures at present

In the second of two articles, Melvyn Wright of EPIC Software explains how to ensure that your own adventure games are both exciting and playable.

available take place either in a magical fantasy land, or in space. The average person would not normally have any expectations of visiting these kinds of environments during his lifetime, so the fascination is obvious. However, this does not mean that an adventure based upon the real world is a bad idea. When people get bored with their fantasy lands they may well want to escape back to reality!

PUZZLING AND PLAUSIBLE

One of the most important aspects of any adventure game is the layout and type of the puzzles that have to be solved by the player in order to successfully complete the game. I would go as far as to say that it is these puzzles (and more importantly, their solutions) which will decide whether the game is to be a success or not. It does not matter how brilliant the program is, nor how fascinating the scenario, the player is likely to quickly become bored and frustrated if he is constantly confronted with tortuous problems which seem to have no logical solution.

On the other hand, an adventure game is like a jigsaw puzzle, inasmuch as once you have solved it, it becomes worthless. If someone spends £10 on a game which he then solves in a matter of days, he is very likely to feel cheated, and rightly so. Therefore, you must strike a balance when you are devising the puzzles for your adventure, and I shall devote the rest of the article to this very important aspect.

It is very difficult to judge exactly how hard your puzzles actually are when you are devising them, as you already know the answers! After a great deal of experience in this matter, I will warn you that the player will find them far harder than you had intended when you devised them. Even experienced adventurers will get stuck at places where you didn't intend there to be any puzzles at all!

The golden rule is to make all the solutions logical. They can be as hard or easy as you think fit, but the solutions *must* be logical and plausible.

For instance, in a certain well-known adventure there is a portcullis which has to be raised to pass through. There is no indication given as to how this feat may be performed and the program does not respond to the usual efforts that would be required to carry out such a task, even if the player possesses objects that would appear to be useful. Consequently, most people give up in despair at this point.

The solution is in fact to rub the ruby, which is one of the items of treasure you have previously encountered. This solution is totally illogical and the only way of solving the problem would be by accident, or by cheating (as I did!). At no time is there any connection suggested between the ruby and the portcullis, nor are there any clues that would lead the player to think that the ruby had to be rubbed at some stage of the game.

Whilst it is not unacceptable to arrange for the ruby to have magical powers to lift the portcullis, such a thing is so far

removed from reality that the total absence of clues is completely inexcusable. It would have been a simple matter to have said "the ruby vibrates slightly" when approaching the portcullis, or to arrange for the ruby to have a portcullis engraved upon it. If the writer wanted this to remain a particularly nasty problem then he could have had a red portcullis. This would have suggested an association between the two objects but would still have required a great deal of thought to solve the problem.

GIVE US A CLUE

The previous example also demonstrates that it is not the puzzles, nor their solution which determine the difficulty of the game, it is the clues contained within the text of the messages that decide whether the game will be easy or hard. Even the most illogical puzzle becomes easy if its solution is virtually given away within the text of the game.

When writing your adventure, try to put yourself in the player's shoes and imagine what actions he is likely to attempt as he comes to each problem. If the solution does not suggest itself naturally, he must be given a prod in the right direction. Moreover, if a problem has to be solved in two stages, give him some encouragement when he has solved the first stage, otherwise he may give up altogether.

For instance, suppose you have a treasure chest that has to be opened by first unlocking it, then prising the lid free. The first attempt to open it should be met with the response "the chest is locked". When the player unlocks it and tries again the program should give a different message, ie: "the lid appears to be jammed". This combination of messages will steer the player gradually towards the full solution to the problem. Had he been confronted with the message: "you cannot do that" or "the chest will not open" then it is very unlikely that he would have realised that the puzzle needed a two-part solution, and would probably have given up after the first stage, not realising that he

had in fact solved half of it.

This takes us on to the subject of error messages. If a player attempts to do something which is clearly impossible, or downright silly, then he should expect to be told, simply: "You cannot do that." There is no need to use up valuable memory in trapping these errors and storing messages like: "you cannot take the door" or "you cannot eat the lamp"! However, he should not be told: "you cannot do that" if he attempts to do something and is prevented from doing so because he has overlooked something.

In Epic games, if the player enters any command that the program recognises (even if it cannot yet be carried out), the player is given a special message depending upon the reason why the command cannot yet be executed. For example, he may be in the wrong place, or in the right place but at the wrong time.

It is often a good idea to include a blanket error message for each of the more common verbs in the game, for example: "you cannot eat that" or "you cannot kill anything here", but beware, this can cause confusion. If the player mis-spells the noun and types: "EAT BISIT" he will be told "you cannot eat that" and may not spot his error, as the program appears to understand him. If he had been told "you cannot do that" the lack of recognition by the program would probably have caused him to re-examine this command. So avoid trying to be too clever with your error messages, keep them as general as possible and make sure that they sound right whatever the player types in.

Although it is part of the game to work out the vocabulary of the program, you should never enforce a strict input from the player for the solution of any of your puzzles (except passwords). You must always try to work out what the player is likely to type in a given situation then cater for it in your program. It is a poor game if the player has to constantly keep rephrasing his commands to get the program to understand him, especially if he is typing the obvious. He will even-

tually give up and assume that he has the wrong solution. For example, if he has a boat the player should be able to cross a river by typing: "CROSS RIVER", "BOARD BOAT", "ROW BOAT", etc. Don't provide "EMBARK" as the only accepted command.

LOGICAL MAPPING

I have stressed the importance of logic when drawing up your puzzles and this applies equally to the map of your adventure layout. If the player ventures north from a certain location, going south should return him to his original location, unless it is a one-way route. He should not end up at a third location simply by typing two opposite directions. Furthermore, if it is a one-way route it should be made clear why it is not possible to return, eg "you have jumped off the cliff" or "the door slams behind you".

Using illogical directions makes it impossible for the adventurer to make a map of his journey and whilst you may think

this is good fun, experience has shown that the majority of players are infuriated by this type of maze. It is quite possible to construct a complicated maze without having to resort to illogical paths which are not retraceable. The use of these reduces the game to a test of trial and error which can only be solved by accident. This is not what adventuring is all about. The provision of this type of maze could be justified if a novel method of solving it is devised, as is the case in some of the Acornsoft adventures.

Another illogical trick used by some adventure writers is to kill off the player at random. The designer will arrange for there to be a monster prowling one section of the game and if you are in that section when the wrong random number comes up — end of game. Thus the section is reduced to a test of patience while you constantly save your position at every move, and reload it each time you get killed. However, this trick is permissible if there is a valid way of tending off the monster, as long as a logical association is established between the monster and the required

weapon beforehand. However, it is acceptable to kill the player suddenly if you clearly explain the reasons for him being killed. In this case he can avoid it next time.

Although the subject of mapping has already been discussed, there are a few additional details which can be incorporated to make the game more playable.

Make it easy for the player to move about and explore his environment, particularly at the start of the game. Do not use 45 degree compass points, stick to north, south, east, west, and occasionally up and down. These make exploration much easier, and are more convenient to type in. Finally, do not kill the player simply for moving about in the dark, unless there is a good reason which is explained in the text.

You must decide for yourself exactly how easy or difficult your adventure game is going to be. However, by implementing the techniques that I have outlined in this article, you will ensure that your game remains interesting and playable, whatever the difficulty.



Software Reviews

Reviewers this month: Dave Carlos, Jonathan Evans, Peter Rochford, Shingo Sugiura, Vijay Sundaram, Philip Tayler.

Title	The Music System
Publisher	Island Logic
Machine	Model B
Price	£24.95 disc, £12.95 x 2 cassette

Island Logic is a new company associated with Island Records who have been developing software since the end of 1983 with their eye very much on the disc user market, and that means BBC owners. Their first product is The Music System, an advanced piece of software containing a Music Editor (based on SYSTEM's program), a Synthesiser (Envelope Generator), a manuscript generator called The Printout and The Linker, which allows compositions to be strung together. All these are directed from a control screen employing icon graphics, Macintosh-style.

As well as the composition facilities, there is also a Keyboard option which allows the playing of notes from the keys. These are digitally recorded for playback if required. There is complete control of volume and a built in metronome.

The most important part of the system remains the Editor with its use of all four voices, 15 available envelopes, automatic transposition, numeric or classic Italian tempo notation and automatic barline creation options. The Linker further increases the power of this Editor, which has always been the best available for a micro.

All the main programs come on a single floppy disc (although a two part cassette version is available). A second floppy disc supplies the song and sound library, backing tracks and pre-defined sounds. To bring it all under the user's control there is a 96 page user manual. Unfortunately due to the necessity for last minute changes in the copy protection of The Music System, we were unable to give it anything but the briefest of trials here at A&B. However we now have the full version and an exhaustive review will appear in the pages of the February magazine.

M.W.

Title	Galaxy Raiders
Publisher	Visions
Machine	Model B
Price	£6.95

Visions Software Factory has come up with some very nice software in the past, notably such games as Daredevil Denis and Pengi.

Their latest offering is Galaxy Raiders which is a nicely implemented version of the Atari classic, Star Raiders. The theme of the game is that you take the role of a starship commander, patrolling the galaxy and defending your starbases against attack from nasty trigger-happy aliens.

There are three screen displays used in the game which you can select at any time. One is an out-of-window view of space where all the action takes place in 3D, the other two being a galactic chart and a damage report screen. There is also a fourth screen which is only seen while the game is "frozen" showing your present status.

To move around the galaxy, you select your destination on the galactic chart which shows the position of your starbases and of course the evil aliens. Once a destination is chosen, you may use hyperspace jump to reach it quickly.

Your ship is equipped initially with a certain amount of fuel and replenishment is only obtained by docking with one of your starbases. Weapons consist of the inevitable laser and missiles which may be guided to their

target by aid of a tracking computer.

There is much more to this game than can be written in the space of a review and a good study of the ten pages of instructions is required to get the best out of the it. My efforts I must admit were not far short of abysmal, but I did manage to get beyond the "rookie" stage — once!

Good use is made of graphics and sound throughout the game though I must say that it is all fairly standard stuff for a game of this type. There are around ten keys to operate but this load may be lessened by the use of joysticks. Other features are those one comes to expect these days — high score table, sound on/off and a "freeze game" facility.

In conclusion, I enjoyed this game but found it rather complex, needing a good deal of thought and practice to achieve any real degree of success. Certainly though it is worth considering if you fancy yourself as a budding Captain Kirk. Right, beam me up Scotty!

P.R.

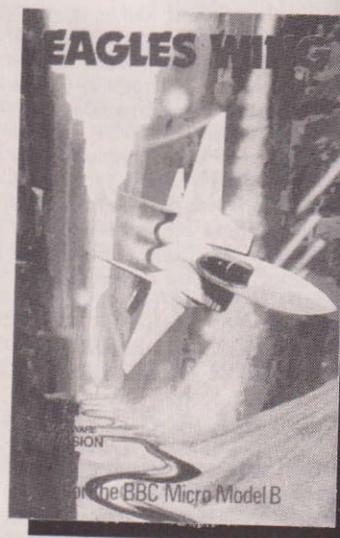
Ratings Table:

SOUNDS	65%
GRAPHICS	70%
DOCUMENTATION	85%
VALUE FOR MONEY	75%
OVERALL	75%

Title	Eagles Wing
Publisher	Software Invasion
Machine	Model B
Price	£7.95 cassette, £9.95 disc

Eagles Wing depicts a strike plane attacking a ludicrously well defended river canyon. Missile launchers, patrol ships and pill boxes blast at you in an effort to destroy you but your plane is well armed as well. You can fire shells or missiles to destroy these missile bases as well as the dams and gun ships that appear in the later stages of the game.

As the game progresses a status display at the top of the screen tells you how much ammunition and fuel you have left,



your score and damage inflicted by the enemy. Once you have gained 99 damage points, if you fly into the canyon wall or if you run out of fuel, your strike plane explodes and the game ends. For every 10000 points you amass, you get a chance to dock with a sister ship to get fuel and repairs.

The game features exceptionally smooth scrolling and some very impressive graphics. The game load is accompanied by interrupt driven music and detailed instructions. Extra options include sound on/off, quit game and hall of fame. The sound is also very good and certainly adds to the enjoyment of this addictive and classy shoot-'em-up.

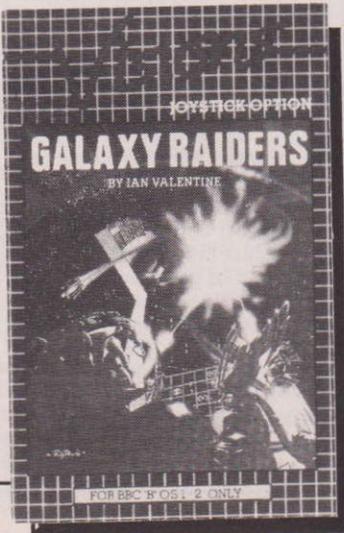
S.S.

Ratings Table:

SOUNDS	90%
GRAPHICS	90%
DOCUMENTATION	70%
VALUE FOR MONEY	70%
OVERALL	80%

Title	Spooks and Spiders
Publisher	Software Invasion
Machine	Model B
Price	£7.95 cassette, £9.95 disc

Spooks and Spiders is another game based on the popular ladders-and-platform game



theme. You control a very well animated little figure around the screen avoiding contact with the spooks, spiders and the skulls which guard the corridors. First of all, you must collect a key at the top of the screen then open all the doors in the order specified by a flashing arrow. Once all the doors have been opened, a damsel will greet you and you go onto the next level in an effort to rescue another one. There is a time limit for each screen so you must hurry.

The graphics are very good. The characters have been carefully designed and they move smoothly in a realistic manner. Unfortunately, the sound is a little boring. However, the general presentation of the game is well up to the usual Software Invasion standards and includes most features such as sound on/off, hall of fame and a nice title page but a freeze option and quit option should have been included as well.

There are three different levels which when completed get faster and faster and, overall, this above average ladders and platform game should please most people. **S.S.**

Ratings Table:

SOUNDS	40%
GRAPHICS	85%
DOCUMENTATION	50%
VALUE FOR MONEY	90%
OVERALL	67%

Title	Attack on Alpha Centauri
Publisher	Software Invasion
Machine	Model B
Price	£7.95 cassette, £9.95 disc

You move a laser base from side to side and fire at things swooping at you from the sky. Pretty original eh? Admittedly the base moves on a prettily drawn planetary landscape, the things that swoop down on you are giant wasps and the graphics are well presented. But that tired old space invaders theme is not what I expect from a game produced in 1984. Nor do I expect any new



arcade game not to offer a joystick option to protect my keyboard from the children's enthusiastic (I admit) bashing. I tried a machine code patch, but the program doesn't appear to use the usual INKEY minus system, so it didn't work. The game is very noisy, but fortunately you can turn the sound off.

In fairness the game is much superior technically to the early space invaders games, and might well have attracted praise if released a year or two earlier. But technique without imagination is as barren in computer games as it is in music or the arts. **J.E.**

Ratings Table:

SOUNDS	55%
GRAPHICS	80%
DOCUMENTATION	50%
VALUE FOR MONEY	55%
OVERALL	65%

Title	Blitzkrieg
Publisher	Software Invasion
Machine	Model B/ Electron
Price	£7.95 cassette, £9.95 disc

I have noticed an interesting trend for software writers to realise that you don't have to fill the screen with lots of colours, and that the lower resolution screen modes (4 and 5) can be used to good effect, leaving more room for a complex program. Among recent programs praised for their graphics, Cylon Attack, Aviator and Twin Kingdom Valley all use the Mode 5 screen.

The choice of a crisp monochrome Mode 4 display for Blitzkrieg is quite satisfactory to my mind, although we should have been provided with an option to change the colours used (green on black) to suite individual taste.

Blitzkrieg is a tank battle game which is cleverly written. At the bottom of the screen is a fixed view of your own gun turret (which recoils realistically when fired). On moving left and right (keys or joystick) the distant landscape, at the top of the screen, scrolls to simulate your cockpit view. In the midground are the tanks which you are fighting. These appear at varying distances and move, in real time, relative to the landscape, whether you are scrolling it or not. If they stop and turn towards you, you'd better move quickly to avoid their shells. When you fire yourself the shells take longer to reach more distant tanks and the sound of them blowing up is also attenuated with extra distance. Distant tanks score more, and you get promoted to increasing military ranks as your score progresses.

Although war games are not my favourite theme, this game did earn my admiration for its use of sound and graphics in creating an effective simulation of the three dimension world. It feels like a cross between a flight simulator type program (on the ground!) and an arcade game. One final impressive touch is that

the program plays a silent game by itself when waiting for a new player to take a turn, just like the ones in real arcades do. The sound may also be switched off in actual play and a freeze game option is provided. My only complaint is that one cannot escape the program with a Control Break at the end. I do object to being forced to switch my machine off and on (which is not good for it). Otherwise — excellent. **J.E.**

Ratings Table:

SOUNDS	80%
GRAPHICS	85%
DOCUMENTATION	60%
VALUE FOR MONEY	75%
OVERALL	85%

Title	Sadim Castle
Publisher	MP Software
Machine	Model B
Price	£7.50 cassette, £10.50 disc

I haven't really got far enough with this adventure to judge its full range of descriptions and puzzles. This might be due to my lack of skill in adventuring, but having solved a couple of the well known full size commercial games, I would rather put the blame on the programmer! Sadim Castle is a real time adventure, and one of its most annoying features is a tendency to kill you after a random amount of real time. Since this even bears no apparent relation to your location or activity, there seems no way of reasoning out a solution — hence my limited progress, despite much frustrating trial and error.

The instructions for Sadim Castle, duplicated on the inlay card and loading program, provide a ghoulish and blood thirsty description of the castle's history. Your task, in fact, is to find and put to rest the remains of a woman walled up and starved to death by her jealous husband. Nothing I have encountered in play has been especially nasty, though the early discovery of a bible, crucifix and clove of garlic provides a none too subtle clue to



CONTINUED OVER

hazards of a supernatural nature.

The screen is split into two windows. Instructions are entered at the bottom and messages displayed above, which can make it hard to match up the two. Inconsistent and messy use of coloured messages made me long for the orthodox scrolling screen of white text. Although no indication of size is given in the documentation, several things make me suspect that this game is not as large as others on the market: (i) the program does not use all available memory on loading, (ii) the save is extremely short and (iii) text messages appear so rapidly that it is hard to believe that any extensive compression of text has been used.

On what I have seen, I can't really recommend Sadim Castle as anything special. Judged by the incredible standards set by Level 9, it doesn't really rate in terms of construction, and it lacks any unusual originality of content to compensate. **J.E.**

Ratings Table:

SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	60%
VALUE FOR MONEY	55%
OVERALL	50%

Title	Lingo
Publisher	Complete Microcomputer Services
Machine	Model B
Price	£12.95

Entertaining, educational and original! Yes, it's all of these, though it will leave the arcade freaks yawning with its sedate manipulation of text on a Mode 7 screen. The program (supplied with a properly printed booklet) has a database of 700 words, of which you are dealt a random 12 on each play, shown at the top of the screen. At the bottom is a standard set of function words (eg to, from, this), suffixes etc. You have to compose a sentence in the middle of the screen by choosing combinations of words from top and bottom. There are also various tricks to permit join-

ing of words etc. You score mostly by using things from the lower half, although there is a bonus for using up all twelve words at the top.

When you have composed your sentence, the program then asks the other players to judge whether it is grammatical and meaningful (in the solo option you must be your own judge). One of the most entertaining aspects of the game is the requirement to construct a scenario to convince your fellow players that your sentence could mean something. Consider one of my own creations: "The living computer ought to move above the road, with a notable foot in the door, mostly in the afternoon and evening." Well, there was this robot salesman, you see, with a revolutionary foot design that allowed it to actually float above the pavement...

There are some small flaws in the program. For example, there is a minor bug when a sentence is rejected, the randomisation procedure at the start of play is unnecessarily slow and the (optional) time limits are too

short. However, it is written in Basic with no tricks, and you can get into the program and modify it if you wish. Disc owners will also be pleased to note that transfer is straightforward and the program will run happily with PAGE at &1900. **J.E.**

Ratings Table:

SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	90%
VALUE FOR MONEY	70%
OVERALL	80%

Title	Starmaze
Publisher	Software Invasion
Machine	Model B
Price	£7.95 cassette, £9.95 disc

You control a ship (which looks deceptively like the one in Meteors) around a maze in search of jewelry. The screen acts as a window over a much larger playing area (the size of which is not specified) so as you move around, you can see a little more of the maze. The ship is controll-

ed in true Asteroids fashion with the added bonus of three smart bombs which destroy everything on the screen. As you go boldly in search of jewelry, you will meet various enemy ships and from time to time, huge boulders which disintegrate into smaller pieces when hit.

Your fuel runs down at an astonishing rate so it must be topped up at frequent intervals by docking with the mothership. Also when you collect a jewel, you must get it back to the mothership before you can collect any more. This of course means that you have to remember where your mother ship was, which makes things rather difficult especially when you use hyperspace.

The graphics in this game are impressive and the characters are very detailed, but the general presentation of the game left a lot to be desired. The instructions to the game are absolutely minimal and there are no extra features such as sound on/off, quit, freeze or even a hall of fame. However, the inclusion of boulders means that you can play "Asteroids" as well as "Starmaze" and overall, it is a very enjoyable game. **S.S.**

Ratings Table:

SOUNDS	75%
GRAPHICS	85%
DOCUMENTATION	30%
VALUE FOR MONEY	80%
OVERALL	68%

Title	Watch Your Weight
Publisher	Acornsoft
Machine	Model B/Electron
Price	£9.95

Watch Your Weight is what the dieting and healthy eating brigade (and doesn't that mean most of us) has been waiting for in the home computer world for some time. It's one of those obvious applications but one which takes a lot of work and research to get just right.

The program is designed to be used in conjunction with the 36 page booklet and both are excellently presented. The main menu, to which you can return at any time by pressing Escape, sums up the four main sections of the program: Do You Need to Diet, Calorie Counter, Meal Plan Guide, and Monitor Your Diet.

If you haven't used the program before go straight to choice A, Do You Need to Diet — which is quite naturally the crucial question. The program requires input for height and current weight. These measurements have to be given exactly as prompted, with the STONES, POUNDS, FEET and INCHES all correctly spelt. I would have preferred the more flexible method employed later in the program, ie prompting with the required word and accepting just the figure.

Once your measurements are in, the program tells you where in the scale you lie, from "below ideal" to "obese". A graphical representation follows and this shows very well the weight/height calculation which is going on, utilising the four colours available in Mode 5. Unfortunately the scales for Stones (vertical axis) and Feet and Inches (horizontal axis) are only infrequently labelled, every five stones for instance and 4'6" and 6'6". This is due to the large character size in Mode 5, which could have been compensated for by redesigning the character set.

The program has been designed to make sure that no damage can be done through its recommendation and this does mean that it might not tell you if you are overweight when you may be slightly. If you are on the border line of any category then the user guide deals with it very well. The graphical representation is bold and gets the message across, the book fills in the details.

The program now advises on how much weight you can lose if you wish (even if you happen to be within the given limits and at the "desirable" weight). On entering the number of pounds (without the earlier rigmarole), the program gives predictions on how many weeks it will take you to lose the desired amount of weight at different levels of daily calorie intake. Your lifestyle is also taken into consideration when calculating the necessary intake, eg sedentary (journalist in front of keyboard) or active (working on a building site).

At this stage your characteristics can be saved to tape for recall in the other program module, Monitor Your Diet. This acts rather like your local slimming group. You have to check in each week, telling the program how much you have lost. The program comes back with statements like "You have lost more than expected this week but this is normal during the first week of the diet". Friendly. Group therapy, you and your BBC. A graph follows with your progress to date and a predicted path for the rest of your diet.

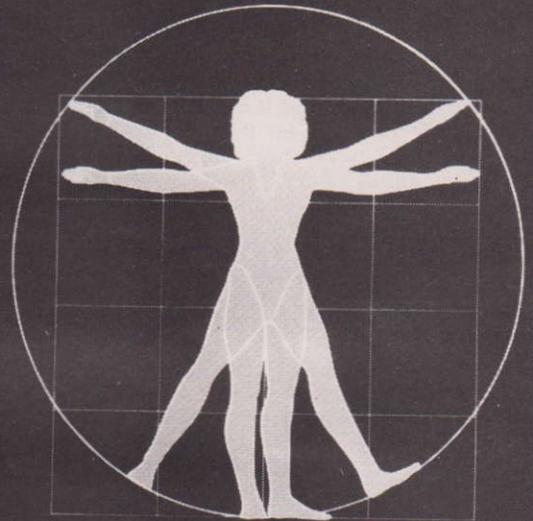
Probably the most important part of the program is the Meal Plan Guide. This is your practical guide to losing that extra weight. Depending on the targets you have been set for each day's calorie intake, the program makes suggestions for meals. There are details of how many calories and how much fibre there is in each plan. If you are on 400 maximum per meal then there are plenty of interesting things like Steak and Kidney Casserole and Grilled Chicken. At 100 per meal it's down to Cabbage and Ham soup, Prawn Salad, Baked Apple and Blackberries, Tomatoes on Toast or an Open Sandwich. There are detailed recipes in the book and some are mouth watering. Only certain amounts of each are allowed of course. Let's not forget

ACORNSOFT / *Whick?*

Watch your Weight

for the BBC Microcomputer Model B

What is...
your name?
your height?
your weight?
You should lose...
What is...
your age?
your sex?
your activity level?
Your metabolic
rate is...
Your daily energy
requirement is...
How many calories
do you want to cut
down by?
This should take
... weeks



that we intend to lose weight!

The Calorie Counter is the fourth module and allows you to get information about how well you are controlling your intake. Any meal plan number or any food contained in the database can be entered. The program comes back with details about the number of calories per measured amount. The user can specify amounts, and total different foods, thus giving an idea of how many calories go to make up your requirement. The program can also advise whether you have gone over your requirement and whether that other element of healthy eating — fibre — is present in your diet in the correct quantities. The book goes into things like alcohol and low calorie drinks. The database is a handy calorie guide with details like Milk, fresh, UHT and skimmed.

There's no doubt that Acornsoft and the Consumers' Association have combined brilliantly to bring us the best in domestic software. The program is highly practical and pretty friendly. The information contained within is fairly up to date in detail and definitely so in attitude to eating and dieting. To be honest, it's a fair buy just for the recipes for onion soup, chilli con carne, chicken and stir fried vegetables, stuffed cabbage leaves, cod casserole and baked bananas. So even if you haven't got a weight problem you can go ahead and create one in order to use this program, excellent both in content and execution.

M.W.

Ratings Table:

GRAPHICS	75%
DOCUMENTATION	100%
VALUE FOR MONEY	90%
OVERALL	100%

CONTINUED OVER

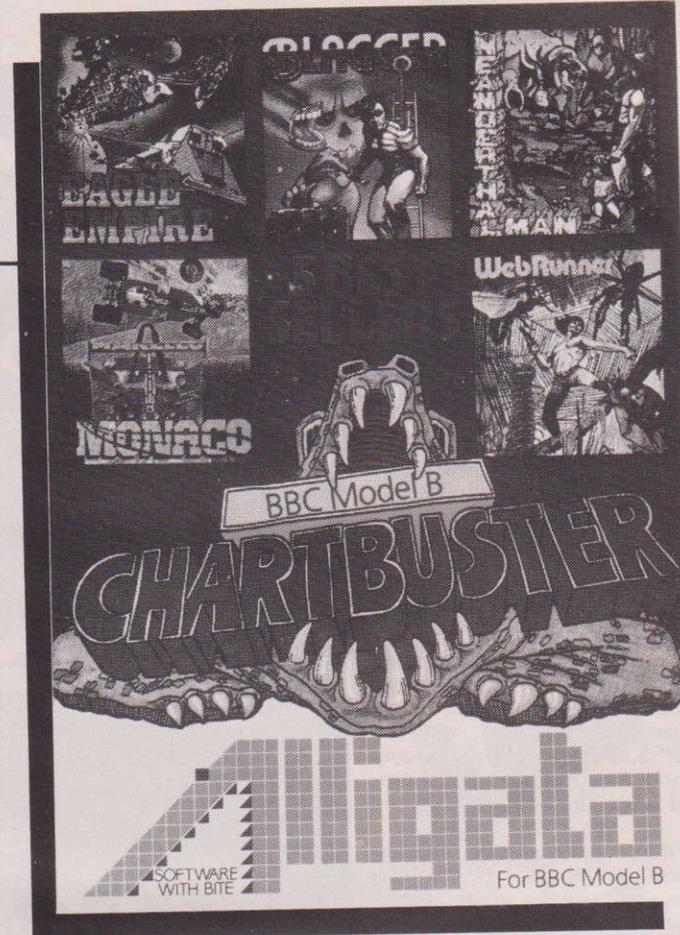
Title Chartbuster
Publisher Alligata
Machine Model B
Price £7.95

If somebody had come up to me and said that Alligata had packaged Blogger, Eagle Empire, Neanderthal Man, Web Runner and Monaco on the same tape and were selling it for £7.95 then I would tell them to go away and check their facts.

This surprising move is most welcome I am sure to those punters who have not yet sampled these very good games. I don't know what the original purchasers will think. Still it makes economic sense to get the most from your costly software development and it works in the music industry with compilations of the best sellers, especially of course around the Christmas period.

Monaco is timely, since racing car games are back in vogue with Pole Position and 3D Grand Prix plus the eagerly awaited Crammond spectacular. It is a straight up and down the screen, scroll it quick and play it fast game. Great fun, colourful and noisy! Blogger is a real winner, the first in what is turning out to be a series of games designed around the platform game with Roger the Doger learning his way around the tricky computer landscape.

Neanderthal Man is another wander about the maze type game although much more limited in score. Good for the younger player this one. Eagle Empire is an early game and it shows. It's professionally produced but is essentially a space invaders/galaxians combination. Great colours though, smooth swift action and keyboard/joystick control. This can't be bad, all on one tape. Then comes Web Runner. Once again, not the most sophisticated game on the market but very well presented and programmed single screen shoot-out stuff. The player travels along the strands of web shooting spiders. It is a very enjoyable game to play though with limited lasting appeal.



No major complaints about this package then. Alligata do not come up with below par games in the first instance and when they put a bunch together for our further delectation, and at a bargain price, it is time for those who did not buy first time around to take notice. Perhaps this will set the trend for other games houses as we move into 1985. **M.W.**

Ratings Table:

SOUNDS	80%
GRAPHICS	80%
DOCUMENTATION	80%
VALUE FOR MONEY	95%
OVERALL	90%

Title Sinbad
Publisher Virgin Games
Machine Model B
Price £7.45

When the game starts, you will find Sinbad at the bottom of the screen. In the air float evil snakes and of course, the flying carpet. You have to guide Sinbad on his mission to convert all the evil enemies. You convert the enemy by touching them but beware, if you touch a convert again, it will knock you down to decrease your energy. If you manage to

convert all the snakes without bumping too many times, you go on to a journey through an asteroid storm! The asteroids come hurtling towards you so you must control the carpet to avoid direct collision with one. When you manage to come out of this, the process is repeated, again and again. The game ends when your energy goes down to zero.

The fast flicker-free graphics are good and the asteroids increasing in size as they come hurtling towards you is especially impressive. Most important of all, this game is totally original. Unfortunately, this does not mean that the game itself is brilliant. In fact, it becomes repetitive and boring. Coupled with the fact that neither the energy nor the score is shown on the screen when the game is being played and there are no extra options such as sound on/off, freeze or quit, Sinbad cannot be highly recommended. **S.S.**

Ratings Table:

SOUNDS	60%
GRAPHICS	80%
DOCUMENTATION	60%
VALUE FOR MONEY	60%
OVERALL	65%

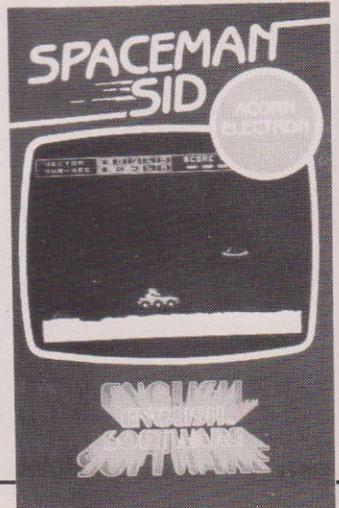
Title Spaceman Sid
Publisher English Software Company
Machine Model B/
Electron
Price £7.95

Spaceman Sid is a product of English Software Company who brought us Airstrike for the Atari Computers a few years ago — and the two programs could certainly have been less similar.

The program loads in two parts; the first contains the now mandatory and typecast scenario which, as usual, has nothing to do with the game. The thought of infiltrating Martian defences to destroy the enemy command camps with a laser may once have set the adrenalin flowing but those days are long gone.

The introductory blurb contains one or two impressive effects which materialise as part two is loading. After the elaborate instructions (and a quite awful piece of music), an inward chortle is the order of the day when the bill of fare served up is merely the old sideways scrolling game.

Spaceman Sid moves across the landscape in his "new XR5 laser-armed Rover" alias a rather ugly shape distantly related to some sort of vehicle I suppose. Rocks, meteors, scout-ships (aerial), UFOs and enemy bases obstruct his path. These can either be shot to pieces or jumped over — and I thought only Ian Fleming conjured up such vehicles!



The first two stages were rather unexciting; one merely ploughed on jumping and shooting at a pretty sedate tempo. Subsequent activities held no apparent promise of any improvements to come and my enthusiasm waned.

The graphics are quite pleasing in some places — for example, when Sid's buggy is struck by some enemy missile or collides with an obstruction, its wheels are propelled in all directions. However, together with most

other features, they are largely unspectacular.

Overall, the game is reasonable but presents an overriding impression of *deja-vu* which squashes its appeal rather quickly. **V.S.**

Ratings Table:

SOUNDS	55%
GRAPHICS	66%
DOCUMENTATION	55%
VALUE FOR MONEY	60%
OVERALL	55%

Title	3D Grand Prix
Publisher	Software Invasion
Machine	Model B
Price	£7.95

The latest and so far greatest in a line of car racing software for BBCs is Software Invasion's 3D Grand Prix. Software Invasion has always been renowned for the quality graphics in its games and 3D Grand Prix is no exception. Judging from the loading time, the program is squeezing code into every nook and cranny of the BBC memory map. The game certainly will not work with any hybrid BBC systems, with certain ROMs or Aries for instance.

The authors, Dave Mendes and Mick O'Neal, have produced a superb Mode 2 screen. In the far distance is the range of blue mountains (these might seem a bit out of place at Silverstone or Brands Hatch but do acknowledge the influence of Atarisoft's Pole Position). The track stretches out ahead with green verge and red and white edging.

The player/driver views the action from low down in the cockpit of his car, the dashboard directly in front, the front tyres, nose end and aerofoil beyond. The impression of movement is given by the red and white bands switching colours and is reinforced by the apparent rotation of the tyre tread.

To some extent, 3D Grand Prix is a compilation of other well-loved formula one games, such as Turbo 64 (gear changing), Chequered Flag, Spectrum (different tracks and cockpit) and of course Pole Position, originally on the Atari but now also available as a BBC version. The latter differs in that you drive a car which you can see on the track. In 3D Grand Prix you are actually on the track. When other cars pass you, they slide by your shoulder and when you pass them, you have to time the moment you cross back into their path.

When cars do appear over your shoulder the 3D perspective is pretty good. The cars are line drawings with some colour fill to distinguish between them. As they move off into the distance, the perspective is less realistic. By then however you are probably hauling on your joystick trying to get enough power to chase and overtake.

Overtaking appears very easy for your computer controlled competitors, not so easy for the player/driver. It is nigh on impossible without using good chunks of the grass verge. Slowing down and slipstreaming (although there is no perceptible speed increase as in real racing), followed by a wide turn around one of the Silverstone bends can do the trick. You have to make sure that you get back on to the track before one of the bollards turns up and brings the race to a crashing halt. Recovery from such a crash is immediate but you have to accelerate from scratch after moving down into the lower gears. There is little chance of taking emergency action to avoid a bollard, if you are going at any half decent speed that is. You have to



“learn” the features of each track.

Now and again the gauge on the left hand side of the dash may indicate that you have reached maximum temperature. There does not appear to be any need to panic however since there are no discernable adverse effects.

Unlike Pole Position there is no bunching of cars, no weaving in and out, more a succession of one to one duels. If you succeed in coming home amongst the first four on Silverstone you move on to Brands Hatch and from there onto the other international circuits.

Features include joystick/keyboard switch (the centre of your steering wheel indicates which one you are in), volume controls and full information on screen about current position, score and high score.

What really grabs you about 3D Grand Prix is the graphics, then you realise that this is a difficult game and get down to the challenge of winning, or at least progressing onto new tracks. Unlike Pole Position you cannot drive ferociously around the track, outstripping the opposition. More subtlety is required and some tactical racing. 3D Grand Prix is more like the real thing from that point of view and overall an exciting and lasting game. **M.W.**

Ratings Table:

SOUNDS	80%
GRAPHICS	90%
DOCUMENTATION	90%
VALUE FOR MONEY	85%
OVERALL	90%

CONTINUED OVER

Title Castle of Gems
Publisher MRM Software
Machine Model B
Price £5.70

The title of this game could well lead you to expect a review of a dungeons and dragons adventure, but intrepid adventurers should read no further as Castle of Gems is an arcade game, and those who spend their leisure hours in the arcades will recognise its striking similarity to a game called Crystal Castles.

Your task is to guide Bertie Bear(!) up and down the stairways and along the walkways and ramparts of a castle, collecting the scattered gems to score points. Naturally there are the usual bunch of meanies who are also scooping up the goodies and, at the same time, exhibiting a strong dislike for a certain small yellow bear. Bonus points are scored for collecting the last gem before the nasties, which I can assure you is not easy.

Guiding Bertie safely around means avoiding the witches, gem gobblers, gremlins and ghosts that inhabit the castle. Deadliest of all are the roaming trees that have an almost uncanny ability to track down Bertie at lightning speed, resulting in a trip to the woods that is certainly no picnic for this teddy. Picture if you will, a bear sprinting along the ramparts of a castle, hotly pursued by four homicidal trees!

When in trouble, you can get your furry friend to step into one of the lifts and be whisked up to another level of the castle, or don the magic hat making him invincible for a short while. Whilst invincible, Bertie can kill off some of the meanies for which bonus points are awarded.

There are eighteen screens to get through, nine on each side of the cassette and all are different configurations of a castle drawn in 3D. Some of the castles are of quite amazing complexity and this, coupled with the use of excellent sprite graphics, results in a colourful game with plenty of activity and interest.

You may start at any level or get the computer to change levels

at random which is quite unusual. Other features include a high score table, keys or joystick option and the ability to switch off the sound.

I have to confess, I am totally addicted to this game since receiving it for review. It really is amusing and fun to play and at the higher levels, provides a real and lasting challenge. My only criticism concerns the use of sound. I felt that the jingles, although good, could have been better to match the quality of the rest of the game. Apart from that this must be one of the best value-for-money games around for the BBC and deserves to do well, as I am sure it will.

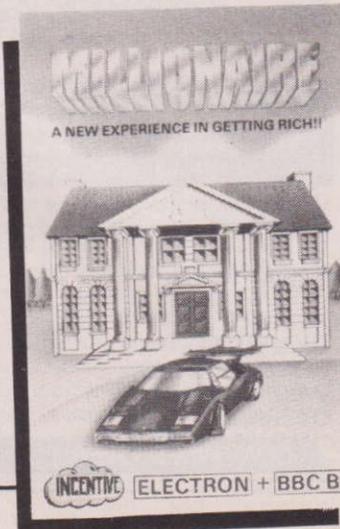
P.R.

Ratings Table:

SOUNDS	65%
GRAPHICS	80%
DOCUMENTATION	90%
VALUE FOR MONEY	100%
OVERALL	85%

Title Millionaire
Publisher Incentive
Machine Model B/
Electron
Price £6.50

"A new experience in getting rich!" claims Millionaire's cassette jacket. It certainly is a new experience — I didn't realise earning £1000,000 would be so boring or pointless. Admittedly I only got as far as £70,000 but it took me about three years in business to earn that much, and I couldn't be bothered to continue further to



see if any exciting or different things were about to happen.

You are introduced to this strategy game by being told that you own a home computer and have written a program which you wish to market. You are willing to put £500 into the project. The decisions are up to you and these will directly influence whether or not you become a millionaire.

Your company, Software Inc, is formed and you choose whether or not you want to specialise in one type of program, and specify what makes a good program from a choice of given qualities. Starting with a terraced house for your office, you begin to do business.

The game rotates in monthly cycles. You are told about your company's programs, sales, tapes in stock, rates, assets and money borrowed and then your sales progress is depicted graphically. Next a news sheet appears with a selection of items which affect your sales.

The main part of the game involves choosing the area you are going to work at from various options, for example programming, seeing Honest Harry which involves buying cheap but possibly dodgy programs or cassettes, selling to retailers, converting existing programs to other machines or trying to obtain a loan.

You are also given five ideas

to boost your sales which can only be used once. Finally you decide how much to spend on advertising and cassette duplication. These options are repeated over and over again each month until you've earned your fortune or given up and decided to sell out.

Initially the game is quite entertaining. You choose a strategy, make some decisions and watch your sales grow. It doesn't take long before you move up to a bigger house on "The Avenue", but gradually the repetition becomes more and more tedious. As time goes by and you earn more money it becomes harder to sell programs, which only adds to the frustration.

Success or failure usually appears to relate more to random good or bad news items than to making the right decisions. However on one occasion, after being given only bad news for 12 months ranging from poor attendance at a computer sales fair to needing repair work costing £4000, I eventually received the good news that one of my programs had been voted best of the year. This seemed like the ideal time to spend £5000 on a TV advertisement to boost my sales sky-high. Sadly they fell. Obviously the programmers know something I don't.

No doubt this game will appeal to some people but personally I wouldn't choose to play

it more than once, and would get more pleasure with a greater chance of earning a million from the newspaper's bingo. **I.H.**

Ratings Table:

GRAPHICS	90%
DOCUMENTATION	95%
VALUE FOR MONEY	60%
OVERALL	50%

Title	Jet Pac
Publisher	Ultimate Play the Game
Machine	BBC Model B
Price	£7.95

Jet Pac, already a firm favourite amongst Spectrum and Vic owners, has now been converted to run on the Beeb and what a good game it is!

The game starts with a rocket ship in three parts. This has to be assembled by picking up each piece in order and dropping it onto the base segment which is already in position. Once it is assembled, you need to fill it with fuel pods as they appear randomly. When fully fueled, you need to board it and take off to another planet. To make things desperately difficult, on

Title	Eric the Viking
Publisher	Mosaic
Machine	Model B
Price	£9.95

The dynamic combination of Mosaic (publishing) and Level 9 (programming) has spawned a classic in their software version of Terry Jones' Eric the Viking. It starts auspiciously at loading with the quaintest opening tune you have ever heard! and all on the interrupts as the rest is loading. Apparently Viking musical instruments included pipes and plucked strings. Level 9 has done its research and come up with the appropriate sounds. At the same time it helps to establish a "feel" for the historical (mythical) period into which we are being transported.

"Welcome to the Saga of Erik the Viking from Level 9 Computing. What now?" Take a LOOK around. Eric is on a mountain-side and, on descending to his farm, finds that his family has been kidnapped! The scene is set. Details in the accompanying booklet (with extracts from Terry Jones' original) tell us that they have been taken off by an army of strange creatures. The scene is set.

Eric's immediate world is that of his farm, yard, smithy, kitchen, ice house, entrance and great halls. Nearby is the river leading to the beach, the shore, rocks, a crag, the sauna, a green bank and the boat house with the "good ship Golden Dragon". The world is populated with objects such as hammer and nails, black pots of stew, furs and footprints! You can tell from the outset that this is going to be a full blown Level 9 adventure as well as a super story.

As usual the adventure has its own limited ability to understand

each planet, there are aliens "in need of blowing up". Luckily you are equipped with the latest Jet Pack and a Quad Photon Laser Phaser. If you are hit by one of the aliens, you lose one of your lives. Extra points may be notched up by collecting various goodies that fall from the sky.

On the first screen the aliens are not too difficult to avoid but on subsequent screens they become more intelligent and track you with ever increasing accuracy.

The characters are detailed and the animation is very well done. The way Jet man walks and the explosions are simply brilliant. The sound is good and all the usual features such as freeze, sound on/off option, one/two player option and the obligatory hall of fame are there. To top it all, Jet Pac is original and very very addictive. Highly recommended. **S.S.**

Ratings Table:

SOUNDS	80%
GRAPHICS	90%
DOCUMENTATION	100%
VALUE FOR MONEY	90%
OVERALL	90%

the two word, verb noun combinations which you enter but Level 9 are masters of the hint. If you are close then friendly messages like "I almost understand" and "Try other words" are issued. There are unexpected results to some actions (and "In this adventure actions speak louder than words!"). If you jump on things they are likely to break into their component parts for instance. EXAMINE is also a handy word.

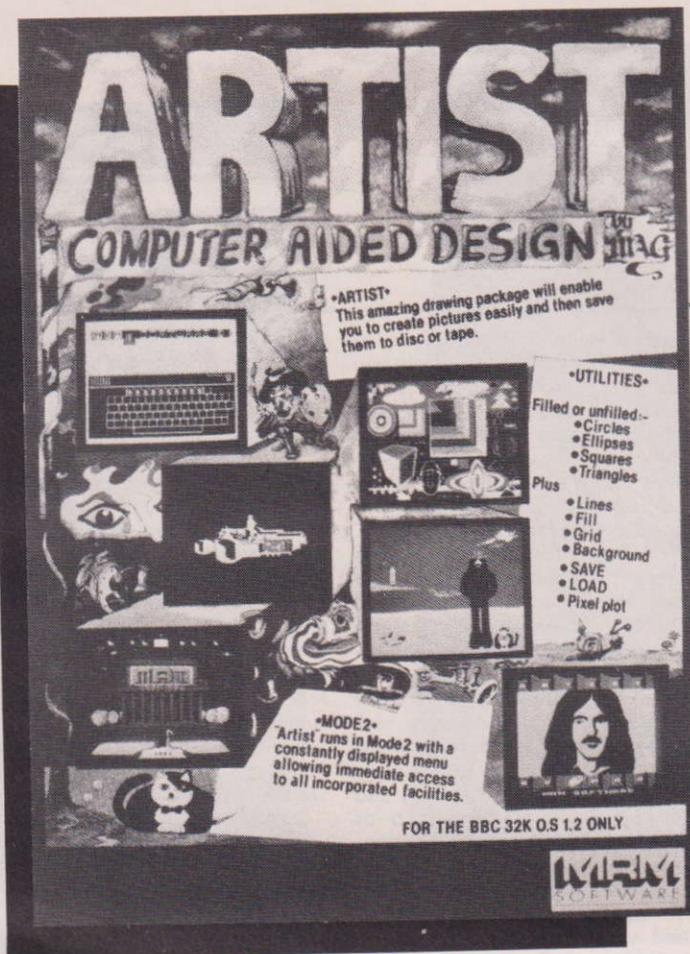
The text descriptions are pretty good but in Eric, Level 9 has also included pictures of each location. You just hit the TAB key to see them. Like Twin Kingdom Valley, the pictures are super and add to the enjoyment of playing. A third size screen window displays four-colour graphics of all the locations. Various picture elements are obviously generated by the same drawing routines in the cause of preserving memory but nevertheless they are good.

Naturally there is a save game facility and there's a clue sheet available from Mosaic if you need HELP. Everything you could expect from an adventure plus the magic ingredients of a stirring tale and a stout hero in Erik (you). If this doesn't take you away from the Christmas television then there is no hope. **M.W.**

Ratings Table:

SOUNDS	90%
GRAPHICS	90%
DOCUMENTATION	90%
VALUE FOR MONEY	90%
OVERALL	95%

CONTINUED OVER



Title Artist
Publisher MRM
Machine Model B
Price £6.95

There are several painting programs on the market for the BBC micro, though I have not had the opportunity to try them. Therefore I can't make direct comparisons but I must say that I found MRM's Artist a well written program that is easy and enjoyable to use. The program runs in Mode 2, reserving the top two lines for a set of menus and providing the rest as your canvas. There are various options for drawing on the screen. If you choose line drawing, the program uses a computer aided design (CAD) technique known as "rubber banding". You first move the cursor to the point at which you wish to start and put the "pen down". You then move your potential line about with the cursor keys varying its length and position until you are ready to fix it in your chosen colour. This makes it very easy to see what you are doing before you commit yourself.

Other CAD techniques are used, for example in the options to draw empty or filled squares and triangles. The shape may be expanded or contracted (using < and >) and "dragged" around by the cursor keys, once again being fixed only when you are happy with its precise size and location. There are similar options for circles and ellipses. In the latter case you can change the size of height and width independently. Another very nice feature makes use of the extended PLOT facility for filling irregular shapes with colour. All you do is drag a vertical bar and then adjust its size to stand within the shape to be filled. The fill will cover any black background area either side of the bar up to the nearest line encountered horizontally in another colour.

Screens may be saved and reloaded for subsequent work, though with a file size the better part of 20K this will be slow if you are using cassette tape. If you have a screen dump routine for

your printer you may of course write your own Basic utility to *LOAD the saved screen and dump it. All in all, this program is nice to use and makes intelligent and full use of the micro's operating system. **J.E.**

Ratings Table:

SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	70%
VALUE FOR MONEY	80%
OVERALL	80%

Title Fantasia Diamond
Publisher Hewson Consultants
Machine Model B/Electron
Price £7.95

This is a text only adventure, converted from the Spectrum, and appears rather Hobbit influenced in design. It has a large vocabulary, fairly powerful parser, is different each time you play it (ie has annoying random elements!) and runs in real time. Other characters come and go and you need to elicit their help, if friendly, and get rid of them if not. There is no random or arbitrary killing, which infuriates

deliberate random elements. One clear bug in my version was that the program seized up when I typed QUIT.

In summary, nothing outstanding, but a perfectly playable real time adventure if you enjoy this kind of game. **J.E.**

Ratings Table:

SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	90%
VALUE FOR MONEY	70%
OVERALL	70%

Title Son of Bigger
Publisher Alligata
Machine Model B
Price £7.45

You play the part of Slippery Sid, the son of Roger the Dodger. Espionage is your middle name and having forced your way into the National Security HQ, you're faced with a no return journey through one of the most dangerous and complex buildings in the land.

This is one of the ever popular exploring type games. Because of the small memory capacity, this type of game has been slow in coming for the Beeb but "Bigger" and now "Son of Bigger" has changed all that. The difference between "Son of Bigger" and the others is that you don't jump in and out of various rooms, instead, as you move Slippery Sid, the picture scrolls (pixel by pixel) revealing a little more of the landscape. Slip-

me in adventures, but you have to eat and drink now and then to maintain your strength.

There is nothing especially original in the content, but the program is generally well written and perfectly playable if you enjoy adventuring. Documentation, so often neglected in computer games, is excellent. You have to get into a fortress, rescue the masterspy Boris and elicit his help in recovering the Fantasia diamond. I have succeeded with the first two tasks so far without encountering a large number of locations, but I don't know how much is left to do.

One version is supplied on tape to run on both the Electron and the BBC (I tested it on the latter). BBC owners may feel cheated of the extra 7K that could be used in Mode 7, but disc drive owners will be pleased that they have room to transfer to disc (the machine code will need downloading before running). A useful tip for BBC owners is that Mode 6 is selected in the short Basic loader and not changed by the machine code. If you change this to Mode 7 the program appears to run all right with the advantage of the better resolution print. I suspected the presence of occasional bugs in the program, though it is hard to tell with



Alligata
 For BBC Model B



perly Sid is very well animated and well defined but because the whole picture has to be moved pixel by pixel in four directions, the playing area only takes up third of the total screen area, a necessity if the screen is to be moved at a reasonable speed. However, this does not seriously affect the enjoyment of the game. Also because of the complexity of the landscape, you need to plan ahead and think as well as manipulate your nimble fingers.

As expected from an established software house such as Alligata, the presentation is high with all the usual features such as sound on/off and hall of fame. Recommended. **S.S.**

Ratings Table:

SOUNDS	60%
GRAPHICS	85%
DOCUMENTATION	65%
VALUE FOR MONEY	70%
OVERALL	70%

Title	Nightmare Maze
Publisher	MRM Software
Machine	Model B
Price	£5.70

The scenario of Nightmare Maze finds you looking down onto a maze drawn in 3D and the task is to guide your man around collecting the keys that appear at various points. You have to collect eight keys to enable you to open the door at one side of the maze to escape to the next level. Why you need eight keys to open one door beats me! Anyway, your task is hampered by the presence of five lunatic springs who are bouncing their way around the maze, doing their best to flatten you.

Your only help comes in the form of a cup of black coffee that appears now and again in the maze. If your man Sleepy Joe can get to it quickly enough and

drink it, he is charged with extra energy and the crazy springs all disappear allowing him to zip round the maze in safety. The respite is short lived however and you are soon back dodging the springs again.

Points are scored for each key collected and a time bonus is awarded on completion of the screen. Should you fail to get all the keys before the time limit you lose a life. The thing that infuriates me about this game is, when you lose a life, you also lose all the keys you've collected, so it's back to square one, or rather — key one! I have lost count of the number of times I have had eight keys and just started making tracks for the door only to be cornered and clobbered.

The second and third screens of the game, which was

as far as I got, feature bouncing balls and hopping frogs instead of springs. The mazes get increasingly complex as you progress and the inhabitants of the maze a lot more efficient in preventing you from collecting the keys.

The graphics are very good and show that a lot of thought and effort went into obtaining a realistic looking 3D effect. For example, all the characters on screen have their shadow beneath them as they move. In the case of the bouncing springs etc, the size of the shadow changes in correct relation to their height as they bounce and, with the little man, the shadow of his legs as he runs changes in relation to the length of stride.

Sound is quite good although not outstanding. I did find the "boing boing" of the springs a little annoying after a

while and it had me searching for the sound off key.

Apart from sound on/off, other features include keys or joystick option and a high score table. Personally, I found guiding the man round the sharp angles of the maze hard to get used to even with the keys — with joysticks almost impossible.

My only real criticism about Nightmare Maze is that the author should have made the first screen a little less difficult. Some people may find it too hard and get put off very quickly. But if you like a game that provides an infuriating challenge buy it. I don't think you will be disappointed. **P.R.**

Ratings Table:

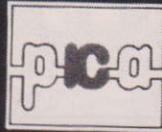
SOUNDS	70%
GRAPHICS	80%
DOCUMENTATION	80%
VALUE FOR MONEY	85%
OVERALL	80%

Title	Squash
Publisher	pICa Software
Machine	BBC B Disc
Price	£9.75 cassette, £11.95 disc

Now this is a strange looking program that can only be described as a rather specialist utility. Its purpose is to reduce the amount of space taken up by text messages of the kind that you get in adventure games and as such is only likely to be of interest to those developing such programs. It claims to be able to reduce text to 45% of its original size but one of the main benefits of adventure writers in my eyes is that the coding prevents the text from being read by those who want to cheat.

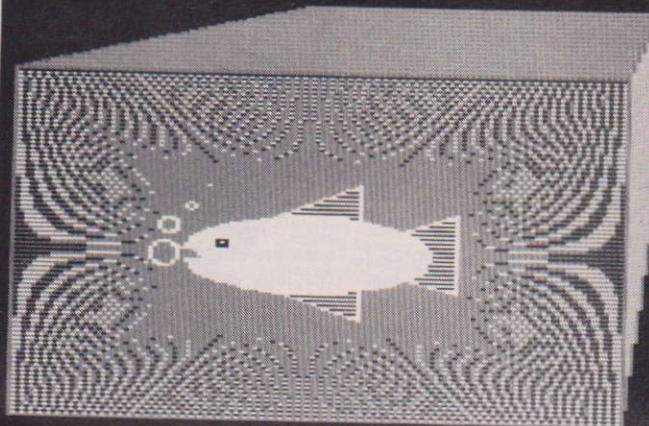
All that is required is for you to type in your text messages in the numerical order that you want to recall them and then, after saving a copy in case of disasters, tell the program to do its stuff. There follows quite a delay while the processing takes place but after completion you can *SAVE both the data and its decoding routines for reloading anywhere in memory that you want. To get a particular

CONTINUED OVER



SOFTWARE SPECIALISTS

DESIGNER



BBC MICRO B
ELECTRON

message on screen all that you need to do is poke the message number into zero page and then call up this routine and it appears as if by magic.

Whilst there are some drawbacks, length of line and method of input, this is likely to be a useful package for those wanting to get a quart into a pint pot in their adventure programs.

D.C.

Ratings Table:

SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	40%
VALUE FOR MONEY	70%
OVERALL	60%

Title	Quest for the Holy Grail
Publisher Machine	Epic Software Model B/Electron
Price	£7.95 cassette, £9.95 disc

Some adventures are so easy that they rapidly become boring. Others are so difficult that one gives up in disgust (or shame!), and promptly goes off adventures completely. The really good adventure allows the beginner to achieve some mobility and success, while posing problems that will give even the most wrinkled adventurer a time of real puzzling before the solution comes (often at about three in the morning...).

This adventure, one of four now available for the Acorn machines, is definitely one of the best I have ever played from the challenge point of view. It lacks the graphics of their Wheel of Fortune (even better!) being solely text, but it creates the kind of world where the adventure freak will wander happily and with growing frustration for several weeks.

It is set around Camelot, with you taking the role of a knight whose application to join the Round Table is being decided. It is decided that you must find the Holy Grail, and return to Camelot with it. Well, it

sound easy enough, doesn't it? Down the hill you go, into a forest where two knights appear to be impassable. Still, there is a tree to climb, and if you happen to have the right things with you, and you take the right fork, you might make it to the swamp.

The SAVE game function has been well used by myself, so that sudden death doesn't seem too permanent, and I found this a great help here as well. On to the almost obligatory castle, complete with dungeons and other features which made this section quite enjoyable, but also where I got stuck.

I found myself amazed at the vast amount of data that Epic have managed to cram in. It is a program I recommend to any fairly proficient Adventurer. P.T.

Ratings Table:

SOUNDS	N/A
DOCUMENTATION	90%
SPEED OF RESPONSE	98%
DESIGN/COMPLEXITY	100%
VALUE FOR MONEY	99%
OVERALL	95%

Title	Art Designer
Publisher Machine	pIcA Software BBC B/Electron
Price	£7.95 cassette, £9.75 disc

There are a whole range of art and drawing packages on the market now ranging from the sophisticated to the downright poor. This one comes towards the poorer end of the spectrum I'm afraid. On booting the disc a menu is provided from which you can select your option. You can start a picture, load a picture, define characters, save characters and load characters.

If we take the last options first we have a basic character defining utility suite. Using this you are able to define any or all of the characters numbered 224 to 252. There is a single 8x8 grid on which you work one character at a time. The list of characters that have been defined is available at the side. However nice this might seem it is really only of use with the main drawing program. There is no facility for

converting to VDU 23 definitions whatsoever. Although you can store and load definitions this too is of little use away from the other program. There is no facility to defining two characters as a unit and no multi coloured option, basic is the right description without a doubt.

The main drawing program is also at the very basic end of the spectrum, for one thing there is only one mode available, Mode 2.

Whilst this does give a nice range of colour there is a distinct lack of resolution as you might guess. There is no "rubber banding" effect so there is little chance to try the position of a line before fixing it and as deletion is a difficult process requiring re-drawing in the background colour, this is a real problem. The function keys are used to give some effects but as no strip is provided you will have to develop your own. All the other options are called using the CTRL and one of the letter keys.

There is some logic in the choice of these keys, eg CTRL W is wipe screen and CTRL T writes text to the screen. The strangest option is CTRL K which prints a "kestrel" on the screen at the current cursor position. To be honest this is simply a gimmick and a very strange one at that. Another problem of the package is its wiping of the screen on pressing CTRL M to return to the menu. You must remember to save the screen (CTRL S) before taking this action or your picture is lost. It is interesting to note that the only way that a screen is saved is using a *SAVE. This means that each saved screen takes 20K of space on a disc or five minutes on a cassette, not exactly ideal.

I could go further in my comments about this package and its failings but sufficient to say that this is not a serious drawing program by any means. It is hard to even describe it as a toy! D.C.

Ratings Table:

SOUNDS	N/A
GRAPHICS	30%
DOCUMENTATION	40%
VALUE FOR MONEY	30%
OVERALL	30%

Down to Business

Jon Vogler

The computer can help save the time and labour of telephone calls simply by use of a well-planned database (**A&B Computing** — October 1984) to produce up-to-date telephone lists of commonly dialled calls. An automatic dialler 'phone needs its own special list: mine sits, under glass, immediately beneath the instrument. Far more sophisticated aids are to be had however, particularly modems.

A modem changes computer signals into telephone signals (MODulates them) and DEModulates telephone signals back to computer signals. As telephone systems (and computers) differ, the modem has switches to match:

- the speed at which the signals are to be transmitted and received (called the Baud Rate),
- whether signals can go freely in both directions, called "duplex" or in only one direction, so that each operator has to switch (rather like the familiar "over to you" of radio conversations) known as "half-duplex". The kind of computer at either end,
- the telephone system's rules for transmitting signals (called "protocols").

Modems may be either:

- Acoustic — you place the telephone handset in a shaped plastic cup. The computer signals are turned into sounds which enter the telephone receiver, and are then turned back into electric impulses and travel down the telephone wires. Signals from the answering computer come down the telephone wires, are turned into sounds by your telephone, then back into electricity by the modem. This is obviously longwinded and surrounding noise may spoil the signal. They are too clumsy for busy people and are not covered in this review.
- Hard wired — these omit the intermediate sound stage. They plug direct into the telephone jack-socket and the telephone plugs into them.

Much of management is about communication. How can your computer help?



The three modems tested.

When the modem is not being used it is "transparent" to normal telephone calls.

Just as the modem imposes a set of rules (as to how information is to be sent) on your telephone, so software is necessary to impose rules on your computer. The disadvantage of programs on tape or disc is the need to load before telephone communication can begin. An improvement is to have the software on ROM, which can be called up by a single keyword.

THREE HARD-WIRED MODEMS: PRISM 1000

This slim flat black plastic box is large enough to sit under any

kind of telephone. It is excellent for communicating with PRESTEL — the huge British Telecom Database — but for "user-to-user" communication (ie between office and factory) it only offers "half-duplex". While this method of communication is less likely to error (because the signals travelling one way do not interfere with those moving in the opposite direction) it requires tedious switching between "transmit" and "receive". Nor can it be used at all to get access to some data bases or "bulletin boards" which operate at 300 baud (30 characters per second) "full duplex".

The cabinet is rather flimsy: looks as if it would break if dropped hard and the front control panel is confusing in that to switch "ON-LINE" you actually have to move the switch away from the word "LINE". Although

the handbook makes this quite clear, good equipment design should be such that a device can be used without reference to the handbook.

The handbook states that this operator switching can be software controlled but gives no hint as to how this can be achieved. I rang PRISM to ask and was told, "Put the switch in the position midway between Tx and Rx."

I tried this but found there was no such position. Perhaps PRISM could clarify this and add it to the handbook.

I was irritated that it came with no mains plug fitted, particularly as a plug with a 5 amp fuse is needed. For most people this means a special errand to buy one.

At a price of £89.95 (inc. VAT), which includes the ROM control chip, this is much the cheapest hard-wired modem available for the BBC and is perfectly adequate if the user only wants access to VIEWDATA.

PRISM SOFTWARE

This excellent menu-driven program makes:

- entering and leaving the PRESTEL network,
 - saving and printing individual pages,
 - recalling those that have been saved,
 - "down-loading" software transmitted over the telephone lines,
 - leaving and receiving mail box messages
- all become very simple.

Its limitation is that it offers no facility for businesslike user-to-user communication. An excellent feature is that the program allows full access to the computer's operating system (to read a disc catalogue, define a user key or even switch off a diary alarm) at any time.

The flimsy handbook is excellently produced, with helpful screen pictures but, alas, no index or fault-finding procedures.

COMPARISON OF HARD-WIRED MODEMS

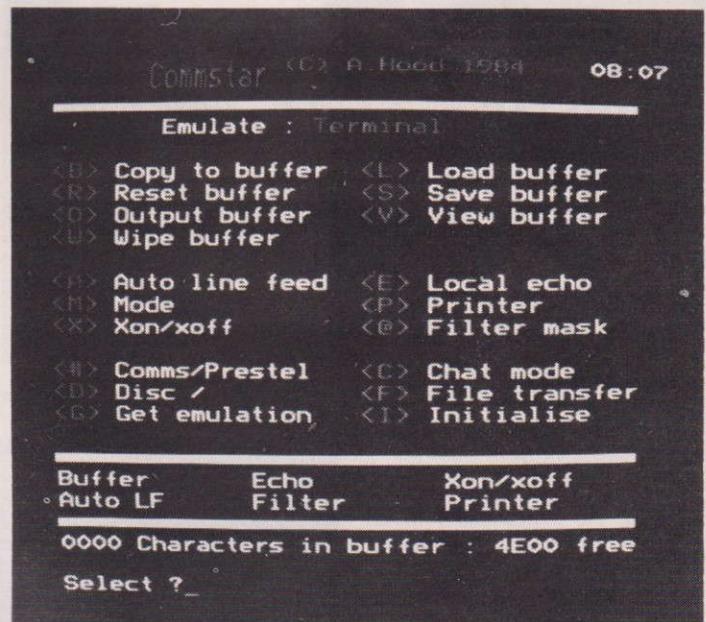
Name of Database Price (inc. VAT)	MIRACLE WS 2000 £152.50	PACE NIGHTINGALE £136.85	PRISM 1000 £89.95
CONSTRUCTION AND APPEARANCE			
1 Big enough for 'phone to sit on?	No	Yes	Yes
2 Big enough for auto-dialler?	No	Yes	Yes
3 Clear control panel?	Yes	Yes but ugly	No
4 Solidly made cabinet?	Yes	Yes	No
5 User port fitted?	Yes	No	No
6 Accessory port fitted?	Yes	No	No
7 Mains plug fitted?	No	Yes	No
OPERATION			
8 Self-test sequence provided?	Yes	Yes	Yes
9 Will it link with Viewdata?	Yes	Yes	Yes
10 Full duplex user-to-user?	Yes	Yes	Half-duplex only
11 600/1200 baud both ways?	Yes	No	No
12 Is its own software provided?	No, uses COMMSTAR	Yes excellent	Yes excellent
13 Approved for British Telecom systems?	Yes	Yes	Yes
OPTIONS: Can it be fitted with:			
14 - Auto-answer?	Promised	Promised	No
15 - Auto-dial?	Yes	Promised	No
16 - Software control?	Yes: not BT approved	Promised	No
MODEM HANDBOOK			
17 Well produced?	Appears provisional	Provisional	
18 Fully detailed?	No	No	Yes
19 Easy to understand?	Yes	No	Yes
20 Quick-start instructions?	Yes	Yes	Yes
21 Fault-finding?	No	Yes	No
22 Detailed contents list?	Yes	No	No
23 Full index?	Sketchy	No	Yes
	Yes	No	No

PACE NIGHTINGALE MODEM

A business-like box, just a little larger than the base of a standard B.T. 'phone and, thoughtfully, just large enough for my autodialler to sit comfortably on top. It is well organised: the wires

disappear at the back and the (rather ugly) control panel faces the user. I have been using an acoustic modem for a year and finding it tedious and frustrating but the NIGHTINGALE certainly made me sing like a bird! It came with clear instructions and correct cables (with plugs on), took me a few minutes to install and worked perfectly first time.

PACE Nightingale: conveniently large enough for an auto-dial 'phone to sit on top. So is PRISM 1000.



COMMSTAR's excellent range of communication options.

There is a wide range of operating modes and speeds. The facility to transmit at 1200 baud and receive at 75 baud in full duplex operation (no "over-to-you" needed), is especially valuable for the business that sends large quantities of data in one direction. The retailer, making daily trading and stock reports to a central warehouse, or

the book-keeper sending a month's figures to the accountant, would reduce their telephone calls to one quarter the duration they would have at 300 baud. Anyone transferring data over international 'phone lines should ensure they have this feature.

CONTINUED OVER



PRISM 1000: Cheap but with limited communications capability.

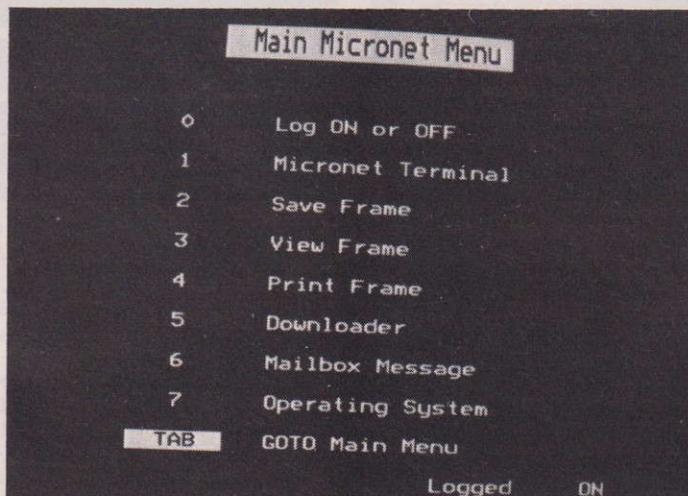
COMMSTAR

To get full benefit from the NIGHTINGALE however, you need PACE's COMMSTAR RCM chip. This offers three different modes of operation:

- To talk to PRESTEL.
- To talk over the 'phone to some other computer terminal. This may be in another office or factory of your business, in your accountant's office, or may be a computerised service, such as a specialist database for your trade. An increasing number of such services are becoming available — no longer need every solicitor have a great library of case law, nor every doctor a room full of medical text books.
- To talk to another computer over a direct wire connection (less than 20 metres away). This is a welcome low-cost alternative to an Econet (or Torchnet) computer network, both of which are larger than necessary to link one manager to one book-keeper.

For all these, COMMSTAR offers a full range of functions. This was the first of the three packages I received and I soon connected with PRESTEL using far fewer keystrokes than with my former acoustic modem, "chatted" to it (sent instructions and received information in return), saved individual pages of data on disc to study "off-line" and at

PRISM software: Clear menus and easy to use but limited for communications.



leisure, without the heavy telephone costs of studying "on-line". A timer told me how long I had been using COMMSTAR (but not, unfortunately, the 'phone call duration). I marked pages to return to them automatically and, joy of joys, for the first time, managed to record ("down load") software transmitted by the Prestel computer, never previously achieved.

Although there are no options currently available, PACE tell me they are just around the corner. Watch this space.

COMMSTAR's hand-book is a model for other manufacturers. It is not expensively produced: a hundred spiral-bound, A5 size pages, copied from a good daisy wheel manuscript, but very accurate and free of "computerese". In particular it has

- a detailed contents list at the front,
- an intelligent introduction, outlining scope and functions,
- concise summary instructions for the expert who wants to start quickly and does not need detailed explanations,
- a glossary of technical expressions,
- a separate summary of all commands,
- a full and accurate index,
- a bright coloured, easy-to-spot-on-the-bookshelf, hard cover.

It is a pity that the

NIGHTINGALE instructions (which came as separate duplicated A4 sheets) are not included. However PACE inform me that this is temporary, until they have received full approval for using the device over the British Telecom network, which they say is imminent.

NIGHTINGALE and COMMSTAR together come at just under £160, including VAT, or you can buy them separately.

MIRACLE 2000

This is perhaps the most exciting of all because it is the furthest advanced in production of useful additional options. It is nicely made with the neatest control panel and imaginative extra connections as the rear for current and future options. Sadly the designers have made one disastrous error: it is too short for a standard B.T. telephone to sit safely on top, so it demands extra desk space which most executives will grudge. It also comes without a fitted plug and requires a 3 amp fuse.

The instruction manual looks like (but does not admit to being) a temporary one. The pages are loose and have only a paper cover. This is a pity because it is detailed, thorough and very well written, with a brief index, an excellent technical specification, a good fault finding section and clear diagrams, showing the different control settings for different applications.

It has the widest range of operations offering 600 and 1200 baud, half-duplex communication in addition to everything that PACE offers. This would be particularly useful for businesses that are going to send large quantities of data in both directions: for example, as the equivalent of a personal telex link, for computer conferencing, etc. It can also transmit at 1200 baud and receive at 75 baud for duplex. Like PACE it can be used over telephone systems that use American protocols. It has no control ROM of its own, MIRACLE will supply COMMSTAR (at £34.95 inc. VAT — a slightly higher price than PACE!).

OPTIONS

MIRACLE offers:

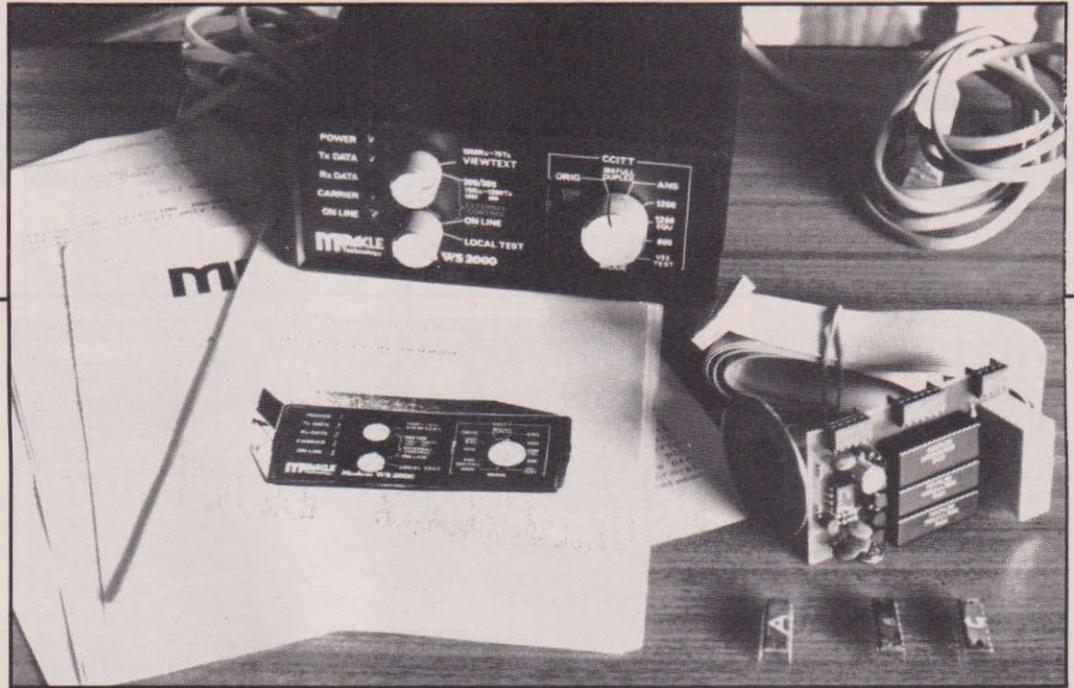
- auto-dial
- auto-answer
- software control.

I have not been able to test these options fully as MIRACLE did not send one vital cable until too close to the editor's deadline. Also at the time of writing the auto-dialler is not approved for use over the British Telecom system.

The auto-dialler enables a standard rotating dial telephone to be controlled from the BBC keyboard. Up to ten numbers can be stored and the system will automatically re-dial numbers which are not connected at the first try.

Software control is achieved by a combination of disc with communication ROMs such as COMMSTAR. It not only supports auto-dialling, but will select the communication mode from software (baud rate, protocols etc) and will pass the user's Customer Identity numbers to PRESTEL. As access to PRESTEL "by hand" is such a tedious business, this is most welcome — by judicious coding the user should be able to link with

MIRACLE WS2000: Attractive control panel but too short for the phone to sit on it.



Options for the MIRACLE WS2000: Auto-dial and software control are available but not yet approved for use on British Telecom networks.

PRESTEL (or any other database) with a mere two or three key-strokes.

Neither of these options came with proper operating instructions; they are too new. Their development is still in a state of flux and readers should regard this review as merely an interim report. I shall keep you updated as the situation changes. The golden rule is to buy equipment with the potential to exploit the exciting developments that will undoubtedly take place within the next year. I am confident that both PACE and MIRACLE come within this category.

GLOSSARY OF TERMS

acoustic acoustic modem	to do with sound one that turns computer signals into sounds, which the telephone turns into telephone signals and vice-versa
auto-answer	device on a modem that allows incoming 'phone calls to access a computer without human intervention
autodialler (automatic dialler)	a 'phone that stores numbers in memory, so they can be dialled with one or two key-presses
bulletin board	a small computer data base that can be read over the 'phone by another computer
baud rate	the speed at which signals are transmitted or received. 300 baud = 30 characters per second and so on
chat	to send instructions and receive information in return
down load	record software transmitted to you by another computer
duplex (or full duplex) half-duplex	system in which signals can travel freely in both directions system in which signals can travel in only one direction; each operator has to switch when he has finished transmitting or receiving
hard-wired modem	one that omits the acoustic stage, turns computer electrical signals direct into telephone electrical signals
modem	a device that changes computer signals into telephone signals and vice-versa
PRESTEL	British Telecom's huge VIEWDATA system
protocols	telephone system's rules for transmitting signals
software control	system to control a telephone operation from software
transparent	allows normal telephone calls to take place as if it was not present
user-to-user communication	a computer talks over the 'phone to another (ie between office and factory)
VIEWDATA	data base that can be read over the 'phone

IEEE Experiment

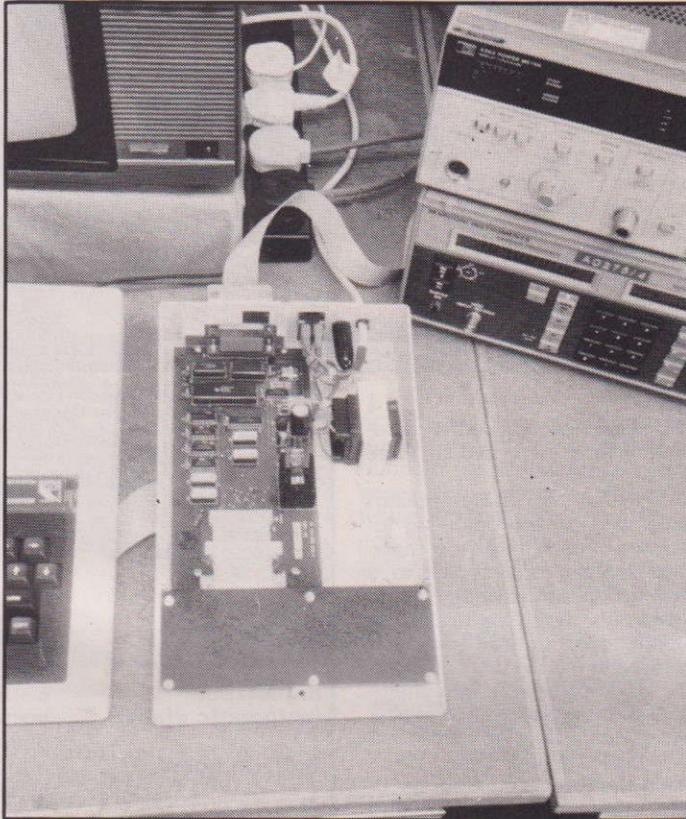
David Abbott

WHAT IS THE IEEE-488 INTERFACE BUS?

Also known as the General Purpose Interface Bus (GPIB), the Hewlett-Packard Interface Bus (HPIB), and the International Electrotechnical Commission (IEC) 625 bus, the Institute of Electrical and Electronic Engineers (IEEE) standard number 488 defines a 'standard digital interface for programmable instrumentation'. Originally written in 1975 and revised in 1978, the standard deals with systems that use byte-serial, bit-parallel means to transfer digital data among a group of instruments and system components.

Put simply this means that data is transmitted over the interface a byte at a time (byte-serial), over eight separate data lines (bit parallel). The flow of data is controlled by three command lines which are used to indicate the successful passage of data from one instrument to another. This is known as a three-wire handshake. In all there are 24 lines connecting instruments on the bus, comprising eight data lines, eight ground lines and eight command lines, three of which are the handshake lines, the other five handling general interface management.

There are two types of data transmitted on the bus: data used to manage the interface itself, and data used by the devices connected by the bus. In the IEEE-488 standard these are known as interface messages and device dependent messages respectively. Devices connected by the bus have one or more of the capabilities of listening, talking and controlling. Under the control of interface messages a listener can receive device dependent messages from another device on the bus, and a talker can send device dependent messages to another device on the bus. A controller sends the interface messages that command the specific actions in the other devices. An example of a listener is a power supply which receives information on a voltage setting



Exhaustive testing for Acorn's IEEE.

and acts upon it. An example of a talker is a digital thermometer which, when commanded, transmits its current temperature reading. A digital multimeter has both the ability to listen and to talk, and a computer usually has all three abilities of listening, talking and controlling.

THE ACORN IEEE-488 INTERFACE

The Acorn interface was designed for Acorn by a company called Intelligent Interfaces Ltd, who also manufacture the unit. The interface supplied for review was, unlike a lot of review hardware, a production unit, working to the full specification, and containing complete documentation. It arriv-

ed in an expanded polystyrene box with one side thoughtfully marked 'TOP'. Inside, in addition to the interface, was an EPROM containing the IEEE filing system, a ribbon cable for connecting the interface to an instrument and the user guide, also produced by Intelligent Interfaces. Also supplied with the review hardware, though perhaps not standard issue, was an application note written by Intelligent Interfaces on the use of functions and procedures in programming the interface in Basic.

The electronics of the interface are housed in the standard Acorn box (teletext adaptor, second processor etc), and connect to the 1MHz bus by a 34 way ribbon cable. Being only 50cm long the cable dictates that the interface is placed next to the microcomputer. The ribbon cable

is permanently attached to the interface, but has a 34 way header to allow connection of further 1MHz bus peripherals at the same time as the interface. The interface does not derive its power supply from the computer but has its own mains connection. In the same style as the computer, the interface comes with an integral mains lead with moulded three-pin plug and on-off switch on the rear panel.

On opening the interface one is struck by how little there is inside. The electronics, nine integrated circuits and a handful of passive components, are on a single printed circuit board, and the largest single component is the mains transformer. The construction is excellent. The three main integrated circuits are socketed, and the board does not contain any modifications. By using shrouded connectors on all the a.c. leads, it is impossible to touch the mains supply anywhere.

The user guide also reflects similar attention to detail. A spirally bound A5 volume of 64 pages and appendices, it is clearly laid out and properly printed. It contains introductory information to get the user going, then goes into a deeper study of the interface operation. A complete list of the IEEE commands is given, with programming examples and a clear description of the command and its effect. The guide includes a short description on using the filing system in assembler, and gives the structure of the OSWORD block for each command. There are appendices covering the minimum abbreviations for each command, error messages, and the fitting of the filing system EPROM. The guide finishes with a single page index.

Despite recommending at the beginning of the user guide that the IEEEFS EPROM be fitted by a dealer, appendix 5 gives very detailed instructions on how to fit the EPROM yourself. As with the hardware, the EPROM supplied contained the current production filing system, version 0.02. Given Acorn's penchant for multiple issues of filing systems (eg Econet), it was gratifying to find from a phone call to

Intelligent Interfaces that this was the definitive version despite the 'temporary' sound of the version number (no OS 0.10 here). On installing the EPROM and typing *HELP IEEE one is greeted by the rather curt 'IEEE Filing system 0.02', 'Please refer to the User Guide', not the usual list of available commands. As the IEEE commands are not issued directly, prefixed by an asterisk as in the DFS, perhaps this omission is not surprising.

USING THE ACORN INTERFACE

Having installed the EPROM and connected the interface to the 1MHz bus everything was ready to go. Starting at the simplest end I chose to control a single listen-only device, a power supply, which was connected to the interface with the supplied cable.

Communication between the computer and the interface is through two channels. A command channel is used for transmitting bus commands and for receiving information on the interface status, and a data channel used for transmitting and receiving data to and from other devices on the bus. This rather unusual approach is a consequence of the communication being through a filing system rather than a more conventional I/O driver.

The first steps therefore are to select the filing system and to open the command and data channels:

```
10 * IEEE
20 cmd% = OPENIN
("COMMAND")
30 data% = OPENIN
("DATA")
```

The integer variables used in lines 20 and 30 can be chosen to suit your needs, but having been assigned, all transfer of information is referenced by these variables.

The bus address of the power supply is assigned in a similar manner:

```
40 power% = OPENIN("5")
```



where '5' is the numeric address set up on dual-in-line switch on the rear of the power supply. All devices on the bus have a numeric address which is used to uniquely identify them. The computer must also be assigned an address. Any number between 0 and 30 is acceptable, though custom has the system controller assigned to address '0'.

```
50 PRINT # cmd% , "BBC
DEVICE NO", 0
```

This instruction is sent to the interface through the command channel referenced by the integer variable 'cmd%' assigned in line 20. The phrase "BBC DEVICE NO" is one of the 28 commands that may be issued to the interface. It can be typed in full or abbreviated to 'B'. All commands have abbreviated forms with the most used commands abbreviated to a single letter. The saving in memory space comes with a lack of readability, a problem experienced in normal basic operation when using long variable names.

Having assigned addresses the interface is initialised with the CLEAR command, and instruments prepared for remote operation with the REMOTE ENABLE command:

```
60 PRINT # cmd% ,
"CLEAR"
70 PRINT # cmd% ,
"REMOTE ENABLE"
```

Everything is nearly ready now for the power supply to be given an instruction. This will be a string of ASCII characters. In order for the device to know

when the string has finished it recognises particular characters as marking the end of the string. These characters may change from one instrument to another and should be set up if they differ from the default character of 'line feed'. The power supply used recognised 'carriage return/line feed', so:

```
80 PRINT # cmd% , "END OF
STRING", CHR$(13) +
CHR$(10)
```

This finishes the preparation. It seems awkward, but only needs to be done once, so can be relegated to a procedure:

```
10 * IEEE
20 PROCinitialise
```

This gives readability to the main program flow, and defines a procedure that could be used in subsequent programs.

The power supply used had two ranges, 0-10V, and 0-50V, with 1000 discrete programmable steps in each range. The required voltage had to be translated to a particular step in the 0-999 range and prefixed with '1' for the lower range, and '2' for the higher range, giving an effective four digit number between 1000 and 2999. This number is then transmitted to the power supply as a string.

A combination of function and procedure was used to get round the problem of a procedure not returning a value:

```
30 REPEAT
40 voltage = FNget_volts
50 PROCvolts (voltage)
60 UNTIL FALSE
```

The function to obtain the required voltage could be a simple INPUT statement, or could include limit value checking, to ensure that the requested voltage lay between 0 and 50 volts. The procedure to set the voltage has to scale the voltage within the required range, convert it to a string, and transmit it to the interface:

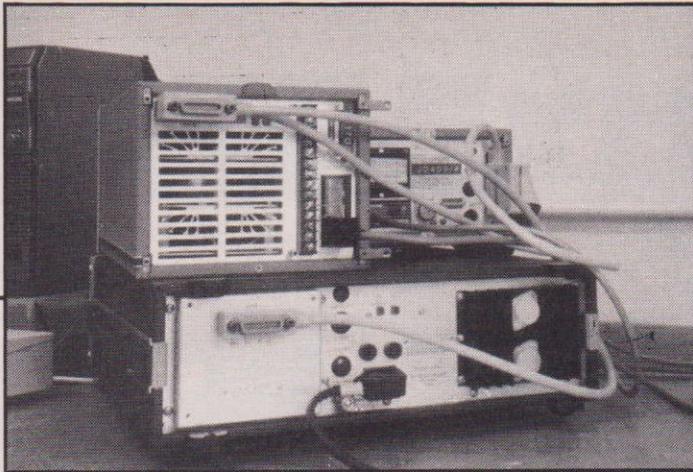
```
100 DEFPROCvolts
(voltage)
110 IF VOLTAGE > 9.990
THEN volts$ = STR$
(2000 + INT
(voltage/0.05 + 05))
ELSE volts$ = STR$
(1000 + INT(voltage/
0.01 + 0.5))
120 PRINT # cmd% ,
"LISTEN", power% ,
"EXECUTE"
130 PRINT # data% , volts$
140 PRINT # cmd% ,
"UNLISTEN"
150 ENDPROC
```

When these lines are executed the power supply that has been assigned to 'power%' sets itself to the voltage 'voltage'. This may seem very long winded, and is compared with other dedicated controllers, but by using the function and procedure statements available on the BBC computer, a concise and readable main program can still be maintained.

GETTIN IN DEEPER

Having mastered the control of a simple listen-only device, the

CONTINUED OVER



next step was to link in a talker so that information could be received by the computer. The obvious complement to the power supply was a volt-meter connected up to measure the voltage set upon the power supply.

As the interface has already been set up the only preparatory statement necessary is to assign the address of the meter in PROC initialise:

80 dvm% = OPENIN ("7")

The taking of a measurement is a two stage process. Firstly the meter has to be set to measure the correct function, volts in this case, with a given resolution. More complex meters might require more information such as which input on a multi-input instrument, whether a number of readings are to be taken and averaged, is any processing of the reading necessary before outputting the data etc. Information on the codes required are obtained from a particular instruments handbook.

For the meter in question the setting up was accomplished by:

```

200 PRINT #cmd%,
    "LISTEN", dvm%, "EXECUTE"
210 PRINT #data%,
    "J3D3T1N1Y1Q1R0"
220 PRINT #cmd%,
    "TRIGGER", dvm%,
    "EXECUTE"
230 PRINT #cmd%,
    "UNLISTEN"
    
```

This sequence only needs to be executed once unless any of the parameters in line 210 need to be changed, so it can normally be included in the initialisation procedure.

As actually reading the meter needs the return of the measured value, this is handled by a function call:

```

90 answer = FNmeter
.
300 DEFFNmeter
310 PRINT #cmd%,
    "TALK", dvm%
320 INPUT #data%,
    voltage$
330 PRINT #cmd%, "UN-
TALK"
340 = VAL (voltage$)
    
```

The way the transfer works should be fairly obvious from this function. A particular instrument, here denoted by 'dvm%' is commanded to talk, ie transmit its data. This is inputted on the data channel into the variable 'voltage\$'. The command 'UN-TALK' puts the bus back into a quiescent state, and the value transmitted is turned from a string to a numeric value using the function 'VAL' and returned to the calling program.

MORE ADVANCED USES

The simple examples of the previous section where a talk-only device, the power supply, was set to a given voltage, and a talker/listener, the voltmeter, was set to a known state and made to transmit a measured value, may seem trivial, but in essence such sequences are all that is necessary in perhaps 80% of applications. Transmission of simple strings between instruments and the controller is all that is necessary to measure the frequency response of an amplifier, to measure the frequency spectrum of an oscillator, or measure the performance of a complex electronic system.

So far we have only seen 10 of the possible 28 commands in use. The remaining 18 fall into three groups:

- 1 - Block data transfer
- 2 - Instrument status
- 3 - Bus status control

The block data transfer instructions 'READ BINARY', 'WRITE BINARY', and 'TRANSFER' are for moving specified numbers of bytes both between a controller and an instrument and between two instruments—one acting as the talker, the other as the listener. In this way data dumps may be performed by copying the contents of an instrument memory straight to a plotter.

The second group, instrument status, covers the use of serial and parallel polls and bus status. The status request command 'STATUS' returns an integer's worth, ie four bytes, of information on the bus status. Individual bits indicate the current status of a number of bus functions. To check for specific states the requisite bit has to be masked out. For instance if an instrument needs attention from the controller, it generates a service request (SRQ). The presence of an SRQ is indicated by bit 5 in the status word being set. This could be handled by:

```

490 DEFPROCstatus
500 PRINT #cmd%,
    "STATUS"
510 INPUT #cmd%, state%
520 state% = state% AND
    &20
530 IF state% = 0 ENDPROC
    
```

If SRQ is not set the status procedure terminates, otherwise the SRQ must be handled. How to handle the SRQ brings in the serial and parallel poll instructions. If there is only one instrument on the bus then it must be generating the SRQ and it can be accessed directly using a serial poll. This instructs the instrument to return status information to the controller, from which the controller can work out why the SRQ was generated and take appropriate action.

If there is more than one instrument on the bus, then which one has generated the SRQ is not known. Two courses of action are then open to the controller. Either it can serial poll each in-

strument in turn until the one generating the SRQ is located, or get the instrument to 'own-up' by using a parallel poll. In a parallel poll each instrument is allocated a particular bit in a status byte. When a parallel poll is issued the instrument generating the SRQ sets its bit in the status byte, thus the controller can immediately distinguish which of eight instruments (there are only eight bits in a byte), is requesting attention. This particular instrument may then be serial polled for more specific information. This sequence is illustrated in the following code:

```

540 PRINT #cmd%,
    "PARALLEL POLL RE-
    QUEST"
550 INPUT #cmd%, poll%
560 IF poll% AND 4 PRO-
    Cserial_poll_dvm
570 IF poll% AND 6 PRO-
    Cserial_poll_psu
580 IF poll% AND 6 PRO-
    Cserial_poll_psu
580 ENDPROC
590 DEFPROC
    serial_poll_dvm
600 PRINT #cmd%,
    "SERIAL POLL",
    dvm%, 1
610 INPUT #cmd%,
    status$
620 status = ASC (status$)
630 IF status AND &40 = 0
    ENDPROC
640 status = status AND 7
650 IF status = 4 PRINT
    "Out of range value"
660 IF status = 5 PRINT
    "Unrecognised
    character"
670 ENDPROC
    
```

The digital voltmeter used was set to respond to a parallel poll on bit 3 (line 560). When presented with a serial poll command it returns one byte of status information (line 600), bit 6 of which is set if it generated the SRQ (line 630). This check is merely a 'belt-and-braces' way of double checking the origin of the SRQ. If it did generate the SRQ, bits 0, 1, and 2 are set to indicate one of two error conditions, these are examined on lines 640-660 and appropriate messages printed out.

Associated commands not

used in this example are "PARALLEL POLL ENABLE" and "PARALLEL POLL DISABLE" which enable/disable the parallel poll on a specific addressed instrument, and "PARALLEL POLL UNCONFIGURE" which stops all instruments taking part in a parallel poll.

In large systems having more than eight polling instruments, there may be two instruments responding on one bit of a parallel poll. In this case it might be necessary for the controller to serial poll each to find the instrument requesting service.

The third and final group of commands are those associated with general bus status control. There are four pairs of commands handling similar functions, and a single un-paired command:

GO TO LOCAL — return addressed device to local
REMOTE DISABLE — return all devices to local

SELECTED DEVICE CLEAR — clears specified device
DEVICE CLEAR — clears all devices on the bus

TAKE CONTROL — pass control to another controller
REQUEST CONTROL — request control from system controller

TIME ON — enable timeout
TIME OFF — disable timeout

LOCAL LOCKOUT — locks panel controls on a specified device

These are all self-explanatory and are used in a variety of ways. For instance 'GO TO LOCAL' would enable an adjustment to an instrument to be made, setting a power supply voltage, whilst other instruments were still under bus control. 'REMOTE DISABLE' on the other hand might be the last statement in a program, that returns all instruments to local control before halting.

Not all instruments respond to all commands. A careful examination of the operating manual will reveal which do not respond to polling, or do not permit block transfer of data. The set of 28 commands, though, allows as much control as each instrument permits, giving the programmer the opportunity to extract as much from the instrument as possible.

IN CONCLUSION

On the hardware side the interface was virtually faultless. Its construction is sound with several nice touches, such as the covering of all points at mains voltage inside the interface. With so few components the reliability should be good, but if anything does go wrong then maintenance should be straightforward due to the ease of access.

My only quibble on the hardware side is with the cable connecting the interface to the instruments. The usual configuration is for a screened cable with a stackable connector at each end. The cable supplied by Acorn is a ribbon cable with a non-stackable connector at each end. This forces the controller to be at the end of a chain, or a single branch in a star-connected system which is a limitation not experienced with other controllers. In addition the non-stackable connector does not have the screw-fit attachment found on conventional bus connectors, leaving the possibility of it becoming disconnected behind a bank of equipment.

When it comes to the software, different people expect different things. The command set in EPROM enables you to perform quite complex bus control operations, but in a rather laborious fashion. The need to operate at the 'TALK/UNTALK' level is balanced by the ability to confine these sorts of operation to functions and procedures, in which case the main program flow takes on the look of a higher level controller.

Documentation, though not abundant, is sufficient, and what there is is well written and well presented. It is though aimed more at the experienced user than at the beginner. A novice in programming instruments on the bus will need more information than the user guide provides, particularly as the low level approach to control means that the

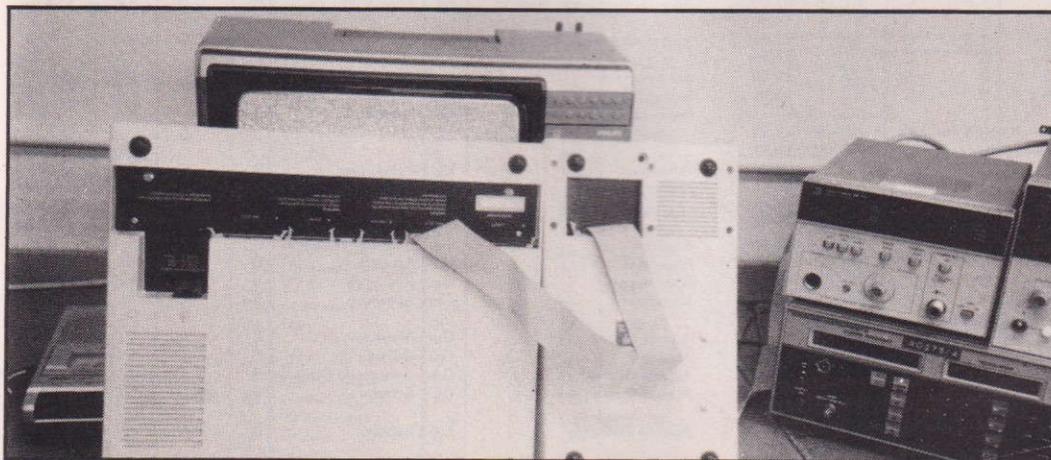
programmer is not protected by a sophisticated I/O driver.

I experienced no problems with the interface. I plugged in the EPROM, connected up the 1 MHz bus and away it went. However another interface, purchased by a colleague, failed to work until a pull-up resistor was connected to pin 1 of the EPROM. Talking both to Intelligent Interfaces and to Acorn failed to throw any real light on the cause, as it seemed to be an isolated incident that no-one else had reported.

Whilst not exactly a problem, I did come across an 'effect' which was a little disconcerting. In common with all filing system ROMS, the IEEEFS moves PAGE upwards in memory to claim space for a work area. If this space is re-claimed for program use it can still be affected by the IEEEFS. Pressing ESCAPE or BREAK/OLD causes certain memory locations to be overwritten, resulting in a corrupted program. This could be embarrassing if one was trying to run an analysis program on data collected over the interface, where all memory space was valuable. This effect is due to the necessity to leave the bus in a known state if a control program was interrupted using the ESCAPE or BREAK keys. As the claiming of work space, and the overwriting of these memory locations takes place even if the interface is not connected (cf the teletext adaptor), then the only way out is to remove the EPROM. Not a practical proposition on a day-to-day basis though.

On balance I found the interface to be easy to use. As an experienced user of the bus, the low level programming required was not a problem, though a first time user would require more general information on the bus operation than had been supplied.

For use in industry or in education, the Acorn interface provides a cost effective alternative to the currently acceptable range of controllers. Question marks fall over reliability, maintenance and support, but the answers will only be found with time.



Software Listings

Finding and choosing the correct software for your needs is a daunting task indeed, whether you are looking for a word processing package or for a new game to test your alien destroying, treasure seeking, path-finding talents!

Often you can be put off even looking through the pages of advertisements which tempt you with vivid descriptions of the amazing graphics and sound effects of the game being offered, you sit there with pen poised above cheque book and your eye catches the small print that tells you that the game will run on just about every available machine except the one sitting beside you!

But BBC and Electron owners need despair no longer

Want a program for your BBC Micro or Acorn Electron? Look no further than our listings to make your choice.

— help is at hand in the following pages. We have put together as comprehensive a list as possible of the software available for these machines. In order to fit in as many as possible we have had to use codes in some columns. The title of the software, whether it is for the BBC or the Electron, the company which produces it, the

form in which it is available, the supplier code and price; all are given for each piece of software listed. The codes used are:

Code	Explanation
Gm	Game
Bs	Business
Ut	Programming utility
Do	Domestic

Ed	Educational
A	Model A BBC
B	Model B BBC
E	Electron
C	Cassette
D()	Disc (40 or 80)
R	Rom or Eprom

As you are probably aware, new software is surfacing all the time so do not assume that there is no such item as the one you are looking for, if it is not included in the following list. Remember that much BBC software is being converted for the Electron and to avoid disappointment it is best to wait for a specifically written program. If you are aware of a piece of software that is not listed here, whether you are a user or a producer, feel free to let us know.

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price						
ABC	Ed	Acornsoft	B	C,D	AL	£9.95.					
ABC	Ed	Bryants	B	C	HW	£11.50					
Abductor	Gm	Salamander	A,B	C	NZ	£4.85					
ABM	Gm	Alligata	A,B	C	AG	£5.95					
Abyss	Gm	Cases	B,E	C	CE	£6.95					
A Cluster of Curves	Ed	Chaddington	B,E	C,D	CN	£10.00					
Action of the Heart	Ed	Garland Comp.	B	C	JX	£11.76					
Accounting Ratios	Bs	Microplex	B	C	MP	£7.95					
Accounts Receivable	Bs	Acornsoft	B	D	AL	£24.95					
Accounts Payable	Bs	Acornsoft	B	D	AL	£24.95					
Accurate	Ed	MP Software	B	C,D		£11.00/ £14.00					
Acids and Alkalis	Ed	Scholar	B	C,D	SC	£5.50, £7.50					
Addcomm	Yt	Vine	B	R	VI	£28.00					
Add-Tabs and Mul-Tabs	Ed	Cottage Soft	A,B	C	CT	£7.50					
Ade	Ut	System	B	R	SY	£60.00					
Adventure	Gm	Micro Power	A,B,E	C	GK	£7.95					
Adventure 1	Gm	Odyssey	B	C	OG	£4.50					
Adventure 2	Gm	Odyssey	B	C	OG	£4.50					
Adventure	Gm	Program Direct	B	C	NP	£5.99					
Adventureland	Gm	Adventure International	B,E,	C	AI	£7.95					
Adventure Quest	Gm	Level 9 Computing	B	C	CU	£9.90					
Adventure Quiz	Ed	Dial	B	C,DL		£4.95, £6.50					
Airline	Gm	Cases	B	C	CE	£6.95					
Algebraic Manipulation	Ut	Acornsoft	B	C	AL	£9.95					
Alien	Gm	FBC	B	C	FB	£6.00					
Alien Break-in	Gm	Romik	B,E	C	RO	£6.99					
Alien Destroyer	Gm	Beebug	B	C	BE	£7.50					
Alien Destroyers	Gm	Micro Power	B	C	GK	£7.95					
Alienswirl	Gm	Amcom	B	C	AO	£5.95					
Alien Swirl	Gm	Micro Power	B	C	GK	£6.95					
Airlift	Gm	Bug Byte	B	C	KP	£5.50					
All aboard	Ed	Arnold-Wheaton	B	C	AW	£9.95 + VAT					
Alligatacalc	Do	Alligata	B	C	SY	£9.95					
Alpha Graph	Ed	Arnold-Wheaton	B	C,D	AW	£15.00 + VAT					
Alien Dropout	Gm	Superior Software	B,E	C	SE	£7.95					
All Fingers Go	Ed	NEC	B	C	NC	£14.95					
Alpha	Ed	Golem	B	C	OB	£8.05					
Alphachopper	Ed	Sulis	B	C	SU	£9.95					
Alphabet	Ed	J B Software	B	C	JS	£4.95					
Alphabeta	Bs	H and H Software	B	C	HH	£28.50					
Amazing Ollie	Ed	Storm	B	C,D	SX	£6.05, £9.95					
Anagrams	Do	Cylindrical Software	A,B	C	CY	£3.95					
Analysers	Bs	Number One Systems	B	C,D	NO	£33/45					
Angles and Parallel Lines	Ed	Scholar	B	C,D	SC	£5.50, £7.50					
Angles and Triangles	Ed	Scholar	B	C,D	SC	£5.50, £7.50					
Angle Tutor	Ed	Pee Bee	B	C,D	PB	£9.95, £12.45					
Android Attack	Gm	Computer Concepts	B	C	GJ	£7.80					
Anagram	Ed	Ed.Soft	B	C	ES	£4.95					
Angles Navigate	Ed	Primary Programs	B	C	PP	£5.95					
Angle(4)	Ed	Chalksoft	B	C	KT	£6.95					
Angle Turner	Ed	Arnold-Wheaton	B	C,D	AW	£15 + VAT					
Anglezap	Gm	Gem	B,E	DC	GM	£7.50					
Animal/Vegetable/Mineral	Ed	Bourne	B,E	C	BO	£8.97, £10.98					
Animal, Vegetable, Mineral	Ed	Arnold-Wheton	B	C,D	AW	£15 + VAT					
Animated Arithmetic	Ed	LCL	A,B,E	C,D	LA	£6.50, £7.50					
Answer Back	Do	Kosmos	B,E	C	KM	£10.95					
Android Attack	Gm	Computer Concepts	B	C	GJ	£8.95					
Animated Arithmetic	Ed	Ludinski CAL	B	C/ D	KA	£6.50/ £7.50					
Animator	Ut	Screenplay	B	C	SC	£11.95					
Animator	Ed	Arnold-Wheaton	B	C,D	AW	£9.95, £12.00 + VAT					
Apollo	Gm	Software Invasion	B	C	IS	£6.95					
Append It	Ut	Aztec S/W	B	C	IB	£3.00					
Apocalypse	Gm	Red Shift	B	C	RS	£9.95					
Arcadians	Gm	Acornsoft	B,E	C	AL	£9.95, £9.20					
Arcade Action	Gm	Acornsoft	B	C	GA	£11.90					
Arcade 1	Gm	Odyssey	B	C	OG	£3.00					
Arcade Games	Gm	Ganymede Systems	B	C	GY	£9.95					
Area of Rectangles	Ed	Scholar	B	C,D	SC	£5.00, £7.00					
Area of Triangles	Ed	Scholar	B	C,D	SC	£7.00, £9.00					

Area Radar Controller	Gm	Software For All	B	C	KN	£6.95
Arithmetic Plus 1-4	Ed	Fernleaf	B	C,D	FE	£35.95
Arrow of Death (1)	Gm	Digital Fantasia	B	C	JT	£6.95
Arrow of Death (2)	Gm	Digital Fantasia	B	C	NT	£8.95
Art Designer	Ut	Pica	B,E	C,D	PI	£7.95, £9.75
Artist	Ut	MRM	B	C	MR	£6.95
Artisan I	Ut	OIC	B,E	C	OI	£12.75
Artist	Ut	MRM	B	C	MR	£6.95
Asteroid Storm	Gm	Micro Power	B,E	C	GK	£7.95
Asteroids/Frong	Gm	Aardvark Software	B	C	IU	£4.00
Asteroid Belt	Gm	Electronics Applied	B	C	IF	£11.50
Asteroid Belt	Gm	Computer Concepts	B	C	GJ	£7.80
Asteroid Miner	Gm	Optima	B	C	OP	£8.95
Astro Navigator	Gm	Micro Power	B	C	GK,	£6.95
Astronomy	Do	BBC	B	C,D	KB	£9.95, £11.50
Astrowars	Gm	Simonsoft	B	C	SI	£6.95
Atlantis	Gm	IJK Software	B	C	IT	£6.95
Atomic Protector	Gm	Optima	B	C	OP	£8.95
Atom Smasher	Gm	Romik	B,E	C	RO	£6.99
Another	Ed	Davy Computing	B	D	DA	£30.00 + VAT
Aviator	Gm	Acornsoft	B	C,D	AL	£14.95, £17.65
Awari	Gm	Foikade	B	C	NR	£5.95
Backgammon	Ut	Bug Byte	B	C	BB	£8.00
Bailiff	Ed	Sulis	B	C	SU	£9.95
Balance Your Diet	Ed	Cambridge Micro	B	C,D	CM	£13.95 +£1.62
Ballard	Ed	Ed.Soft	B	C	ES	£3.00
Ballooning	Ed	Heinemann	B	C	HE	£7.25 + VAT
Balloons	Gm	C J E Micros	B	C	NV	£6.00
Bandits at 3 O'Clock	Gm	Micro Power	B,E	C	GK	£6.95
Bank	Ed	Primary	B	C,D	PP	£5.95, £7.95
Bank Statement	Ed	Scholar	B	C,D	SC	£6.00, £8.00
Banner	Do	Micro-Aid	A,B	C	IZ	£2.95
Barset and Barpic	Ed	Longman	B	C,D	LM	£14.50 +VAT
Barrage	Ed	Micro Power	B	C	GK	£7.95
Base 10	Ed	Dial	B	C,D	DL	£4.95, £6.50
BASIC Compiler	Ut	Ack	B	C,D	AC	£14.95, £19.95
BASIC Environment	Ut	Harris	B	D	HM	£14.50
Basic Goodies	Ut	Simonsoft	A,B	C	MS	£5.95
Basic Maths	Ed	Aztec S/W	A,B	C	IB	£3.00
Basic Number Help	Ed	Longman	B	C,D	LM	£9.95, £12.95
Basic Statistics	Bs	Micropak	B	C	MP	£7.95
Battlezone Six	Gm	Kansas	B	C	KA	£9.50
Battlezone 2000	Gm	Lothlorien	B	C	LO	£6.95
Battle Tank	Gm	Superior Software	B	C	SE	£7.95
BBC Artfun	Do	R.H. Electronics	B	C	RH	£9.95
BBC Kaleidoscope	Ed	Dial	B	C	DL	£8.50
BBC Logo	Ed	Dial	B	C,D	DL	£6.50, £8.00
BBC Octuplet	Ed	Dial	B	C	DL	£8.50
BCPL Stand Alone Generator	Ut	Acornsoft	B	D	AL	£49.90
BCPL Calculations	Ut	Acornsoft	B	D	AL	£9.95, £11.50
Beamscan	Bs	Beamscan	B	C,D	BS	£40.45
Beat the Bug (Molecule)	Gm	Bridge	B	C	BR	£6.90
Beat the Clock	Ed	Arnold-Wheaton	B	C,D	AW	£15 + VAT
Bed Bugs	Gm	Optima	B	C	OP	£8.95
Beebart	Ut	Quicksilva	B	C	QS	£14.95
Bee Base	Gm	GCC	B	E	GL	£45.94
Beeb-Chase	Ut	Database Software	B	C	NU	£7.50
Beebmunch	Gm	I.J.K. S/W	B	C	IJ	£5.95
Beebtrek	Gm	Software for All	A,B	C	KN	£7.95
Bells	Ed	Dial	B	C,D	DL	£4.95, £6.50
BEEP-BEEP	Gm	IJK	B	C	IJ	£3.95
Beep-Beep (Super Simon)	Gm	IJK Software	B	C	IJ	£4.50
Beebcalc	Bs	Gemini	B	C	GM	£19.95
Beebmon	Ut	Micro Power	A,B	C	GK	£7.95
Beebplot	Bs	Gemini	B	C	GM	£19.95
Beeboids	Gm	Odyssey	A,B	C	OG	£2.75

SOFTWARE SUPPLIERS

Supplier
Code

AA	Anthony Aspitel Software Systems 56 London Road Harleston Norfolk IP20 9BZ	BB	Bug-Byte Mulberry House Canning Place Liverpool L1 8JB
AB	ABC Primary 19 Crumstone Court Longmeadow Estate Killingworth Newcastle Upon Tyne	BE	Beebugsoft PO Box 109 High Wycombe Bucks HP11 2TD
AC	ACK Data 21 Salcombe Drive Nottingham NG5 8JF	BJ	BJ Software 26 Fore Hill Avenue Doncaster DN4 7EU
AD	Dial Software 72 Downend Road Downend Bristol	BK	BAKsoft 34 Humberstone Road Cambridge
AG	Superior Systems Ltd 178 West Street Sheffield WS1 4ET	BM	Blue Moon Software Co. Freeport Swanley Kent BR8 7UY
AJ	AJ Software 61 Jeddo Road London W1Z 9ED	BO	Bourne Educational Bourne House The Hundred Romsey Hampshire SO5 8BY
AK	A.S.K. Ltd London House 68 Upper Richmond Road London SW15 2RP	BO	Bourne Educational Software Headbourne Worthy Winchester Hants SO23 7SQ
AL	Acornsoft Ltd 4a Market Hill Cambridge CB2 3NJ	BR	Bridge Software 36 Fernwood Marple Bridge Stockport Cheshire SK6 5BE
AM	Microplus Software 6 Litton Way Leeds	BS	Beamscan 20 Vaughan Avenue Hendon London NW4 4HU
AN	Addison-Wesley 53 Bedford Square London WC1B 3DZ	BT	Beast International Mustians Eton, Windsor Berkshire SL4 6EX
AO	Amcom 23 Hivings Hill Chesham Bucks HP5 2PG	BU	Busco 16 Colwill Walk Mainstone Plymouth
AP	Processor Applications 22 Mercer Close Basingstoke Hants	CA	Carvels 3/7 Bank Street Rugby
AR	Aardvark Software 100 Ardeigh Green Road Hornchurch Essex RM11 2LG	CR	Carswell Computers Carswell Barn Faringdon Oxon SN7 8JN
AS	ASP Software Number One Golden Square London W1R 3AB	CD	Carsondale Enterprises Ltd 44 Kingsway Stoke-on-Trent Staffordshire ST4 1JH
AT	ATM King's Chambers Queen Street Derby DE1 3DA	CG	Challenge Games 64 Ferndale Road London E11
AV	A J Vision Service Ltd 61 Jeddo Road London W1Z 9ED	CH	Chalksoft Ltd 37 Willowslea Road Worcester WR3 7QP
AW	Arnold-Wheaton Software Software Publishing Division Parkside Lane Leeds LS11 5TD	CL	Clwyd Technics Ltd., Microprocessor Centre Coach House Kelsterton Road Flint Clwyd CH6 5TH

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price								
Beebon Mon	Ut	McKeran	A,B	C	MK	£2.00							
Beebmon	Ut	Watford	B	R	WA	£22.00							
Beebsynth	Ut	Clares	A,B	C	CL	£7.95							
Beeb-Tote	Gm	Micro Power	B	C	GK	£5.95							
Beefeater	Ed	Sulis	B	C	SU	£7.95							
Bertie Bear	Ed	Dial	B	C,D	DL	£4.95, £6.50							
Besieged	Ed	Sulis	B	C	SU	£9.95							
Beyond Basic	Ed	BBC/NEC	A,B	C	KB	£7.25							
Billiards	Gm	H and H Software	B	C	HH	£8.50							
Binary Numbers	Ed	Chaddington	B,E	C,D	CN	£10.00							
Birds of Prey	Gm	Romik	B,E	C	RO	£6.99							
Bismark	Gm	ASP Software	B,E	C	AS	£6.99							
Black Box and Gambit	Gm	Acornsoft	B	C,D	AL	£9.95, £11.50							
Blackjack/Textpro	Gm	Software Invasion	B	C	IS	£6.95							
Blagger	Gm	Alligata	B,E	C	SY	£7.95							
Blockbuster	Gm	Micro Power	B	C	GK	£7.95							
Blockfit	Ed	System	B	D	SY	£46.00							
Blue Dragon	Gm	MP	B,E	C,D	MP	£7.48, £10.50							
Boat Race	Ed	Pee Bee	B	C,D	PB	£8.50, £11.00							
Boeing 767	/Ut	Flightdeck	B	C	FL	£7.67							
Bomb Alley	Gm	Software Invasion	B	C	IS	£7.95							
Bomber Scramble	Gm	Kansas	B	C	KA	£9.50							
Bounce	Gm	Computercat	A,B	C	CC	£4.95							
Bouncer	Gm	Acornsoft	B	C,D	AL	£9.95, £11.50							
Bouncers	Gm	A&F	B	C	GE	£8.00							
Bounty Pirates	Gm	Aztec S/W	A,B	C	IB	£5.50							
Boris in the Underworld	Gm	Superior	B	C	SE	£7.95							
Boxes/Maze	Ed	Primary	B	C,D	PP	£5.95, £7.95							
Boxer	Gm	Acornsoft	B	C,D	AL	£9.95, £11.50							
Brain Teasers	Gm	Dynabyte	A,B	C	DB	£5.95							
Break-in	Ed	Highlight	B	C,D	HI	£6.00, £7.00							
Break-Up	Gm	Miking S/W	B	C	KC	£3.95							
Breakout	Gm	I.J.K. S/W	A,B	C	IJ	£3.95							
Breakout	Gm	Bryants S/W	B	C	HW	£3.75							
Brick 'em in	Gm	Software For All	B	C	KN	£6.95							
Bridge to the East	Gm	Ixon	B	C	IN	£8.05							
Bridgeman	Gm	Bridge	B	C	BR	£6.90							
Budget	Do	Micro-Aid	B	C,D,F	IZ	£9.95, £11.70							
Budget	Bs	Micropax	B	C	MP	£7.95							
Budget-Multiproduct	Bs	Micropax	B	C	MP	£12.95							
Budget-Multiproduct	Bs	Micropax	B	D	MP	£25.00							
Bugblaster	Gm	Alligata	B,E	C	SY	£7.95							
Bug Bomb	Gm	Virgin Games	B	C	VG	£7.95							
Bumble Bee	Gm	Micro Power	B	C	GK	£7.95							
Business Game	Ed	Acornsoft	A,B	C	AL	£9.95, £9.20							
Bun Fun	Gm	Squirrel Software	A,B	C	SS	£6.50							
Caesar the Cat	Es	Mirror	B	C	MR	£6.95							
CaLIGNA -	Gm	Golden Challenge	B	C,D	GC	£7.95, 10.00							
Canyon	Gm	BBC Pubs	B	C	KB	£10.00							
Capitals	Ed	Edsoft	B	C	ES	£5.95							
Capitals and Punctuation	Ed	RJE Software	A,B	C	RJ	£4.95							
Carbohydrate Metabolism	Ed	Garland Comp.	B	C	JX	£18.24							
Careers Analysis	Ed	Arnold-Wheaton	B	D	AW	£155 + VAT							
Careers Information	Ed	Arnold-Wheaton	B	D	AW	£45 + VAT							
Car Journey	Ed	Heinemann	B	C	HE	£9.25 + VAT							
Caplett 1	Ed	Scholar	B	C,D	SC	£7.00, £9.00							
Caplett 2	Ed	Scholar	B	C,D	SC	£5.50, £7.50							
Carousel	Gm	Acornsoft	B	C	AL	£9.95							
Car Race	Gm	Kingfisher	B	C	KF	£6.90							
Cashbook Accounts	Bs	Gemini	B	C	GM	£59.95							
Cashbook	Do	Micro-Aid	B	C	IZ	£5.95							
Cashbook	Do	Micro-aid	A,B	C	IZ	£13.95							
Cassette 99	Ed	Ludinski CAL	A,B,E	C	KA	£5.00							
Castaway	Gm	Simonsofy	B	C,D	SI	£8.95							
Castle of Riddles	Gm	Acornsoft	B	C	AL	£9.95							
Catalog	Bs	Dialog	B	C/ D	DG	£19.50							
Catalogue	Ut	Baksoft	A,B	C	BK	£4.00							
Cat and Mouse	Ed	Kingfisher	A,B	C	KF	£6.90							
Cat & Mouse	Gm	Micro Power	A,B	C	GK	£4.95							
Catchapple	Ed	Kingfisher	A,B	C	KF	£6.90							
Caveman Adventure	Gm	Program Power	B	C	GK	£6.95							
Caves of Anoran	Gm	FBC Systems	B	C	FB	£7.00							
Cells & Serpents	Gm	ASP Software	B,E	C	AS	£6.99							
Cells & Serpent	Gm	Hexagon S/W	A,B	C	JA	£5.00							
Centibug	Gm	Superior	B,E	C	SE	£7.95							
Central Heating	Ed	Heinemann	B	C	HE	£9.25 + VAT							
Cesil	Ed	Dial	B	C,D	DL	£6.50, £8.00							
CECIL	Ed	Eduquest	A,B	C	NW	£19.95							
Cesil Interpreter	Ed	Computersmith	B	C	LC	£15.00							
Challenger	Gm	Joe the Liar	B	C	JL	£7.45							
Character Shapemaker	Ut	Square	B	C	SQ	£7.00							
Chargen	Ut	Busco	A,B	C	BU	£3.95							
Chargen and Demo	Ut	Rainbow Research	B	C	RR	£8.50							
Character Builder	Ut	Davensof	A,B	C	DX	£4.95							
Character Definer	Ut	A.J.	B	C,D	AJ	£9.95							
Character Enlarger	Ut	Cylindrical Software	A,B	C	CY	£3.95							
Character Orientating	Ut	Cylindrical Software	A,B	C	CY	£3.95							
Character Generator	Ut	MP S/W	B	C	JZ	£3.00							
Character Generator	Ut	Software for All	B	C	KN	£4.95							
Characters	Ut	Computer Concepts	A,B	C	GJ	£6.67							
Characters & Envelope Definer	Ut	Electronics Applied	B	C	IF	£5.50							
Chard	Ut	System	B	C	SY	£9.00							
Chargen	Ut	Odyssey	A,B	C	OG	£4.50							
Chemical Analysis	Ed	Acornsoft	B	C	AL	£13.80							
Chemical Collisions	Ed	Cambridge Micro	B	D	CM	£15.00 + VAT							
Chemical Simulations	Ed	Acornsoft	B	C	AL	£13.80							
Chemical Structures	Ed	Acornsoft	B	C	AL	£13.80							
Chemistry	Ed	Micro Power	B,E	C	GK	£6.95							
Chess	Gm	Micro Power	A,B	C	GK	£5.95							
Chess	Gm	Micro Power	B,E	C	GK	£7.95							
Chess	Gm	Acornsoft	B,E	C	AL	£9.95							
Chess	Gm	Bug Byte	B	C	EA	£11.50							
Chess	Gm	Superior	B,E	C	SE	£7.95							
Children From Space	Ed	A.S.K.	B	C	AK	£9.95							
Childs Play Pack	Ed	Dial	B	C,D	DL	£6.50, £8.00							
CHI-Squared	Bs	Micropax	B	C	MP	£7.95							
CHI-Squared, contingency tables	Bs	Micropax	B	C	MP	£7.95							
Chords	Ed	Aztec	A,B	C	AZ	£6.50							
Christmas Carols	Do	Ega Beva	B	C	EB	£9.95							
Circle Tutor	Ed	Pee Bee	B	C,D	PB	£9.95, £12.45							
Circus	Gm	Digital Fantasia	B	C	NT	£8.95							
City Defense	Gm	Bug-BYTE	B	C	BB	£7.50							
Classification (In)vertebrates	Ed	Scholar	B	C,D	SC	£6.00, £8.00							
Claude	Gm	Alligata	B	C	AG	£7.95							
Claws	Ed	Bryants S/W	A,B	C	HW	£3.75							
Clone Ranger	Ut	J.C. Software	B	D	JS	£11.60							
Cloze	Ed	GED Software	B	C	GD	£4.50							
Cloze Procedure	Ed	Bryants S/W	A,B	C	HW	£4.85							
Code Breaker	Gm	Program Power	A,B	C	GK	£4.95							
Code-Breaker	Ed	RJE Software	A,B	C	RJ	£4.95							
Collectors Catalogue	Do	Acornsoft	B	C	AL	£9.95							
Code Race	Ut	Computer Concepts	B	C	GJ	£6.67							
Coin Analysis	Bs	Micro-Aid	B	C	IZ	£4.95							
Colditz Adventure	Gm	Superior Software	B	C	SE	£7.95							

Colour Snap	Ed	Ega Beva	B	C	EB	£11.95
COMAL	Ln	Acornsoft	B	R	AL	£49.85
Comatch	Ed	Clares	A,B	C	CL	£4.95
Combination Business Pack 1	Bs	Gemini	B	C,D	GM	£159.00
Combination Business Pack 2	Bs	Gemini	B	C,D	GM	£79.95
Combination Business Pack 3	Bs	Gemini	E	C	GM	£79.95
Combination Home Pack 1	Do	Gemini	B,E	C,D	GM	£79.95
Commercial Accounts	Bs	Gemini	B	C	GM	£19.95
Commstar	Ut	PACE	B	R	PA	£34.00
Community	Gm	Ixion	B	C	IN	£6.90
Compass	Ed	GED Software	B	C	GD	£4.50
Compendium	Gm	Computercat	B	C	CC	£5.95
Complete Machine Code Tutor	Ed	New Generation	B	C	NG	£14.95
Comput Applications Project	Ed	Addison-Wesley	B	D	AN	£70.00
Connect 4	Gm	Database Software	B	C	NU	£5.90
Conquering Everest	Gm	ASP Software	B,E	C	AS	£6.99
Constellation	Ed	Micro Power	B	C	GK	£6.95
Constellation	Do	Superior	E	C	SE	£7.95
Contours/Places	Ed	Primary	B	C,D	PP	£5.95, £7.95
Co-ordinates	Ed	Primary	B	C,D	PP	£5.95, £7.95
Contribution Analysis	BS	Micropax	B	C	MP	£7.95
Cookbook Wizardry	Do	Database Software	B	C	NU	£7.50
Copter Capers	Gm	A&F	B	C	GE	£6.90
Copy Disc	Ut	A.J.	B	C	AJ	£5.95
Corn Cropper	Gm	Cases	A,B,E	C	CE	£6.95
Corporate Climber	Gm	Dynabyte	B,E	C	DB	£7.95
Cosmic Asteroids	Gm	Alligata	B	C	AG	£4.95
Cosmic Combat	Gm	Micro Power	B	C	GK	£6.95
Cosmic Fighters	Gm	Kansas	B	C	KA	£9.50
Cosmic Kidnap	Gm	Superior	B	C	SE	£7.95
Coucapcur	Ed	Ed. Soft	B	C	ES	£4.95
Countdown to Doom	Gm	Acornsoft	B	C,R	AL	£9.95
Counter Attack	Gm	OIC	B	C	OI	£6.50
Counting	Ed	Clares	A,B	C	CL	£4.95
Counting	Ed	Cottage Software	B	C	CT	£9.50
Dairy Farmer	Ed	Heinemann	B	C	HE	£9.25 + VAT
Dallas	Gm	Cases	A,B,E	C	CE	£6.95
Dambusters	Gm	Alligata	B	C	SY	£7.95
Danger! UXB	Gm	Micro Power	B,E	C	GK	£7.95
Dap 1	Ut	Gnomonica	B,E	C	GN	£15
Dap 2	Ut	Gnomonica	B	C	GN	£20
Dare Devil Dennis	Gm	Visions	B	C	VI	£7.95
Darts	Gm	Superior	B	C	SE	£6.95
Database	Ut	Computercat	B	C	CC	£12.95
Database	Bs	Gemini	B	C	GM	£19.95
Data-Quiz	Ut	Bryants S/W	B	C	HW	£4.88
Database	Ut	R. H. Electronics	B	C	RH	£12.95
Database	Bs	Acornsoft	B	C,D	AL	£11.90 £15.35
Database	Ed	Ed. Soft	B	C	ES	£19.95
Database	Bs	Primasoft	B	C	CT	£9.95
Database	Bs	Computercat	A,B	C	IJ	£11.95
Database	Bs	Software for All	A,B	C	KN	£9.95
Data File	Do	Kansas	B	C	KA	£12.50
Datext	Ut	Optima	B	C	OP	£9.95
Dating Game	Do	Acornsoft	B	C	AL	£12.65
Decay	Ed	GSN	B	D	GS	£15.00
Defchr	Ut	Micro-Aid	A,B	C	IZ	£2.95
Demon Decorator	Gm	Micro Power	B	C	GK	£6.95
Demon Knight	Gm	ASP Software	B,E	C	AS	£6.99
Density and Circuit	Ed	Acornsoft	A,B	C	AL	£11.90
Descender	Gm	FBC Systems	B	C	FB	£7.50
Desert Trek	Ed	Trekasoft	B	C,D	TR	£5.50
Design	Ut	Beebug	B	C,D	BE	£10.00, £19.00
Desk Diary	Bs	Acornsoft	A,B,E	C	AL	£9.95
Desperate Dan	Gm	Thor	B	C	TH	£5.95
Detective	Gm	ASP Software	B,E	C	AS	£6.99
Detective	Gm	Computersmith	B	C	LC	£5.50
Determination of Electrostatic	Ed	GSN	B	C,D	GS	£14.00, £15.00
Devil's Causeway	Gm	Anirog Computers	A,B	C	OA	£6.00
DFM Database	Bs	Dialog	B	C/D	DG	£24.00
DFS Upgrade	Ut	Alligata	B	E	SY	£29.95
DFM Mail Labels	Bs	Dialog	B	C/D	DG	£10.00
Dictator	Gm	D. K. Tronics	B	C	DK	£6.95
Digger	Gm	Visions	B	C	VI	£7.95
Disassembler	Ut	Superior	E	C	SE	£7.95

SOFTWARE SUPPLIERS

CM	Comsoft	7 Roman Drive Leeds West Yorkshire LS8 2DR	DY	Dynatech Microsoft	Rue du Commerce Bouet St. Peter Port Guernsey C.I.
CN	Chaddington Software	14 Selkirk Close Worthing BN13 1PR	EB	Ebury Software	National Magazine House 72 Broadwick Street London W1V 2BP
CO	Computer Rentals Ltd	CRL House 9 Kings Yard Carpenters Road London E15 2HO	EG	SESS Ltd	Central Trading Estate 275-277 Bath Road Bristol BS4 3EH
CO	Comsoft	7 Roman Drive Leeds Yorkshire LS8 2DR	EH	Heinemann	Computers in Education 22 Bedford Square London
CY	Cylindrical Software	177 College Road Moseley Birmingham B13 9LJ	EJ	Logic Systems	85 Hemingford Road Cambridge
CS	Stable Software	Compton Street Compton Nr Winchester Hants	EL	ECL Software	29 Richmond Close Ware Herts SG12 0EN
CT	Cottage Software	Heather Cottage Selly Hill Whitby North Yorkshire	ET	Etna Software	West End House West End Lane Marshchapel Lincs
CU	Level 9 Computing	229 Hughenden Road High Wycombe Buckinghamshire HP13 5PG	EU	Educare	139a Sloane Street London SW1X 9AY
CX	Contex Computing	15 Woodlands Close Cople Bedford MK44 3UE	FB	FBC Systems	10 Castlefields Main Centre Derby
DA	Davy Computing Ltd	Moorcroft House 2 Clarence Lane Sheffield S3 7UZ	FE	Fernleaf Educational	Fernleaf House 31 Old Road West Gravesend Kent DA11 0LH
DB	Dynabyte Software	31 Topcliffe Mews Wide Lane Morley Yorks	FL	Flight Deck Software	25 Halsey Road Kempston Beds. MK42 8AP
DC	D.A.C.C. Ltd	23 Waverly Road Hindley Greater Manchester WN2 3BN	FM	4MAT Educational Software	Linden Lea Rock Park Barnstaple Devon EX32 9AQ
DD	DDT Software	Southfield House 11 Liverpool Gardens Worthing West Sussex BN11 1RY	FY	Wida Software	2 Nicholas Gardens London W5 5HY
DK	DK Tronics	Unit 2 Shire Hill Industrial Estate Saffron Walden Essex CB11 3AX	GA	Galaxy Software	123 Links Drive Solihull West Midlands B91 2DJ
DG	Dialog	19 Short's Gardens London WC2H 9AT	GC	Golden Challenge Software	2-4 Chichester Rents Chancery Lane London WC2A 1EG
DO	Doctor Soft	258 Coneygree Road Peterborough PE2 8LR	GD	70 Stoke Road	Bletchley Milton Keynes
DS	Diamondsoft Ltd	Cheadle Hulme Cheadle Cheshire SK8 5YB	GE	A&F Software	83 Hyde Road Gorton Manchester M18 7JD
			GJ	Computer Concepts	16 Wayside Chipperfield Hertfordshire WD4 9JJ

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price	Title	Type	Manufacturers	Memory	Software Supplier	Price		
Games of Strategy	Gm	B.B.C.	A,B	C	KB	£10.00	Hangman	Gm	MP S/W	B	C	JZ	£4.00
Games Pack II	Gm	Micromail	B	C	OE	£6.75	Happy Letters	Ed	Bourne	B,E	C,D	BO	£8.97,
Gauntlet	Gm	Micro Power	E	C	GK	£6.95							£10.98
Gateway to Karos	Gm	Acornsoft	B	C	AL	£9.95	Happy Numbers	Ed	Bourne	B,E	C,D	BO	£8.97,
G.B. Geography	Ed	Primasoft	B	C	PR	£6.95							£10.98
GCE Maths (O) 1/2	Ed	Bryants	A,B	C	HW	£9.50	Harlequin	Ed	LTS	B	D	LT	£14.95
Genetic Code	Ed	Garland Comp.	B	C	JX	£17.65	Harlequin	Ed	LTS	B	D	LT	£14.95
Geography Map	Ed	Bryants	B	C	HW	£4.85	Harmony	Ut	Doctor Soft	B	C	DS	£6.95
Geography							Headway	Ed	GSN	B	C,D	GS	£200.00
France/Spain/Germany/I- taly/Belgium/USA/India	Ed	Corona	B	C,D	JY	£6.00,	Heist	Gm	Softspot	B	C	SF	£6.95
						£9.00	Helicopter Rescue/Tunnel/ Hi-VIEW	Gm	A Lane	A,B	C	OC	£4.00
German Irregular Verbs	Ed	Carsondale	B	C	CD	£13.80	Henry IV Part 1	Ln	Acornsoft	B	D	AL	£59.80
German Master	Ed	Kosmos	B,E	C	KM	£9.95	Roadrace	Ed	Penguin	B,E	C	PE	£5.95
Get it Right	Ed	Sulis	B	C	SU	£9.95	Hell Driver	Gm	Micro Power	B,E	C	GK	£7.95
Get Set	Ed	Griffin	B,E	C	GR	£9.95	Hi-Bouncer	Gm	Mirrorsoft	B	C,D	MR	£6.95,
Get the Message	Gm	Dial	B	C,D	DL	£4.95,							£9.95
						£6.50	Hide and Seek	Ed	A.S.K	B	C	AK	£9.95
Ghost/Diamonds	Gm	A Lane	A,B	C	OC	£3.00	History Quiz	Do	Acornsoft	B,E	C	AK	£12.65
Ghost Maze	Gm	Software for All	B	C	HN	£6.95	Gm Computer Concepts	Gm	Harris	B	D	HM	£28.75
Ghost Town	Gm	Adventure					Bs Harris	Do	BJ Software	B	C	BJ	£6.00
							Do BJ Software	Do	Diamondsoft	B	C	DS	£14.95
Ghous	Gm	Micro Power	B	C	GK	£7.95	Do Diamondsoft	Bs Gemini	B	C	GM	£19.95	
Gideon's Gamble	Gm	Superior Software	B	C	SE	£7.95	Do Persoft	Do Persoft	B	C	IY	£12.50	
Glooper	Gm	Microplus	B	C	AM	£6.95	Do BJ Software	Do Dynatech	B	D	DY	£39.95	
Glycolysis - TCA Cycle	Ed	Garland	B	C	JX	£15.00	Do B.B.C.	Ed Acornsoft	B	C	AL	£9.95	
Gnasher	Gm	Superior	B	C	SE	£6.95	Ed Soft Centre	Gm Acornsoft	B,E	C,R	AL	£9.95,	
Gobbler	Gm	M G B	B	C	MG	£5.45							£9.20
Golden Voyage	Gm	Adventure					Horror Castle	Gm A&F	B	C	GE	£8.00	
							Horserace	Gm Dynabyte	B,E	C	DB	£6.95	
Golf	Gm	International	B,E	C	AI	£7.95	Hot Cakes	Ed Private Tutor	B	C,D	PT	£7.95,	
Golf	Gm	Microplus	B	C	AM	£4.95							£8.95
Golforama	Gm	Computersmith	B	C	LC	£5.50	Housekeeper	Ed Heinemann	B	C	HE	£9.25	
													+ VAT
Grand Prix	Gm	Software for All	B	C	HN	£5.95	Howzat	Gm A&F	B	C	GE	£6.90	
Grand Prix	Gm	Microplus	A,B	C	AM	£4.25	Human Blood Groups	Ed Garland	B	C	JX	£15	
Granny's Garden	Ed	4MAT	B	C,D	FM	£10.00,	Hunchback	Gm Superior Software	B	C	SE	£7.95	
						£12.00	Hydraulics	Ed Database Software	A,B	C	NU	£5.50	
Graph Capers Senior	Ed	Gem	B	C	GM	£8.50	Hyperdrive	Gm IJK	B	C	IT	£6.50	
Graphs	Ed	Bryants	A,B	C	HW	£4.85	Identikit	Ed Stell	B,E	C	ST	£7.95	
Graphics Aid Pack	Ed	Microwave NW	B	C	MW	£8.95	'...I Do'	Do Acornsoft	B	C	AL	£12.65	
Graphito	Ut	Addison-Wesley	B	C	AN	£21.95	Identikit/Word Finder	Ed Heinemann	B	C	HE	£9.25	
													+ VAT
Grafix	Ut	Williams	B	D	WI	£10.00	Index	Ut Microwave NW	B	C	MW	£6.95	
Golf	Gm	Bryants S/W	B	C	HW	£4.88	Index Numbers-Basket	Bs Micropax	B	C	MP	£7.95	
Golf	Gm	Bug Byte	B	C	BB	£7.00	Index Numbers-Changer	Bs Micropax	B	C	MP	£7.95	
Golf	Gm	Computersmith	B	C	LC	£5.50	Indexit	Ut Williams	B	D	WI	£10.00	
Gomoku	Gm	Micro Power	A,B	C	GK	£3.95	Inhabitant	Ed Longman	B	C,D	LM	£9.95,	
Graphics Package	Ut	Salamander	B	C	NZ	£24.95	Inheritance						£12.95
							Inheritance	Gm S.W. Hessel S/W	B	C	IW	£5.95	
Graph and Charts Pack	Bs	Acornsoft	B,E	C	AL	£9.95,	Inkosi	Ed Garland Comp.	B	C	JX	£34.70	
						£9.20	Intergalactic Trader	Gm Chalksoft	B	C	KT	£5.95	
Graphics Pack	Ut	Bug-Byte	B	C	BB	£9.50	International Special Agent	Gm Micro Power	B,E	C	GK	£8.95	
Graphs (Arithmetical)	Ed	Bryants	B	C	HW	£4.85	Intervention commercial	Gm O.K.	B	C	OK	£10.00	
Great Britain Ltd	Gm	Hessel	B	C	HS	£5.95	Intervention educational	Bs System	B	C	SY	£345.00	
Greater and Smaller	Ed	Scholar	B	C,D	SC	£6.50,	In the Grip of Ice	Ed System	B	C	SY	£115.00	
						£8.50	Intro	Gm O.K.	B	C	OK	£10.00	
Grig Blitz	Gm	Computecat	B	C	CC	£5.95	Introducing Map Skills 1/2	Ed Clares	A,B	C	CL	£7.95	
Group Statistics	Bs	Micropax	B	C	MP	£7.95		Ed Cambridge Micro	B	C,D	CM	£13.95,	
Guardian	Gm	Alligata	E	C	SY	£7.95	Introduction to						£1.62
Guided Discovery	Ed	Etna Software	B	C	ET	£9.95	Microcomputing in	Ed Hutchinson	B	C	HN	£17.25	
Gunsmoke	Gm	Software Invasion	B	C	IS	£7.95	Teaching						
Guzzler	Gm	Computersmith	B	C	LC	£5.50	Invaders	Gm Software Invasion	B	C	IS	£6.95	
							Invaders	Gm Superior Software	B	C	SE	£7.95	
Handwriting 1/2	Ed	Chalksoft	B	C	CH	£9.95	Invaders	Gm Software for All	A,B	C	KN	£6.95	
Handgroid	Gm	Micromode	B	C	MO	£4.00	Invaders	Gm Hexagon S/W	A,B	C	JA	£6.00	
Hangman	Ed	Micro Aid	B	C	IZ	£7.95	Invasion	Gm ASP Software	B,E	C	AS	£6.99	
Hangman Player	Ed	Square	A,B	C	SQ	£7.00	Invisible Man	Ed Chalksoft	B	C	KT	£5.95	
Hangman	Gm	Micro Aid	B	C	IZ	£7.95	Invoicing	Bs Acornsoft	B	D	AL	£24.95	
Hangman	Gm	Aztec S/W	A,B	C	IB	£5.50	Invoices and Statements	Bs Gemini	B	C	GM	£19.95	
							ISO-Pascal	Ln Acornsoft	B	R	AL	£69.00	
							Janepius	Ed Longman	B	C	LM	£14.50	
							Jars	Ed Acornsoft	B	C	AL	£11.90	
							JCB Digger	Gm Acornsoft	B	C	AL	£9.95,	
												£11.50	
							Jet Power Pack	Gm Micro Power	B	C	GK	£7.95	
							Jigsaw Puzzle	Ed Ega Beva	B	C	EB	£9.95	

Jigsaw & Sliding Puzzles	Ed	Golem	B,E	C,D	OB	£7.95, £9.95
Johnny Reb	Gm	Lothlorien	B	C	LO	£6.95
J.R.	Gm	Software for All	B	C	KN	£6.95
Julius Caesar	Ed	Penguin	B,E	C	PE	£5.95
Jumbles	Ed	Bryants S/W	B	C	HW	£4.88
Jumbo	Gm	Molimerx	B	C	AJ	£17.25
Jungle Ambush	Gm	Kindsoft	B	C	KU	£6.50
Jungle Journey	Ed	Treksoft	B	C	TR	£5.50
Junior Maths	Ed	Aztec	A,B	C	AZ	£3.00
Junior Maths Pack	Ed	Micro Power	B	C	GK	£6.95
Junior Word Splits	Ed	Sulis	B	C	SU	£9.95
Just a Mot	Ed	Sulis	B	C	SU	£9.95
Kamikaze	Gm	A&F	E	C	GE	£7.90
Keeping Myself Alive	Ed	Heinemann	B	C	HE	£9.25 + VAT
Katakombs	Gm	Golem	B	C,D	OB	£5.95, £7.95
Keyrecog	Ed	Ed. Soft	B	C	ES	£4.95
Kidney	Ed	Garland	B	C	JX	£12
Kingdom of Hamil	Gm	Acornsoft	B	C	AL	£9.95
Killer Gorilla	Gm	Micro Power	B,E	C	GK	£7.95
Knowledge Quest	Ed	Pee Bee	B	C,D	PB	£10.95, £14.45
Konexion	Gm	M and M Software	A,B	C	MM	£5
Kopfjäger	Ed	Cambridge Micro	B	D	CM	£15.00 + VAT
Kremlin	Gm	Doctor Soft	B	C	DO	£6.95
Kubla Khan	Gm	Blue Moon	B	C	BM	£8.95
L-	Ed	ATM	B	D	AT	£10.00
Labdis	Ut	Silversoft	B	C	SV	£6.95
Labyrinths of La Coshe	Gm	Micro Power	B	C	GK	£7.95
Ladder Maze	Gm	Superior	B	C	SE	£6.95
Landfall	Gm	Virgin Games	B	C	VG	£7.95
Language Development Pack	Ed	LTS	B	C,D	LT	£12.95
Language Development Pack	Ed	LTS	B	C,D	LT	£12.95
Language Tutor	Ed	Rainbow Research	B	C	RR	£5.00
La Princesse (French)	Ed	Aztec S/W	B	C	IB	£6.50
Language-Lab	Ed	M and M Software	A,B	C	MM	£7.50
Landfall & Serpent	Gm	GT Software	B	C	JW	£6.50
Laser Command	Gm	Micro Power	B,E	C	GK	£7.95
Laser Letters	Ed	Shards	B	C,D	SH	£6.95, £9.95
Laser Probe	Ed	Hill MacGibbon	B	C	HM	£6.95
Laser Zone	Gm	Salamander	B	C	SA	£7.95
Las Vegas	Gm	R.H. Electronics	B	C	RH	£8.95
Launching Logic	Ed	Shiva	B	C	SV	£14.95
Learn Addition	Ed	ABC Primary	B	C	AB	£6.50
Learn Subtraction	Ed	ABC Primary	B	C	AB	£6.50
Leap Frog	Gm	IJK Software	B	C	IJ	£7.50
Learning Compendium I	Ed	Ega Beva	B	C	EB	£11.95
Learning Compendium II	Ed	Ega Beva	B	C	EB	£9.95
Ledger	Bs	Micro Aid	B	C	IZ	£7.95
Legion	Gm	Software Projects	B	C	SW	£7.95
Letters	Ed	Chalksoft	B	C	CH	£6.95
Let's Count	Ed	A.S.K	B	C	AK	£9.95
Letterbugs	Ed	Highlight	B	C,D	HI	£6.00, £7.00
Librarian/Word Finder	Ed	Heinemann	B	C	HE	£9.25 + VAT
Library Classification	Ut	Aztec	A,B	C	AZ	£6.50
Library Dewey Classification	Ed	Aztec S/W	B	C	IB	£6.50
Life	Gm	Ixon	A,B	C	IN	£4.75
Life Plus	Gm	Mayday	A,B	C	IX	£4.49
Lift	Ed	Cambridge Micro	B	D	CM	£15.00 + VAT
Lift off with Numbers	Ed	Shiva	B	C	SV	£14.95
Lightpen Colourgraphic	Ut	R.H. Electronics	B	C	RH	£9.95
Linear Programming	Bs	Micropax	B	C	MP	£12.95
Linear Regression, Correlation	BS	Micropax	B	C	MP	£7.95
Lines and Angles	Ed	4MAT	B	C	FM	£5
Link-4-Plus	Gm	ABC Software	A,B	C	KR	£6.95
LINKWORD French, German,	Ed	Acornsoft	B	C	AL	£14.95
Spanish	Ed	Acornsoft	B,E	C,R	AL	£16.85, £16.10
Lisp	Ut	Aztec	B	C	AZ	£16.85
LISP Demonstrations	Ut	Acornsoft	B	C,D	AL	£9.95, £11.50
Logo-Forth	Ut	H.C.C.S.	A,B	E	HC	£59.00
Logo 2	Ut	Computer Concepts	B	C	GJ	£10.00
Longitudinal Waves	Ed	Heinemann	B	C	EH	£12.50

SOFTWARE SUPPLIERS

KA	Kansas City Systems Unit 3 Sutton Springs Wood Chesterfield S44 5XF	MK	David McKeran 23 Warwick Drive East Herrington Sunderland Tyne and Wear
KB	BBC Publications British Broadcasting Corpora- tion 35 Marylebone High Street London W1M 4AA	MM	M and M Software 1391 Leek Road Abbey Hulton Stoke-on-Trent Staffs ST2 8BW
KF	Kingfisher Computer Services Durley Lane Keynsham Bristol BS18 2AQ	MN	Merlin Computer Products 18 Mansel Street Swansea SA1 5SG
KH	Superior Software 69 Leeds Road Bramhope Leeds	MO	Micromode 32 West End Avenue Gatley Cheshire
KM	Kosmos 1 Pilgrims Close Harlington Dunstable Bedfordshire LU5 6LX	MO	Molimerx Ltd 1 Buckhurst Road Town Hall Square Bexhill-on-sea East Sussex
KN	Software for All 72 North Street Romford Essex	MR	MRM Software 17 Cross Coates Road Grimsby South Humberside
KS	K. A. Spencer 74 Dovers Park Bathford Nr Bath Avon	MS	Musicsoft 12 Fallowfield Amphill Beds
KU	Kudusoft 130 Main Street Tweedmouth Berwick-upon-Tweed TD15 2AW	MW	Microwave NW 24 Belford Road Stretford Manchester M32 0DL
LA	Ludinski Computer-Assisted Learning 24 Avondale Avenue Staines Middlesex	OI	OIC Ltd 15 Burglead Close College Town Camberley Surrey GU15 4XL
LC	Computersmith 40 Greenfields Avenue Bromborough Wirral Merseyside L62 6DD	OP	Optima Software Ltd 36 St. Petersgate Stockport SK1 1HL
LM	Longman Group Longman House Burnt Mill Harlow Essex	OT	Oxhey Tutors 19 Tudor Walk Watford Herts. WD2 4NY
LO	Lothlorien 56a Park Lane Poynton Cheshire SK12 1AE	PB	Pee Bee Software PO Box 175 High Wycombe Bucks.
MA	MP Software and Services 165 Spital Road Bromborough Merseyside L62 2AE	PU	Pumpkin Programs 35 Hammerfield Avenue Aberdeen AB1 6LL
MB	Microbyte Software Freepost Newquay TR7 2BR	SA	Salamander Software 17 Norfolk Road Brighton East Sussex BN1 4AA
MD	MED 640 Melton Road Thurmaston Leics	SC	Scholar Soft Coniscliffe Woolington Gdns Woolington Newcastle Upon Tyne NE13 8AP
MI	Microgame Simulations 73 The Broadway Grantchester Cambridge CB3 9NQ	SC	Screenplay 134 St. Vincent Street Glasgow
MG	MGB Software Support 52 Barley Croft Harlow Essex	SC	Starcade 2 Elworthy Avenue Liverpool L26 7AA

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price								
Looking at Graphs	Ed	Heinemann	B C	HE	£9.25								
Looking at Scales	Ed	Heinemann	B C	HE	£9.25								
Look it up	Ed	GED Software	B C	GD	£4.50								
Look Sharp!	Ed	Mirror	B,E C	MR	£7.95								
LOGO	Ln	Acornsoft	B R	AL	£69.00								
Logo Challenge	Ed	Addison-Wesley	B C,D	AN	£29.95								
Lorry / Farm	Ed	Primary	B C,D	PP	£5.95								
Lords of Time	Gm	Level 9	B C	CU	£9.90								
Lost City	Gm	Superior Software	B C	SE	£7.95								
Lost In Space	Gm	Salamander	B C	SA	£9.95								
Lunar Rescue	Gm	Alligata	B C	AG	£7.95								
L Trap	Gm	Gem	B C	GM	£8.50								
Lunar Lander	Gm	A&F Software	B C	GE	£6.90								
Macbeth	Ed	Penguin	B,E C	PE	£5.95								
Mach 1	Ut	Gnomonica	B E	GN	£39.95								
Magic Adventure	Gm	Kansas	B C	KA	£8.50								
Mailer	Ut	ASD Ltd	B C	AS	£5.75								
Mailing List	Bs	Gemini	B C	GM	£19.95								
Mailing	Bs	Micro-Aid	A,B C	IZ	£7.95								
Mailing System	Bs	Acornsoft	B D	AL	£24.95								
Map Rally	Ed	Bourne	B,E CD	BO	£8.97								
Making Ends Meet	Ed	Cambridge Micro	B C,D	CM	£15.00								
Manage	Gm	Cases	B C	CE	£6.95								
Mansion Murders	Gm	Challenge Games	B C	CG	£6.95								
Mapping Skills	Ed	Heinemann	B C	HE	£9.25								
Mark Book	Ed	Carvells	A,B C	CA	£5								
Mark Book	Ed	BBC	A,B C	KB	£15								
Martian Attack	Gm	Micropower	B C	CT	£7.95								
Mass	Ut	DDT	B R	DT	£34.95								
Masterbard Hamlet	Ed	Sulis	B C	SU	£12.95								
Master Copier	Ut	Aztec S/W	A,B C	IB	£6.50								
Masterfile	Ut	Beebug	B CD	BE	£10.00								
Mastermind	Gm	Micro Power	A,B C	GK	£3.95								
Matchup	Ed	Edsoft	B C	ES	£5.95								
Mathgrid	Ed	Soft Centre	B C,D	SN	£8.00								
Maths Invaders	Ed	Stell	B,E C	ST	£7.95								
Mathskills I/II	Ed	Griffin	B,E C	GR	£11.95								
Maths Man	Ed	GED Software	B C	GD	£4.00								
Maths Pack	Ed	Ega Beva	B C	EB	£11.95								
Maths Pack	Ed	Dial	B C,D	DL	£4.95								
Maths Topics 1	Ed	Cambridge Micro	B C,D	CM	£13.95								
Maths Topics 2	Ed	Cambridge Micro	B C,D	CM	£15.00								
Mathspell	Ed	Diamondsoft	B C	DS	£7.95								
Maths Topics 1	Ed	CUP	B C	UP	£18								
Maths Translation	Ed	Corona S/W	B C	JY	£6.00								
Maths Tutors, Graphs	Ed	Salamander	B,E C	SA	£9.95								
Maths Tutors, Vectors	Ed	Salamander	B,E C	SA	£14.95								
Matching	Ed	Clares	A,B C	CL	£5.95								
Maze	Gm	Acornsoft	B C,D	AL	£9.95								
Matrices	Ed	Chaddington	B,E C,D	CN	£10.00								
Maze Invaders	Gm	Micro Power	B C	GK	£4.95								
Maze Man	Gm	C J E	B C	NV	£6.00								
Micro Budget	Do	Micro Power	A,B C	GK	£6.95								
Meditor	Ut	MED	B C	MD	£9.50								
Medmon	Ut	MED	A,B C	MD	£9.95								
Membership Manager	Do	Acornsoft	B C	AL	£9.95								
Memocalc	Bs	Microaid	B C	IZ	£9.95								
Mental Arithmetic Tests	Ed	Small School	B C	SM	£6.95								
Mental Maths and Place Value	Ed	Edsoft	B C,D	ES	£4.95								
Merchant of Venice	Ed	Penguin	B,E C	PE	£5.95								
Mercy Mission to Mars	Gm	D.A.C.C.	B C	DC	£5.95								
Merlins Castle	Ed	Pumpkin	B C	PU	£5.00								
Meteor Mission	Gm	Acornsoft	B C,D	AL	£9.95								
Meteor Mission	Gm	Acornsoft	B C,D	AL	£11.50								
Meteor Mission	Gm	Acornsoft	B C,D	AL	£9.95								
Meteors	Gm	Acornsoft	B,E C	AL	£9.95								
Metrics (5)	Ed	Chalksoft	B C	KT	£9.95								
Microbial Pop. Dynamics	Ed	Microwave NW	B C	MW	£7.00								
Microbug	Ed	Arnold-Wheaton	B C,D	SY	£15.00								
Micro Man	Gm	Pro S/W	B C	LD	£8.00								
Micro Maths	Ed	LCL	A,B,E C,D	KA	£24.50								
Micros in Classroom 1-5	Ed	Longman	B C,D	LM	£20.00								
Milikan's Oil Drop	Ed	GSN	B C,D	GS	£14.00								
Micromon	Ut	Molimerx	B C,R	MO	£15.00								
Micromon	Ut	Molimerx	B C,R	MO	£14.00								
Middle Kingdom	Gm	Pro Software	A,B C		£28.00								
Microtext	BS	Acornsoft	B C	AL	£7.95								
Microtype	Ed	Kansas	B C	KA	£49.85								
Micros in Maths Classroom	Ed	Longman	B C,D	LM	£12.50								
Millionaire	Gm	Incentive Software	B,E C	IN	£6.50								
Million Mazes	Gm	Ludinski	B,E C	KA	£6.50								
Mined Out	Gm	Quicksilva	B C	QS	£6.95								
Miner	Gm	Ixon	B C	IN	£6.90								
Minefield	Gm	Eduquest	A,B C	NW	£5.95								
Minefield	Gm	A&F Software	A,B C	GE	£6.00								
Missile Base	Gm	Acornsoft	B C	AL	£9.95								
Missile Control	Gm	C J E	B C	NV	£9.00								
Missile Control	Gm	Microcomputers	B C	GM	£9.95								
Missing Signs	Ed	Acornsoft	A,B C	AL	£11.90								
Missile Strike	Gm	Superior	B C	SE	£7.95								
Missing Length	Ed	Scholar	B C,D	SC	£6.50								
Mission Impossible	Gm	Aztec S/W	A,B C	IB	£6.50								
Mitosis	Ed	Garland	B C	JX	£15								
Mixed Games	Gm	I.J.K. S/W	A,B C	IT	£3.95								
MMaths	Ed	Ed. Soft	B C	ES	£4.95								
Model A Invaders	Gm	I.J.K. S/W	A,B C	IT	£4.95								
Model B Invaders	Gm	I.J.K. S/W	B C	IT	£6.95								
Moli-Tool	Ut	Molimerx	B R	MO	£28.00								
Moments + Van	Ed	RJE Software	B C	RJ	£4.95								
Monaco	Gm	Alligata	B C	SY	£7.95								
Money Box	Gm	Bryants	A,B C	HW	£4.85								
Moneyplus 1-4	Ed	Fernleaf	B C,D	FE	£35.95								
Monster Maths	Ed	Shards	B C,D	SH	£6.95								
Monster Maze	Ed	Kingfisher	A,B C	KF	£6.90								
Monsters	Gm	Acornsoft	B,E C	AL	£9.95								
Monsters and Giants	Ed	Longman	B C,D	LM	£9.20								
Monster Battles	Gm	Bryants S/W	B C	HW	£4.80								
Moon Mission	Gm	Superior	B C	SE	£7.95								
Moon Raider	Gm	Micro Power	B,E C	GK	£7.95								
Morse Code	Ed	Philip Dodderidge	B C	PD	£6.50								
Morse Code Fun	Ed	Aztec	A,B C	AZ	£3.00								
Moving Molecules	Ed	C.U.P	B C	CP	£13.95								
Mr EE	Gm	Micro Power	B C,D	GK	£6.95								
Mr T's Alphabet Games	Ed	Ebury	B C	EB	£9.95								
Mt T's Measuring Games	Ed	Ebury	B C	EB	£9.95								
Mr T's Money Box	Ed	Ebury	B C	EB	£9.95								
Mr T's Number Games	Ed	Ebury	B C	EB	£9.95								
Mr T's Shape Games	Ed	Ebury	B C	EB	£9.95								
Mr T Tells The Time	Ed	Ebury	B C	EB	£9.95								
Mr T Makes Music	Ed	Ebury	B,C C	EB	£9.95								
Mr T Meets His Match	Ed	Ebury	B C	EB	£9.95								
Mr T's Simple Sums	Ed	Ebury	B C	EB	£9.95								
Mr Wiz	Gm	Superior	B,E C	SE	£7.95								
Multi-Aid	Ut	Dynabyte	A,B C	DB	£7.95								
MultiFile	Bs	Bug Byte	A,B C	BB	£25.00								
MultiForth 83	Ut	Skyware	B R	SK	£40.								

Multiple Slit Interference	Ed	GSN	B	C,D	GS	£14.00.
						£15.00
Multiply and Divide	Ed	Cottage Soft	A,B	C	CT	£7.50
Multitest	Ed	System	B	C,D	SY	£14.95
Munchyman	Gm	Micro Power	A,B	C	GK	£5.95
Music Tutor	Ed	Ed. Soft	B	C	ES	£9.95
Musit	Do	B.B.C.	A,B	C	KB	£10.00
Music Editor	Ed	System	B	C	SY	£9.00
Music Maker	Gm	Rainbow S/W	A,B	C	KS	£3.50
Music Synthesiser	Ut	Bug-Byte	B	C	BB	£9.50
Music Master	Ed	Merlin	B	C	MN	£6.95
Music Processor	Gm	Quicksilva	A,B	C	QS	£14.95
Music Quiz	Do	Acornsoft	B	C	AL	£12.65
Musictools 1	Ut	Musicsoft	B	C	MS	£5.75
Musical Numbers	Ed	Bryants S/W	B	C	HW	£4.88
Musical Number Box	Gm	Bryants S/W	A,B	C	HW	£3.75
Mutant Invaders	Gm	I.J.K. S/W	A,B	C	IT	£5.95
Mutant Spiders	Gm	Superior	B	C	SE	£6.95
MX 80 Type 3 Screen Dump	Ut	Software for All	A,B	C	KN	£6.95
My Mathematical Self	Ed	Heinemann	B	C	HE	£9.25
						+VAT
Mystery of the Jowa Star	Gm	Shards	B,E	C	SH	£7.95
1984	Gm	Incentive	B	C	IV	£6.95
1914	Ed	Cambridge Micro	B	C,D	CM	£15.00
						+VAT
Nominal Ledger	Bs	Micropower	B	C	GK	£7.99
Note Invaders Package	Ed	Chalksoft	B	C	CH	£9.25
Number Balance	Ed	Acornsoft	A,B	C	AL,	
					GA	£11.90
Networks-Basic	Bs	Micropax	B	C	MP	£12.95
Networks-Pert.	Bs	Micropax	B	C	MP	£17.95
Networks-Big Part	Bs	Micropax	B	D	MP	£75.00
Nightmare Maze	Gm	MRM	B,E	C	MR	£5.70
Nightmare Maze	Gm	MRM	B,E	C	MR	£5.70
Number Bond	Ed	Primary Programs	B	C	PP	£3.95
Number Chaser	ED	A.S.K	B	C	AK	£9.95
Number Fun	Ed	Griffin	B	C	GR	£9.95
Number Lang	Ed	Dial	B	C,D	DL	£4.95,
						£6.50
Number Puzzler	Ed	A.S.K	B	C	AK	£9.95
Number Gulper	Ed	A.S.K	B	C	AK	£9.95
Number Rally	Ed	Longman	B	C	LM	£9.95
Number Skills 0-20	Ed	Longman	B	C	LM	£9.95
Number Skills 0-999	Ed	Longman	B	C	LM	£9.95
Nursery Rhymes	Ed	Ega Beva	B	C	EB	£9.95
Neanderthal Man	Gm	Alligata	B	C	SY	£7.95
Negadd & Negmin	Ed	Scholar	B	C,D	SC	£7.00,
						£9.00
Nemesis	Gm	Micro Power	B	C	GK	£7.95
Neutron	Gm	Superior	B	C	SE	£6.95
Night Sky	Do	Bridge	B	C	BR	£9.90
Number	Ed	Edsoft	B	C,D	ES	£4.95
Numberfun	Ed	Griffin	B,E	C	GR	£9.95
Numerology	Ed	Pumpkin	A,B	C	PU	£5.00
Nuts	Ed	Creative Sparks	B	C	TE	£7.95
Odds on Geography	Ed	Dial	B	C,D	DL	£4.95,
						£6.50
Odds on Inventors	Ed	Dial	B	C,D	DL	£4.95,
						£6.50
Odds on Monarchs	Ed	Dial	B	C,D	DL	£4.95,
						£6.50
Odds on Musicians	Ed	Dial	B	C,D	DL	£4.95,
						£6.50
Odds on Writers	Ed	Dial	B	C,D	DL	£4.95,
						£6.50
Oblivion	Gm	Bug-BYte	B	C	BB	£7.50
Old Father Time	Gm	Bug-Byte	B	C	BB	£9.50
Oil	Gm	Computersmith	B	C	LC	£5.50
Ollie Octopus' Sketchpad	Ed	Storm	B	C,D	SX	£6.05,
						£9.95
Omega Probe	Gm	Optima	B	C	OP	£8.95
One to Nine	Ed	Acornsoft	B	C	AL	£9.95
Oneshot	Ut	Clares	B	D	CL	£12.00,
						£15.00
						(3")
1-2-3 Snap	Ed	Ega Beva	B	C	EB	£11.95
Open Evening Timetable	Ed	A.J.	B	C,D	AJ	£14.95,
						£19.95
Optimon	Ut	Optima	B	C	OP	£9.95
Optics	Ed	Hutchinson	B	C	HN	£18.40

SOFTWARE SUPPLIERS

SE	Superior Software 69 Leeds Road Bramhope Leeds	SU	John Wiley and Sons Ltd Distribution Centre Shripney Road Bognor Regis West Sussex PO22 9SA
SF	Softspot 29 South Crescent Prittlewell Southend Essex SS2 6TB	SV	Silversoft London House 271-273 King St. London W6 9LZ
SH	Shards Software 189 Eton Road Ilford Essex IG1 2UQ	SW	Software Projects Bear Brand Complex Allerton Road Woolton Liverpool Merseyside L25 7SF
SH	Shumwari Associates 12 Marlin Court Marlow SL7 2AJ	SX	Storm Winchester House Wootton Grove Sherborne Dorset
SI	Scisoft 5 Minster Gardens Neuthorpe Eastwood Notts. NG16 2AT	SY	Synergy Software 7 St. Andrews Close Slip End Luton LU1 4DE
SI	Simonsoft 25 Tatham Road Abingdon Oxon OX14 1QB	SY	System Software 12 Collegiate Crescent Sheffield S10 2BA
SJ	S.J. Grist 127 Waxwell Lane Pinner Middlesex	TE	Technical Education 112 City Road London EC1
SK	Skywave Software 73 Curzon Road Boscombe Bournemouth BH1 4PW	TH	Thor Erskine Industrial Estate Liverpool Merseyside L6 1AP
SL	Silverlind Ltd 156 Newton Rd., Burton-on-Trent Staffordshire DE15 0TR	TS	3SL Computers Brook House 513 Crewe Road/Wheelock, Sandbach Cheshire CW11 0QX
SM	Small School Software 41 Sinah Lane Hayling Island Hampshire PO11 0HJ	UP	Cambridge University Press Edinburgh Building Shaftesbury Road Cambridge
SN	Soft Centre Renryle Cottage Okehurst Lane Billinghurst West Sussex RH14 9HR	VA	Vampyre Software PO Box MT15 Shadwell Leeds LS17 8DW
SO	Solar Soft 5 Westmorland Drive Camberley Surrey GU15 1EW	VC	Vulcan Computing 32 Guildford Road 32 Guildford Road Farnham Surrey GU9 9QB
SP	Sapphire Software Box 67 Wakefield Yorkshire	VI	Visions Software 1 Felgate Mews Studland Street London W6
SQ	Square Software 12a Uplands Terrace Swansea W Glamorgan	VG	Virgin Games 61/63 Portobello Road London W11 3DD
SR	Starsoft 9 Chatsworth Road Worsley Manchester M28 4NU	VN	Vine Micros Marshborough Sandwich Kent CT13 0PG
SS	Squirrel Software 4 Bindloss Avenue Eccles Manchester M30 0DV	WI	5 Belmont Avenue Edmonton London N9 7JL
ST	Stell Software 36 Limefield Ave Whalley Lancs BB6 9RJ	YH	Yorke House Software 33 West Street Oundle Peterborough PE8 4EJ

CONTINUED OVER

SOFTWARE LISTINGS

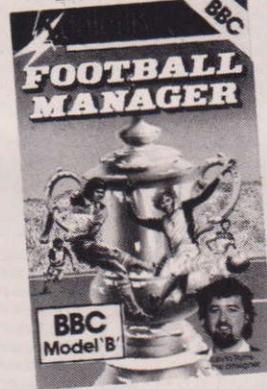
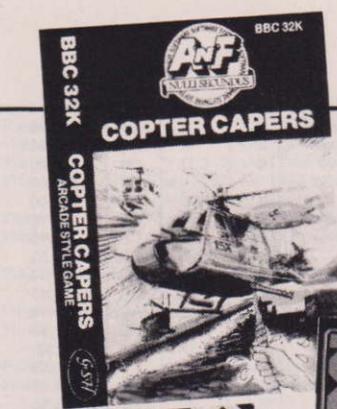
Title	Type	Manufacturers	Memory	Software Supplier	Price							
Options	Ed	System	B C	SY	£23.00	Planetarium	Ed	Superior	B C	SE	£7.95	
Options Timetable	Ed	A.J.	B C,D	AJ	£14.95, £19.95	Planet Invaders	Gm	Merlin	B C	MN	£7.95	
Order Processing	Bs	Acornsoft	B D	AL	£24.95	Planetfall	Gm	ASP Software	B,E C	AS	£11.45	
O.S. Quiz	Ed	Arnold-Wheaton	B C	AW	£6.00 + VAT	Planet of Colourful Sound	Ed	Honeyfold	B C,D	HO	£9.95, £11.95	
Oscilloscope	Ed	RJE Software	B C	RJ	£6.95	Planetoid	Gm	Acornsoft	B C	AL	£9.95	
Othello	Gm	Computer Concepts	A,B,E C	GJ	£8.95	Playbox	Gm	Comsoft	B,E C,D	CM	£6.50, £8.50	
Othello	Gm	Computercat	B C	CC	£8.95	Play With Words	Ed	Pee Bee	B C,D	PB	£8.50, £11.00	
Othello	Gm	Sapphire	B C	SH	£5.95	Plegaron People Eaters	Gm	R. H. Electronics	B C	RH	£8.95	
Paintbox	Ut	Beebug	B C,D	BE	£10.00, £12.00	Plotter	Ed	Dial	B C,D	DL	£6.50, £8.00	
Paintbox	Do	Oakleaf	B C	OA	£9.95	Plunder	Gm	Cases	B C	CE	£6.95	
Painter	Gm	A & F	B C	GE	£8.00	Podd	Ed	ASK/Acornsoft	B,E C,D	AL	£9.95, £11.50	
Painting	Ut	BBC	A,B C	JB	£6.0	Population Growth	Ed	C.U.P.	B C	CP	£13.95	
Paras	Gm	Lothlorien	B C	LO	£6.95	Poker Dice	Gm	Micro Power	B C	GK	£5.95	
Pareto Analysis	B	Micropax	B C	MP	£7.95	Powerboat Race	Gm	Futura S/W	B C	JC	£7.95	
Parity	Ed	N. Darwood	A,B C	JB	£10.00	Polar Traveller	Ed	Trekkasoft	B C,D	TR	£5.50	
Parts of a Sentence	Ed	Scholar	B C,D	SC	£5.00, £7.00	Polaris	Gm	Bug Byte	B C	KP	£5.50	
Pascal	Ed	Chalksoft	B C	KT	£5.95	Polygon Tutor	Ed	Pee Bee	B C,D	PB	£7.50, £10.00	
Passit Transformations	Ed	Edsoft	B C	ES	£5.95	Pontoon	Gm	M and M Software	B C	M	£5	
Password	Ed	MP	B C,D	MP	£11.00, £14.00	Pool	Gm	Dynabyte	B,E C	DB	£7.95	
Past to Present	Ed	Heinemann	B C	HE	£9.25 + VAT	Population Growth	Ed	Cambridge Micro	B C,D	CM	£13.95	+ £1.62
Paul Daniel's Magic Show	Do	Acornsoft	B C,D	AL	£9.95, £11.50	Position	Gm	Micro Power	B,E C	GK	£6.95	
Payroll	Bs	Micro-Aid	B C	IZ	£17.95	Procaid	Ut	Micro Aid	A,B C	IZ	£3.45	
Peeko Computer	Bs	Acornsoft	A,B C	AL	£9.95, £9.20	Proclflush	Ut	Micro-Aid	A,B C	IZ	£1.00	
Peggit	ED	Ed. Soft	B C	ES	£5.95	Procar	Ut	Micro-Aid	A,B C	IZ	£1.95	
Password	Ed	MP Software	B C,D	MP	£11.00, £14.00	Process Capability	Bs	B J Software	B C	BJ	£8.00	
Pengwyn	Gm	Postern	B C	PT	£6.95	Protease	Gm	D.K. Tronics	B C	DK	£6.95	
Pansion	Bs	Micro-Aid	B C	IZ	£4.95	Primary Art	Ed	Alligata	B,E C	SY	£7.95	
Pentiles	Ed	Silverlind	B C	SL	£6.95	Primary Time	Ed	Alligata	B,E C	SY	£7.95	
Percentages	Ed	Scholar	B C,D	SC	£5.00, £7.00	Princess	Gm	Aztec S/W	A,B C	IB	£6.50	
Percy Penguin	Gm	Superior	B,E C	SE	£7.95	Printer Driver Generator	Ut	Acornsoft	B C,D	AL	£9.95, £11.50	
Perseus and Andromeda	Gm	Digital Fantasia	B C	NT	£10.29	Process Capability	Bs	B J Software	B C	BJ	£8.00	
Personal Accounts	Do	Kansas	B C	KA	£10.50	Project Planner	Bs	Triptych	B C,D	TP	£19.95, £24.95	
Personal Money Management	Do	Acornsoft	B,E C	AL	£11.90, £11.50	Progo	Ed	Edsoft	B C,D	ES	£8.95, £10.50	
Pettigrews Diary	Gm	Shards	B,E C	SH	£7.95	Protractor Tutor	Ed	Pee Bee	B C,D	PB	£7.80, £10.30	
Pharaoh's Tomb	Gm	A&F Software	B C	GE	£8.00	Pub games/Picasso package	Gm	Starsoft	B C	SR	£9.95	
Philosopher's Quest	Gm	Acornsoft	B C	GA	£9.95	Punc-Man	Ed	Chalksoft	B C	KT	£7.95	
Physics	Ed	Micro Power	A,B,E C	GK	£6.95	Punctuation/Word Finder	Ed	Heinemann	B C	HE	£9.25 + VAT	
Picture Maths	Ed	A J Visions	B C	AV	£9.95	Punctuation	Ed	Bryants S/W	B C	HW	£4.88	
Picfile	Ed	Cambridge Micro	B C,D	CM	£20.08	Purchasing	Bs	Acornsoft	B D	AC	£24.95	
Picture Builder	Ed	Hill MacGibbon	B C	HM	£9.95	Putting Numbers In Order	Ed	Scholar	B C,D	SC	£7.00, £9.00	
Picture Puzzles	Ed	LCL	A,B,E, C	LA	£6.50	Pyramid	Ed	Highlight	B C,D	HI	£6.00, £7.00	
Picture Book	Ed	LTS	B D	LT	£14.95	Pyramid of Doom	Gm	Adventure International	B,E C	AI	£7.95	
Picture Spell	Ed	GED Software	B C	GD	£5.00	Pyramid Painter	Gm	Thor	B C	TH	£5.95	
Pieman	Gm	Musicoft	B C	MS	£3.75	Questionmaster	Ed	Hutchinson	B C	HN	£28.75	
Pinball	Gm	Microbyte	B C	MB	£5.95	Q Bert	Gm	Superior Software	B C	SE	£7.95	
Perspective	Ut	Aztec	B C	AZ	£6.50	Quick Thinking!	Ed	Mirror	B,E C	MR	£6.95	
Picasso GS	Ut	Odyssey	B C	OG	£4.50	Railroader	Ed	Stell	B C	ST	£7.95	
Picsave	Ut	Hexagon S/W	A,B C	JA	£6.00	Rally A/B	Ed	Longman	B C,D	LM	£9.95, £12.95	
Pick-a-Word	Ed	Ega Beva	B C	EB	£11.95	Record Changer	Do	A.J.	B C,D	AJ	£19.95, £24.95	
Picture Book	Ed	LTS	B D	LT	£14.95	Record Keeper	Ut	BBC Pubs	B C	KB	£13.80	
Picture Maker	Ut	Acornsoft	B,E C	AL	£9.95, £9.20	Recover	Ut	Baksoft	A,B C	BK	£6.00	
Picture Maths	Ed	A.J.	B C,D	AJ	£9.95, £12.95	Readability	Ed	Arnold-Wheaton	B C	AW	£6.00 + VAT	
Picture Puzzles	Gm	Ludinski	B,E C	KA	£6.50	Readability	Ed	GSN	B C,D	GS	£8.00, £9.00	
Pirate Adventure	Gm	Adventure International	B,E C	AI	£7.95	Return to Eden	Gm	Level 9	B C,D	CU	£9.95, £11.95	
Pirate Planes	Ed	Chalksoft	B C	CH	£9.25	Report	Ed	GSN	B D	GS	£38.50	
	Gm	A&F	B C	GE	£8.00	Revenge of Zopr	Gm	Kansas	B C	KA	£9.50	
						Reversi	Gm	Microbyte	B C	MB	£5.95	
						Reversi	Gm	Superior Software	B,E C	SE	£6.95	
						Reversi	Gm	Kansas	B C	KA	£6.25	
						Reversi 1	Gm	Silverlind	B C	SL	£6.95	
							Gm	Micro Power	A,B C	GK	£5.95	

Reversi 2	Gm	Micro Power	B	C	GK	£5.95	Signals & Magic	Ed	HRH	B	C,D	HH	£4.80
Ripple Tank	Ed	RJE Software	B	C	RJ	£7.95		Ed	Acornsoft	A,B	C	AL	£11.90
River Adventure	Ed	Pee Bee	B	C,D	PB	£9.50, £12.00	Signs Silversoft Index	Ed/Do/BS	Silversoft	B	D	SV	£24.99
Riverworld Adventure	Gm	O.K.	B	C	OK	£10.00	Simonsoft Sprites 2	Ut	Simonsoft	B,E	C,D	SI	£12.95
Road Racer	Gm	Superior Software	B	C	SE	£7.95	Simple Word Processor	Do	A.J.	B	C,D	AJ	£9.95
Road Runner	Gm	Superior Software	B	C	CH	£7.95							£14.95
Road Safety	Ed	Bryants	A,B	C	HW	£4.85	Simple Queues	BS	Micropax	B	C	MP	£7.95
Robotic Sums	Ed	GED Software	B	C	GD	£4.50	Simulation Surgery	BS	Micropax	B	C	MP	£12.95
Robot	Gm	Miking S/W	B	C	KC	£4.95	Simulation-Carlton Trucks	BS	Micropax	B	C	UP	£12.95
Rocket Raid	Gm	Acornsoft	B	C	AL	£9.95	Sinbad	Gm	Virgin	B	C	VG	£7.95
Rocky	Gm	Superior	B	C	SE	£7.95	6502 Development System	Ut	Acornsoft	B	D	AL	£49.85
ROM Read	Ut	A.J.	B	C,D	AJ	£8.95, £11.95	Sixers	Gm	O.I.C.	B,E	C	OI	£6.95
Roman Empire	Gm	Lothlorien	B	C	LO	£6.95	Skwosh	Gm	Miking S/W	B	C	KC	£3.95
Romeo and Juliet	Ed	Penguin	B,E	C	PE	£5.95	Sliding Block Puzzles	Gm	Acornsoft	B	C	AL	£9.95
Roulette	Gm	Micro Power	A,B	C	GK	£5.95	Sliding Block Puzzle	Ed	Ega Beva	B	C	RB	£9.95
Row of Four	Gm	Software For All	B	C	KN	£6.95	Ski Slalom	Gm	R.H. Electronics	B	C	RH	£8.95
Royalty Quiz	Do	Acornsoft	B	C	AL	£12.65	Sir Francis Drake Adventure	Ed	LCL	B,E	C	LA	£6.50
Rubble Trouble	Gm	Micro Power	B	C	GK	£7.95	Slicker Puzzle	Gm	G.K. Tronics	B	C	DK	£6.95
Run Rabbit Run	Ed	Hill MacGibbon	B	C	HM	£6.95	Snail Trail	Gm	R.H. Electronics	B	C	RH	£4.95
Russian Irregular Verbs	Ed	Carsondale	B	C	CD	£21.00	Snake	Gm	Kansas	B	C	KA	£8.50
Russian Text Fill	Ed	Carsondale	B	C	CD	£11.96	Snake Pit	Gm	Computer Concepts	B	C	GJ	£6.67
SAS Commander	Gm	Comsoft	B,E	C	CM	£4.95	Snapper	Gm	Ppostern	B	C	PT	£6.95
Savage Island 1/2	Gm	Adventure International	B,E	C	AI	£7.95	Snig	Gm	Acornsoft	B,E	C,R	AL	£9.95, £9.20
Savage Pond	Gm	Starcade	B	C,D	SC	£8.95	Snooker	Gm	Computercat	B	C	CC	£6.75
Scales and Decimal Estimation	Ed	RJE Software	B	C	RJ	£3.95	Snookey	Gm	Visions	B	C	VI	£8.95
Scanning/Word Finder	Ed	Heinemann	B	C	HE	£9.25 + VAT	Snookey	Gm	Acornsoft	B	C	AL	£9.95
School Text	Ed	GSN	B	C,D	GS	£14.00, £15.00	Snookey	Gm	Beebug	B	C	BE	£7.50
Science 1	Ed	Shards	B,E	C,D	SH	£6.95, £9.95	Snowball	Gm	Level 9	B	C	CU	£9.90
Science Pack	Ed	Dial	B	C,D	DL	£4.95, £6.50	Son of Blagger	Gm	Alligata	B	C	AG	£7.95
Science Fiction Quiz	Do	Acornsoft	B,E	C	AL	£12.65	Sort Animator	Ed	International	B,E	C	AI	£7.95
Sets and Operators	Ed	Shiva	B	C	SV	£14.95	Sort M/C	Ut	OIC	B	C	OI	£6.50
737 Simulator Flight	Gm	Salamander	B,E	C	SA	£9.95	Sort B/A	Ut	Micro-Aid	A,B	C	IZ	£1.00
Scramble	Gm	Bug-Byte	A,B	C	BB	£6.95	Sortout	Ed	Micro-Aid	A,B	C	IZ	£1.00
Scred	BS	Stable	B	C	CS	£18	Spacehawks	Gm	Highlight	B	C,D	HI	£6.00, £7.00
Scribe	BS	Merlin	B	C	MN	£29.95	Space Adventure	Gm	Computer Concepts	B	C	GJ	£7.80
Scribe II	Do	Alligata	B,E	C,D	SY	£9.95, £14.95	Space Adventure	Gm	Virgin Games	B	C	VG	£7.95
Sea Cliff Erosion	Ed	Cambridge Micro	B	C,D	CM	£15.00 + VAT	Space Adventure	Ed	LTS	B	C,D	LT	£11.95
Sea Lord	Gm	Bug-Byte	B	C	BB	£7.50	Space Cab	Gm	Kansas	B	C	KA	£7.25
Sea Wolf	Gm	Optima	B	C	OP	£8.95	Space Fighter	Gm	Superior Software	B	C	SE	£7.95
Search for the Jewels	Gm	SJG Soft	B	C	SJ	£8.95	Space Invaders	Gm	Bug-Byte	B	C	BB	£5.50
Searchbas	Ut	Micro-Aid	A,B	C	IZ	£1.95	Space Pirates	Gm	Bug-Byte	A,B	C	BB	£5.50
Secret Mission	Gm	Adventure International	B,E	C	AI	£7.95	S-Pascal	Ut	Acornsoft	B	C,D	AL	£16.85, £19.90
Seed Germination	Ed	Garland Comp.	B	C	JX	£18.82	Spacex	Ed	4MAT	B	CD	FM	£8.65, £10.40
Seige	Gm	Postern	B	C	PT	£6.95	Spaceguard	Gm	MP Software	B	C	MP	£6.50
Sentence Maker	Ed	Arnold-Wheaton	B	C	AW	£9.95 + VAT	Space Hi-way	Gm	Amcom	B	C	AO	£7.45
Sequences	Ed	Chalksoft	B	C	CH	£5.95	Space Kingdom	Gm	Software For All	B	C	KN	£7.95
737 Flight Simulator	Gm	Salamander	B,E	C	SA	£9.95	Space Maze	Gm	Micro Power	B	C	GK	£7.95
Shirley Conran's Magic Garden	Do	Acornsoft	B	C	AL	£9.95	Spaceflight	Gm	Miking S/W	B	C	KC	£7.95
Sheepdog	Ed	Longman	B	C	LM	£9.95, £12.95	Space Warp	Gm	Bug Byte	B	C	BB	£11.50
Sheepdog Trials	Ed	Bryants S/W	B	C	HW	£4.80	Space Fighter	Gm	MP S/W	B	C	JZ	£8.50
Share Analyser	BS	Synergy	B,E	C,D	SY	£14.95, £19.95	Space Fighter	Gm	Superior S/W	B	C	KH	£7.00
Shoot/Top Shot	Ed	Soft Centre	B	C	SN	£6.00	Space Games Pack 1	Gm	Futura S/W	A,B	C	JC	£3.99
Shootout	Gm	MP S/W	B	C	JZ	£5.00	Space Games Pack 2	Gm	Futura S/W	A,B	C	JC	£3.99
Seek	Gm	Micro Power	A,B	C	GK	£6.95	Space Games Pack 3	Gm	Futura S/W	A,B	C	JC	£4.99
Sentence Sequencing	Ed	Acornsoft	A,B	C	AL	£11.90	Space Games Pack 4	Gm	Futura S/W	A,B	C	JC	£4.99
Sentence Shaker	Ed	GED Software	B	C	GD	£4.50	Space Station Alpha	Gm	Icon	B,E	C	IO	£6.95
747	Gm	Doctor Soft	B	C	DO	£7.95	Space Jailer	Gm	Micro Power	B	C	GK	£6.95
747	Gm	D.A.C.C.	B	C	DC	£9.95	Space Journey	Ed	Honeyfold	B,E	C,D	HO	£9.95, £11.95
Shadowfax	Gm	Postern	B	C	PT	£6.95	Space Ranger	Gm	Microbyte	B	C	MB	£7.95
Shape Generator	Ut	Software for All	B	C	KN	£11.50	Space Station Alpha	Gm	Icon	B,E	C	IO	£7.95
Shapes Package	Ed	GED Software	B	C	GD	£8.00	Spaceman Sid	Gm	English Software	B,E	C	EN	£7.95
Shape Snap	Ed	Ega Beva	B	C	EB	£11.95	Space Trek	Gm	Program Direct	B	C	NP	£5.99
Shop Keeper	Ed	Heinemann	B	C	HE	£9.25 + VAT	Space Pirates	Gm	Bug Byte	A,B	C	KP	£8.00
Shopping	Ed	GED Software	B	C	GD	£4.50	Spanish Tutor A/B	Ed	Kosmos	B,E	C	KM	£9.95
Shrinking Professor	Gm	A&F	B	C	GE	£8.00	Special Agent	Ed	Heinemann	B	C	HE	£9.25 + VAT
Shuttle	Gm	Molimerx	B	C	MX	£14.95	Speechparts	Ed	Bryants S/W	B	C	HW	£4.88
Shuttle Pilot	Gm	Oakleaf	B	C	OA	£9.95	Speed and Light	Ed	Acornsoft	A,B	C	AL	£11.90
							Spellbound (lrg/hrq)	Ed	GSN	B	C,D	GS	£14.00, £15.00
							Spellcheck (Wordwise)	Ut	Beebug	B	D	BE	£19.00
							Spellcheck	Ed	Edsoft	B	C,D	ES	£4.95
							Spelling	Ed	Soft Centre	B	C	SN	£6.00
							Spell 7 + /9 +	Ed	Primaru	B	C,D	PP	£5.95, £7.95

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
Spelltest	Ed	Bryants	A,B	C	HW £4.85
Spellings	Ed	ECL	B	C	EL £5.99
Spiderman	Gm	Adventure International	B,E	C	AI £7.95
Spitfire Command	Gm	Superior	B	C	SE £7.95
Spitfire Flight Simulator	Gm	Alligata	B	C	SY £7.95
Sphinx Adventure	Gm	Acornsoft	B,E	C	AL £9.95, £9.20
Splashdown	Ed	Highlight	B	C,D	HI £6.00, £7.00
Splooch	Ed	Highlight	B	C,D	HI £6.00, £7.00
Spreadsheet	Ed	Contex	B	C	CX £7.99
Sprites	Ut	Beebug	B	C,D	BE £10.00, £12.00
Spy	Ut	System	B	C	SY £24.15
Squash	Ut	Pica	B	C,D	PI £9.75, £11.95
Squash	Gm	Aztec S/W	A,B	C	IB £5.50
Squeeze	Ed	ASK/Acornsoft	B,E	C,D	AL £9.95, £11.50
Staircase Stampede	Gm	Comsoft	B	C,D	CM £7.50, £9.50
Standards and Variances	Bs	Micropax	B	C	MP £7.95
Starbattle	Gm	Kudusoft	B	C	KU £5.50
Star Battle	Gm	Superior	B	C	SE £7.95
Star Gazer	Ed	Heinemann	B	C	HE £9.25 + VAT
Starlander	Gm	Kudusoft	A,B	C	KU £3.50
Star Patrol	Gm	Kudusoft	B	C	KU £6.50
Starship Command	Gm	Acornsoft	B,E	C,R	AL £9.95, £9.20
Star Seeker	Do	Mirrorsoft	B	C,D	MR £9.95, £12.95
Star Trader	Gm	FBC Systems	B	C	FB £9.50
Star Striker	Gm	Superior	B	C	SE £7.95
Starfighter	Gm	FBC Systems	B	C	FB £7.50
Star Trek Adventure	Gm	Superior Software	B	C	SE £7.95
Star Trek	Gm	Micro Power	A,B	C	GK £5.95
Star Maze	Gm	Database Software	B	C	NU £7.50
Star Patrol	Gm	Kudusoft	B	C	KU £6.50
Startrek / Candy Floss	Gm	I.J.K.S/W	A,B	C	IT £5.95
Star Trek	Gm	Hexagon S/W	A,B	C	JA £5.50
Starpac	Ed	Micro-Aid	B	C	IZ £9.95
Starter Word Splits	Ed	Sulis	B	C	SU £9.95
Stats 1	Bs	ME & P Products	A,B	C	KK £15.00
Statistics 1/2	Ed	Chaddington	B,E	C,D	CN £10.00
Stock	Ed	System	B	C,D	SY £14.95
Stock Car	Gm	Micro Power	B	C	GK £7.95
Stock Control	Bs	Acornsoft	B	D	AL £24.95
Stock Control	Bs	Gemini	B	C	GM £19.95
Stock Control, classification	BS	Micropax	B	C	MP £7.95
Stock Control-EOQ	BS	Micropax	B	C	MP £7.95
Stock Control-Roq and Rol	BS	Micropax	B	C	MP £7.95
Stockmarket	Gm	Micro-Aid	B	C	IZ £4.95
Stockmarket	Gm	ASP Software	B,E	C	AS £6.99
Story	Ed	HRH	B	C,D	HH £5.65, £6.95
Story A - Spanish Gold	Ed	Chalksoft	B	C	CH £7.95
Storybuilder	Ed	Bryants S/W	B	C	HW £4.85
Stock Valuation	Bs	Micropax	B	C	MP £7.95
Story	Ed	H&H	B	C,D	HH £7.50, £9.50, £10.50
Stranded	Gm	Superior	B,E	C	SE £7.95
Strange Odyssey	Gm	Adventure International	B,E	C	AI £7.95
Stunt Flyer	Gm	Phoenix Software	B	C	PH £6.99
Subkiller	Gm	D.K. Tronics	B	C	DK £6.95
Submarines	Ed	GED Software	B	C	GD £4.00
Suffixes	Ed	Golem	B	C	OB £8.05



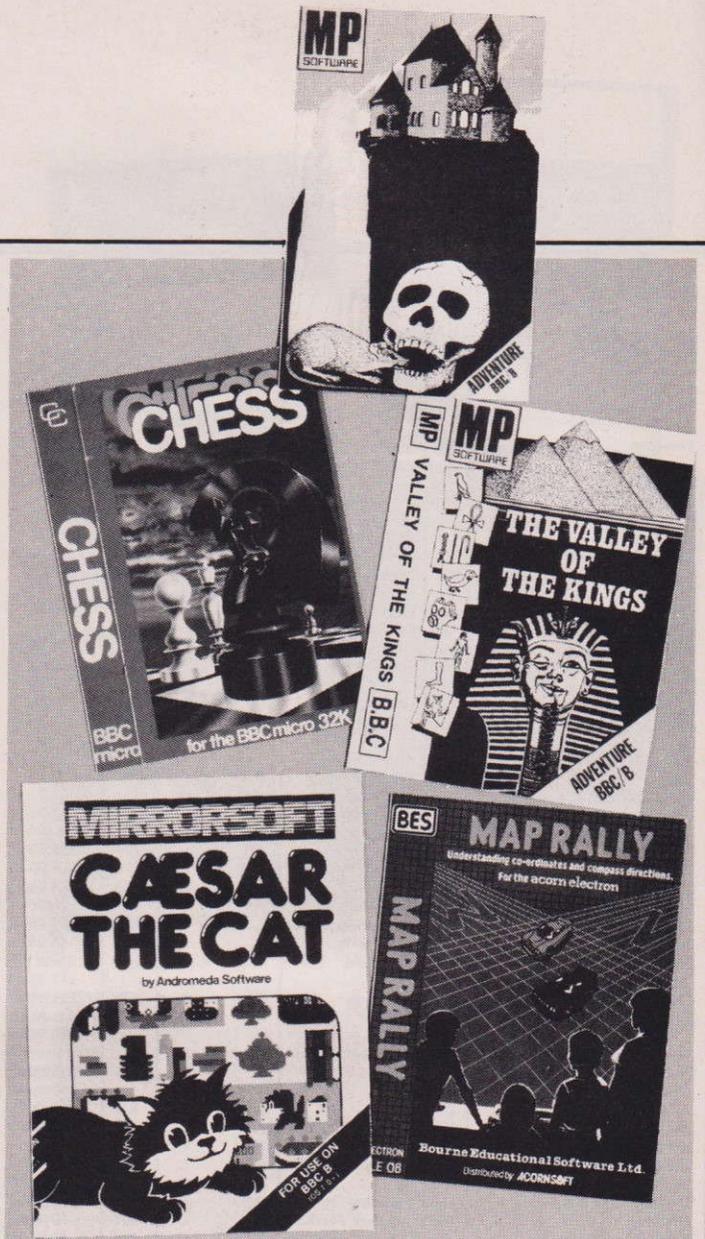
Sum Fun	Ed	GSN	B	C	GS	£8.00, £9.00
Summit (hrg/lrg)	Ed	GSN	B	C,D	GS	£8.50, £9.50
Super Fruit	Gm	Simonsoft	B,E	C,D	SI	£5.95
Super Fruits	Gm	D.K. Tronics	B	C	DK	£6.95
Super Invaders	Gm	Acornsoft	B	C	AL	£9.95
Superlife	Ed	Golem	B,E	CD	OB	£4.95, £6.95
Supersquare	Ed	GSN	B	C,D	GS	£8.50, £9.50
Superplot	Ut	Beebug	B	C	BE	£10.00
Super Spell	Ed	Aztec	A,B	C	AZ	£5.50
Supergolf	Gm	Squirrel Software	B	C	SS	£7.50
Super Hangman	Gm	I.J.K. S/W	B	C	IT	£3.95
Survival	Ed	System	B	C	SY	£14.95
Survivor	Gm	MP Software	B,E	C,D	MP	£7.48, £10.50
Swag	Gm	Micro Power	B,E	C,D	GK	£6.95
Swamp Monsters	Gm	M P Software	B	C	JZ	£6.50
Swamp Monsters	Gm	M P Software	B	C	JZ	£6.50
Swordmaster	Gm	Micrograf	B,E	C,D	MF	£7.95, £10.95
Tables Test	Ed	Bryants S/W	B	C	HW	£4.88
Tables	Ed	Bryants	A,B	C	HW	£4.85
Tables	Ed	ECL	B	C	EL	£5.99
Table Sums	Ed	Griffin	B	C	GR	£9.95
Table Adventures	Ed	A.S.K	B	C	AK	£9.95
Tables Wizard	Ed	Hill MacGibbon	B	C	HM	£6.95
Take It Away	Ed	Arnold-Wheaton	B	C	AW	£6.00 + VAT
Talkback	Ed	Acornsoft	E,B	C,D	AL	£9.95, £11.50
Tank Attack	Gm	Gem Software	B	C	GC	£7.95
Tanks	Gm	Salamandar	B	C	SA	£7.95
Tape Catalogue	Ut	A.J.	B	C	AJ	£5.95
Tape Copy	Ut	Davansoft	A,B	C	NX	£7.50
Tarzan	Gm	Alligata	B	C	AG	£7.95
Taxcalc	Ut	BBC Pubs	B	C	KB	£17.25
Teacher in the Custard	Ed	Pee Bee	B	C,D	PB	£8.50, £11.00
Teacher's Toolkit	Ed	Wida Software	B	C	FY	£30.00
Teletext Pack	Ut	Beebug	B	C,D	BE	£10.00, £12.00

Temperature Control Simulation	Ed	Acornsoft	B	C,D	AL	£9.95, £11.50	Toolstar Touch Typist Touch Type Tutor	Ut	PACE	B	R	PA	£34.00
Ten Little Indians	Gm	Digital Fantasia	B	C	NT	£10.29	Towering Inferno	Ed	Computercat	B	C	CC	£9.95
Tense French	Ed	Sulis	B	C	SU	£9.95	Tower of Alos	Ed	Technical Education	A,B	C	TE	£4.95
Tessalations	Ed	Cambridge Micro	B	D	CM	£25.00 + VAT	Towers	Gm	Sulis	B	C	SU	£9.95
Tess	Ed	HRH	B	C,D	HH	£6.55, £7.85	Town Planner	Gm	A&F Software	A,B	C	GE	£6.90
Tesselator	Ut	Addison-Wesley	B	C	AN	£21.95 + VAT	Towns of Britain	Ed	Bryants	A,B	C	HW	£4.85
Test Match	Gm	CRL	B	C	CO	£7.95	Townstest	Ed	Heinemann	B	C	HE	£9.25 + VAT
Tetrapod	Gm	Acornsoft	B	C,D	AL	£9.95, £11.50	3-D Ice Hockey	Ed	Aztec S/W	A,B	C	IB	£6.50
Text Grader	Ed	Hutchinson	B	C	HN	£28.75	3 in 1	Ed	Silverlind	B	C	SL	£6.50
Text Print Extension	Ut	Ratco Soft	A,B	C	RA	£2.00	Trafalgar	Gm	Computersmith	B	C	LC	£5.50
Text Processing Pack	Bs	Eduquest	B	C	NW	£10.00	2002	Gm	R. H. Electronics	A,B	C	RH	£7.50
Theatre Quiz	Do	Acornsoft	B,E	C	AL	£12.65	Trailblazer	Gm	Squirrel Software	B	C	SS	£8.00
The Animator	Ut	Screenplay	B	C	SC	£11.95	Tramix	Gm	Superior Software	B	C	SE	£7.95
The Count	Gm	Adventure International	B,E	C	AI	£7.95	Tree of Knowledge	Ed	Arnold-Wheaton	B	C	AW	£12.95 + VAT
The Complete Cocktail Maker	Do	Acornsoft	B	C,D	AL	£9.95, £11.50	Trek	Gm	D. K. Tronics	B	C	DK	£6.95
The Horse Lord	Gm	Century	B	C	CY	£7.95, £12.95 + book	Triangles Revenge	Ed	Acornsoft	A,B,E	C	AL	£9.95
The Hulk	Gm	Adventure International	B,E	C	AI	£7.95	Triangles/Shapes	Gm	Micrograf	B,E	C,D	MF	£7.95, £10.95
The Mystery Fun House	Gm	Adventure International	B,E	C	AI	£7.95	Tripute	Ed	Soft Spot	B	C	SF	£6.95
The Seventh Star	Gm	Acornsoft	B	C	AL	£9.95	Triangle Tutor	Ed	Primary	B	C,D	PP	£5.95, £7.95
The Frog	Gm	James Hager	B	C	IV	£6.50	T-Squared Timetabling	Gm	Dial	B	C,D	DL	£4.95, £6.50
The Golden Baton	Gm	Digital Fantasia	A,B	C	NT	£8.95	Turtle Graphics	Ed	Pee Bee	B	C,D	PB	£6.50, £9.00
3-D Mouse Maze	Gm	Rainbow S/W	B	C	KS	£3.50	Turbo Compiler	Ed	Yorke House	B	D	YH	£25.00
3-D Maze	Gm	Hexagon S/W	A,B	C	JA	£6.00	Turt Graphics	Ut	Salamander	B	C	SA	£9.95
3D Maze	Gm	Earthshock S/W	A,B	L	KI	£3.00	Twelfth Night	Ed	Acornsoft	B	C,D	AL	£9.95, £11.50
3D Maze	Gm	I.J.K. S/W	B	C	IT	£3.95	Twenty Crosswords	Gm	Penguin	B,E	C	PE	£5.95
The Alien Planet	Ed	Honeyfold	B,E	C,D	HO	£9.95, £11.95	Twin Kingdom Valley	Gm	NEC	B	C	NC	£6.90
The Basic Lesson	Ed	Ega Beva	B	C	EB	£11.95	Type Invaders	Ed	Bug-Byte	B,E	C	BB	£9.50
The Bunsen	Ed	Scholar	B	C,D	SC	£6.00, £8.00	Typing Tutor	Ed	Carswell	B	C	CR	£8.95
The Computer Programme Programs Vol 2	Do	B.B.C.	B	C	KB	£10.00	Ultima-File	Ed	Carswell	B	C	CR	£6.95
The Computer Programme Programs Vol 1	Do	B.B.C.	A,B	C	KB	£10.00	Ultrascale	Dm	Ixon	A,B	C	IN	£7.50
The Golden Baton	Gm	Digital Fantasia	A,B	C	NT	£10.29	Understanding Your Weather	Bs	BBC Publications	B	R	KB	£74.95
The Graphics Lesson	Ed	Ega Beva	B	C	EB	£11.95	Unimo	Ed	Heinemann	B	C	HE	£9.25 + VAT
The Generators	Gm	Quicksilva	B	C	QS	£6.95	Utilities Package	Gm	Dial	B	C,D	DL	£3.95, £5.50
The Halls of Time	Gm	OK	B	C	OK	£10.00	Unorigional Games	Ut	Salamander	B	C	SA	£9.95
The Lemming Syndrome	Gm	Dynabyte	B,E	C	DB	£7.95	Unorthodox Engineers	Gm	McKeran	A,B	C	MK	£2.00
The Frog	Gm	Software For All	B	C	KN	£7.95	Util-1	Gm	Mosaic	B	C	MD	£9.95
The Guns of Navarone	Gm	D.A.C.C.	B	C	DC	£7.95	Utility EPROM	Ut	Gem Software	B	C	GC	£9.95
The Mine	Gm	Micro Power	B	C	GK	£7.95	Utility Pack	Ut	A.J.	B	R	AJ	£19.95
The Theorem of Pythagoras	Ed	Small School	B	C	SM	£6.95	Utilities	Ut	Computersmith	B	C	LC	£5.50
The Ring of Time	Gm	Kansas	B	C	KA	£9.50	Utilities	Ut	Qualitysoft	A,B	C	QT	£4.00
The Typing Master	Do	Anthony Ashpitel	B	C	AA	£20.00	Utilities	Ut	ASD Ltd	B	C	AS	£5.75
The Wizard of Akyrz	Gm	Digital Fantasia	B	C	NT	£10.29	Utilities	Ut	Golem	A,B,E	CD	OB	£5.95, £7.95
The Garden	Ed	Clares	A,B	C	CL	£6.95	Utility A	Ut	Micro-Aid	A,B	C	IZ	£5.95
The Time Machine	Gm	Digital Fantasia	A,B	C	NT	£8.95	Utility Pack	Ut	Ega Beva	B	C	EB	£7.95
There	Ed	Golem	B	C	OB	£8.05	Vader Raid	Gm	FBC Systems	B	C	FB	£7.50
3-Deep Space	Gm	Postern	B	C	PT	£7.95	Valley	Gm	ASP Software	B,E	C	AS	£11.45
3D-Tankzone	Gm	Dynabyte	B	C	DB	£8.95	Valley of the Pharoahs	Gm	FBC Systems	B	C	FB	9.50
Time	Ed	Stell	B,E	C,D	ST	£7.95	Varkman/Meanies	Gm	Aardvark Software	A,B	C	IU	£4.00
Timeman Two	Ed	Bourne	B,E	C	BO	£8.97, £10.98	Vampire Castle	Gm	Micrograf	B	C,D	MF	£6.95, £9.95
Timeman One	Ed	Bourne	B,E	C,D	B	£8.97, £10.98	VASM	Ut	Vida	B	R	VR	£35.00 + VAT
Time Series Analysis	Bs	Micropax	B	C	MP	£7.05	VAT Traders Ledger	Bs	Harris	B	D	HM	£21.50
Timetable Clock	Ed	Primary	B	C,D	PP	£5.95, £7.95	Velocity of Light	Ed	GSN	B	C,D	GS	£14.00
Timetabling OPT 1-6	Ed	Hutchinson	B	C	HN	£17.25	View Printer Drivers	Ut	Acornsoft	B	C	AI	£9.95
Timetabling TT 1-6	Ed	Hutchinson	B	C	HN	£17.25	View Printer Driver	Ut	Alligata	B	C	SY	£7.95
Time Traveller	Ed	Sulis	B	C	SU	£9.95	Views/Faces	Ed	Primary Programs	B	C	PP	£3.95
Timetrek	Gm	Micro Power	B,E	C	GK	£6.95	Viewindex	Ut	Acornsoft	B	D	AL	£14.95
Tiny Pascal	Ut	H.C.C.S.	A,B	R	HC	£59.00	Viewsheet	Bs	Acornsoft	B	R	AL	£59.80
Titrations	Ed	System	B	C	SY	£14.95	Viking England 1-4	Ed	Acornsoft	B	C,D	FE	£45.95
Tomb Adventurer	Ed	Heinemann	B	C	HE	£9.25 + VAT	Viper	Gm	R. H. Electronics	B	C	RH	£8.95
Thombs of Arkenstone	Ed	Arnold-Wheaton	B	C	AW	£15.00 + VAT	Vocab	Do	Beebug	B	C	BE	£10.00
Tom Thumb Adventure	Gm	OK	B	C	OK	£10.00	Vogon Attack	Gm	Micromail	B	C	OE	£6.33
Toolbox	Ut	BBC Pubs	B	C	KB	£21.00	Volcano	Gm	Acornsoft	B	C,D	AL	£9.95, £11.50
Toolkit	Ut	Beebug	B	R	BE	£27.00	Vortex	Gm	Software Invasion	B	C,D	IS	£7.95, £11.95

CONTINUED OVER

SOFTWARE LISTING

Title	Type	Manufacturers	Memory	Software Supplier	Price
Voodoo Castle	Gm	Adventure International	B,E C	AI	£7.95
Vu-calc	Bs	Psion	B C	PS	£14.95
Vu-file	Bs	Psion	B C	PS	£14.95
Vu-type	Ed	BBC Pubs	B C	KB	£16.10
Wall	Gm	Micro Power	B C	GK	£5.95
Watch Your Weight	Do	Acornsoft	B C,D	AL	£9.95, £11.50
Watts in Your Home	Ed	Cambridge Micro	B C,D	CM	£13.95 + £1.62
Weather Station	Ed	Arnold-Wheaton	B C,D	AW	£15.00 + VAT
Web Runner	Gm	Alligata	B C	SY	£7.95
Whatsit	Ed	Ed. Soft	B C	ES	£4.95
What's it Worth?	Ed	Arnold-Wheaton	B C	AW	£10.00 + VAT
What's to Eat?	Do	Shumwari	B C,D	SH	£10.45, £13.45
Where?	ED	Primary Programs	B C	PP	£3.95
Where?	Ed	Micro Power	B,E C	GK	£6.95
Where...Their	Ed	Primary	B C,D	PP	£5.95, £7.95
Which Salt?	Ed	Micro Power	B C	OK	£6.95
White Barrows	Gm	ASP Software	B,E C	AS	£6.99
White Knight	Gm	BBC Pubs	B C	KB	£11.50
Whitewash	Gm	Amcom	B C	AO	£5.95
Whole Number Arithmetic	Ed	RJE Software	B C	RJ	£7.95
White Barrows Conquering Everest	Gm	ASP Software	A,B C	AS	£11.45
Wilt-Spelling	Ed	Longman	B C,D	LM	£9.95, £12.95
Wizard	Gm	Quicksilva	B C	QS	£6.95
Wizard's Challenge	Gm	Micro Power	B C	GK	£7.95
Wolfpack	Gm	Doctor Soft	B C	DO	£7.95
Woodland Terror	Gm	MP	B,E C,D	MP	£7.48, £10.50
Woodstock	BS	Micropax	B D	MP	£29.50
Wordflash	ED	Ed. Soft	B C	ES	£4.95
Word Fun	Ed	GSN	B C,D	GS	£8.00, £9.00
Wordgames	Ed	Griffin	B,E C	GR	£9.95
Word Hang	Ed	Bourne	B,E C,D	BO	£8.97, £10.98
Word Hunt	Ed	Acornsoft	A,B C	AL	£11.90
Wordmaster	Ed	Sulis	B C	SU	£9.95
Word Master	Ut	R.H. Electronics	B C	RH	£9.95
Word Mover	Do	BBC	B C	KB	£9.95
Word Perfect	Ut	Doctor Soft	B C	DS	£9.95
Wordpower	Ed	Sulis	B C	SU	£9.95
Word Processor	Bs	Gemini	B C	GM	£19.95
Wordprocessor	Ut	ASD Ltd	A,B C	AS	£5.75
Wordsmith	Do	A.J.	B C,D	AJ	£19.95, £24.95
Word Tray Wizard	Ed	Hill MacGibbon	B C	HM	£6.95
What's Your Reason?	Ed	Arnold-Wheaton	B C	AW	£10 + VAT
Wordscan	Gm	Dial	B C,D	DL	£6.50, £8.00
Workshop	Ed	Acornsoft	B,E C,D	AL	£9.95, £11.50
Word Sequencing	Ed	Acornsoft	A,B C	AL	£11.90
Wordspell	Ed	Griffin Software	BE C	GR	£9.95
Words, Words, Words	Ed	A.S.K	B C	AK	£9.95
Wordsworth	Ut	Ian Copestake	B C	IC	£17.25
Wordy	Ut	Odyssey	B C	AS	£5.75
Word Sequencing	Ed	Acornsoft	A,B C	AL	£11.90
Word-Square	Gm	Dial	B C,D	DL	£4.95, £6.50
Wordsworth	Ut	Ian Copestake	B C	IC	£17.25
Wordy	Ut	Odyssey	B C	OG	£4.50



Worded	Ed	Processor Applications	B C	AP	£5.95
Wordpro	Bs	IJK Software	B C	IT	£10.50
Wordscan	Bs	Dial	B C	AD	£12.00
World Geography	Ed	Superior	B,E C	SE	£7.95
World Geography	Ed	Micro Power	B C	GK	£6.95
World Geography	Ed	4MAT	B CD	FM	£8.65, £10.40
Worldwise	Ed	Bourne	B,E C,D	BO	£8.97, £10.98
Write On	Ed	Arnold-Wheaton	B C,D	SY/ AW	£9.95, £12.00 + VAT
Xanagrams	Gm	Postern	B C	PT	£6.95
X CAL	Ut	H.C.C.S.	A,B R	HC	£65.50
Your Adventure	Ed	LTS	B C,D	LT	£10.95
Zarm	Gm	Micropower	B C		£7.95
X CAL	Ut	H.C.C.S.	A,B R	HC	£65.00
Your Adventure	Ed	LTS	B C,D	LT	£10.95
Zany Kong	Gm	Solar Soft	B C	SO	£6.50
Zombie Island	Gm	Software For All	B C	KN	£6.95
Zombies	Gm	Micro Power	A,B C	GK	£3.95
Zorakk the Conqueror	Gm	Icon	B,E C	IO	£6.95

A & B'S NATIONWIDE DEALERGUIDE

01 - 437 0699

CHESHIRE

FAIRHURST INSTRUMENTS LTD

Complete range of BBC equipment including Econets, Printers, Plotters, Colour Monitors, Graphic Tablets, Upgrades, Disc Drives, Disc Controller chips, Torch Computers, Z80 Discpack. Extensive range of Software.
Dean Court, Woodford Rd., Wilmslow, Cheshire Tel: 0625 533741

northern computers

TEL: 0928 35110

Churchfield Road, Frodsham, Cheshire WA6 6RD
 BBC, ACORN, ELECTRON
 Open 9-6.30 6 days

DEVON

TOTNES COMPUTER SHOP

4 The Plains, Totnes, Devon.
 Tel: 0803 866095

Computer learning centre. Micro computers for home and business plus peripherals/software and accessories.

MAIL ORDER ENQUIRIES WELCOME

ESSEX

ESTUARY SOFTWARE PRODUCTS

Estuary now have BBC's in stock together with a wide range of software and accessories. Complete spares kit in stock. The home computer centre.

261 Victoria Ave., Southend-on-Sea.
 Phone: (0702) 343568

KENT

MEDWAY COMPUTERS LTD.

- BBC authorized dealers and service centre
- Torch Z80 disc pack available
- Our own credit facilities
- Access and Barclaycard welcome

We are open 9 till 5.30 six days a week.
141 New Rd., Chatham, Kent ME4 4PT.
 TEL: (0634) 826080

LANCASHIRE

HCCS MICROCOMPUTERS

120/122 Darwin Street, Blackburn, Lancs
 Tel: 0254 672214

Open 9am to 5.30pm Mon-Sat (except Thurs 9am to 12.30)

ACORN/BBC DISTRIBUTOR

Forth and Pascal for BBC Micro and for Epson HX20. Printers, Disc Drives, Consumables.

LEICESTERSHIRE

Leigh Computer Systems

NEVER KNOWINGLY UNDERSOLD
 Official Acorn/BBC dealer and service centre
7 Coventry Road, Hinckley, Leics LE10 1QF
 Tel: 0455 612139

BBC Model B, Electron, Disk drives - Cumana Disc drives from CSX £149. Phone for prices larger disc drives. Shugart 100K singles, BBC discs, TV (monitors, accessories & software). Printers - Epson FX80, RX80 and many more. Also Sinclair agents, Oric agents and the Dragon service centre.

MICRO-MAYS

OFFICIAL ACORN/BBC DEALER

BBC Model B, Electron. Printers: Epson FX80, RX80, Shinwa CP80, Seikosha GP100, Star DP510. Disk Drives: Teac 100K single, twin, Shugart 100K singles, BBC Disks, TV (monitors, accessories and software). Also agents for Atari, Commodore, Sinclair, Oric and Dragon.
MAYS COMPUTERS, 57 Churchgate, City Centre, Leicester LE1 3AL (0533) 22212

LONDON

THE VIDEO PALACE

Londons largest home computer store. Model B and Torch. ZX and Commodore 64 stockists. Full range of games software.

100 Oxford Street, London W1
 Tel: 01-637 0366

PAUL ELECTRICAL LTD

250-252 Grand Drive, Raynes Park, SW20.
 Tel: 01-542 6546

Official Acorn dealer. Full range of Cumana and Disc Drives in Stock.

ALSO TRADING AS

Woods Radio, 257 Lavender Hill, SW11
 01-228 2682

Supply and Repairs to Education and Local Councils

GREATER MANCHESTER

Leigh Computer Systems

NEVER KNOWINGLY UNDERSOLD

Official Acorn/BBC dealer and service centre **75 Cross Street, Sale.** BBC Model B, Electron, Disk Drives - Comana disc drives from CSX £139. Phone for prices of larger disc drives. Shugart 100K singles, BBC discs, TV (monitor accessories & software). Printers - Epson FX80, RX80 and many more. Also Sinclair agents, Oric agents and the Dragon service centre.

MIDDLESEX

TWICKENHAM COMPUTER CENTRE

Acorn • BBC • distributors and Apricot dealers

Micro Computers for home and business plus peripherals/software and accessories. Always a wide range in stock at:

72 Heath Road, Twickenham, Middx.
 TEL: 01-892 7896

MERSEYSIDE

MICROMAN Computers

ACORN STOCKISTS & SERVICE CENTRE
 Complete range of Acorn/BBC equipment & upgrades. Printers (Star, Epson, Juki), Disc Drives (Pace, Torch Z80). Specialist ROM's & peripheral equipment (Solidisk, Computer Concepts, Educational Software etc.)
Rainford Industrial Estate, Mill Lane, Rainford, St Helens, Merseyside. Tel: (074488) 5242

WEST SCOTLAND

WEST COAST PERSONAL COMPUTERS

BBC, Acorn and Torch dealers. Range of Disk Drives, Printers and Monitors on display.

47 Kyle Street, Ayr.
 (0292) 285082

SHETLAND ISLES

We stock a wide range of software books and peripherals



Local service and northern mail order centre

20 Commercial Road, Lerwick, Shetland Isles
 (0595) 2145 B B C

SUFFOLK

Suffolk Computer Centre

BBC Microcomputer Service & Information Centre
 Microcomputers • Disc Drives • Monitors
 Matrix & Daisywheel Printers • Joysticks
 Cassettes • Light Pens • Graphics Tablet
 Books & Software

3 Garland St., Bury St Edmunds.
 Telephone: 0264 - 705503
 Open: Mon - Sat 9 - 5.30.

SURREY

SIMNETT COMPUTERS LIMITED

One of the UK's largest independent suppliers of micro-computer equipment. Ring **01-541 1495** or visit Unit 14, St. George's Ind. Est., 380 Richmond Road, Kingston upon Thames, Surrey KT2 5QB

BUYING GROUP - YES THAT'S US!

CROYDON COMPUTER CENTRE



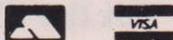
Official Acorn dealer and service centre. Full range of peripherals and spares for BBC Micro, Electron, Torch etc.

29A Brigstock Rd, Thornton Heath, Surrey.
 BRING THIS COUPON FOR £5 DISCOUNT
 Tel: 01 - 689 1280

A & B COMPUTING

Lineage: 40p per word.

Semi display: £9.00 per single column centimetre.
Ring for information on series bookings/discounts.



01 - 437 0699

Send your requirements to:
WILL FOX, ASP LTD,
1 GOLDEN SQUARE, LONDON W1.

All advertisements in this section must be prepaid.
Advertisements are accepted subject to the terms and conditions printed on the advertisement rate card (available on request).

ACCESSORIES

BBC/ELECTRON "IMAGE 2"

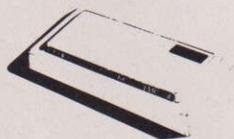
Without doubt the best back-up copier money can buy. Copies with probably all software. Send SAE for details of incredible features. Unlocks & locks progs. 100% M/C £4.80

PETER DONN (Dept AB)
33 Little Gaynes Lane,
Upminster,
Essex RM14 2JR

CAMBRIDGE COMPUTER DESKS

Variety of models in real wood or formica from £35.

SAE for product information:
53 Long Lane, Willingham,
Cambs. (0954) 60840



SUPERB HARD COVERS for your BBC Micro & Electron

- * Engineered in top quality high impact rigid ABS — very tough.
- * Super textured finish in cream to tone with your Micro.
- * Looks attractive in the home.
- * Cushioned on foam pads.
- * Gives excellent protection.
- * Ideal for schools.

BBC Cover: £10.95 (+£1.55 p&p)
Electron Cover: £6.95 (+£1.00 p&p)

Send cheque to:-

TEKFORM
Grange Close, Sandbach,
Cheshire CW11 9ET.
Tel: (09367) 3098

DUPLICATION

jbs records COMPUTER PROGRAMS

Real-time or (Slow) High-speed professional Cassette Duplication and Blanks 1 - 1000+. Computer printed Cassette Labels, BBC Disk Duplication and Unformatted Disks 1 - 500+. Fast security delivery service.

jbs records — a division of
FILTERBOND LTD, 19 Sadlers Way,
Hertford SG14 2DZ 0992-551188

ASTROLOGY

ASTROLOGY

for beginners. Special starter pack for only £11.50. Consists of a simple programme to calculate a horoscope, an introductory booklet and 2 self teaching programmes (how to interpret the horoscope).

NO PREVIOUS KNOWLEDGE REQUIRED for the B.B.C., A&B, Electron and many other micros, also wide range of programmes for more **Experienced Astrologers.** Cash with order (add 50p outside U.K.) or large SAE for free Catalogue to:

ASTROCALC (Dept A&B),
67 Peascroft Road, Hemel Hempstead, Herts HP3 8ER.
Tel: (0442) 51809.

SOFTWARE APPLICATIONS

DATA-WIN

Horse Racing, new program for BBC 'B'. Top rated. Horses can be found very easily, with impressive results.

Send £19.95 to:

DATA-WIN, 13 Hulham Rd.,
Exmouth, Devon
or phone
(0395) 263105
for further details.

HOME ACCOUNTS.

Use your home computer! Comprehensive coverage of bank accounts, credit cards, HP., etc. For BBC and ELECTRON. £8.45. Free details: Discus Software, Freeport, Windmill Hill, Brixham TQ5 9BR. (080 45 55532).

GOING TO THE DOGS?

Shorten the odds with

STADIUM

Greyhound Race Predictor for BBC Model B. £8.95 inc P&P.

Copus, 55 Lower Ashley Rd.,
New Milton, Hants.

ADD-ONS

SAVE... SAVE... SAVE

DISCOUNT COMPUTERS AND SOFTWARE

BBC Model B + Cassette recorder + Five games £385.00
Acorn Electron £184.00
Sinclair Spectrum 48K + six games..... £119.95
BBC Model B Disc Drive from..... £149.50

Prices include VAT & P&P

DISCOUNT SOFTWARE FOR ATARI * BBC * CBM 64 * VIC 20 * SPECTRUM * ORIC 1 * TEXAS 99/44

Send no money. For free lists send SAE stating machine type to:

RAMTOPS

47 Broom Lane, Levenshulme M/c M19 2TX
or telephone 061-442 5603

REPAIRS

MICRO-SERV for expert repairs to BBC machines and disk drive. For details call or write to: Unit 4, Denny Workspace, Denny, Scotland FK6 6DW. Tel: Denny (0324) 823468.

JOYSTICKS

For BBC Micro, top quality joysticks at an amazingly low price. Only £10.95 a pair including P&P. Easier to handle and faster than others costing twice as much. Cheques/POs to: **Peritron, Dept AB, 21 Woodhouse Road, London N12 9EN.**

SOFTWARE

COMPUTER SOFTWARE: Business and Games for most Computers

Commodore 64, Vic 20, BBC, Atari, Dragon, Spectrum, MZ700, ZX81.

New Releases for CBM 64, Spectrum, BBC, Atari, Dragon, Spectrum, MZ700, ZX81.

New releases for CBM 64 Spectrum, BBC. Every 2 weeks — just send S.A.E. and we send you a new list every 2 weeks.

Altai C10 data cassettes 40p each. 5 C15 data cassettes £2.40 5 1/4" floppy discs D/sided — DL density. £2.30 each or 5 for £10. Send to: **M. J. Seaward, St. Olaf's Road, Stratton, Bude, Cornwall EX23 9AF. Tel: (0288) 4179**

COURSES

PRACTICAL COMPUTING

A series of 1 day courses for beginners; programming; business applications. £25 per day (lunch included), with qualified tuition.

Details from:

COMPUTER WORKSHOP
32 Sydenham Road, SE26 5QF
PHONE: 778 9080

SOFTWARE EDUCATIONAL

TEST PROGRAMME BBC-B, short answer and multi choice on-screen timing and scoring. Tests supplied: Heat Transfer, Radio activity, Semi conductors, computer Quiz. Easy to add your own questions. Program fully tested by secondary pupils. Tape £5.00, Disc £6.00 or SAE for details. R. M. Lambert, Bal Cotage, Turriff, Aberdeenshire AB5 7DQ.

SOFTWARE EDUCATIONAL

A COMPLETE touch typing course for the BBC Micro. Colourful graphics makes acquiring the skill an enjoyable experience. Proved and tested in schools. Disc or set of cassettes £15 inc P&P. AR Educational Software, 23 Fearnville Place, Leeds LS8 3DY.

SHOW JUMPER — ideal Christmas gift (BBC) £7.50 inclusive. Also 32 educational tutors. Bryants (Educational) Software, 1 The Hollies, Chalcraft Lane, Bognor.

ALPHALEARN/ALPHATEACH 2 alphabet teaching programs for pre-school children. BBC (B) £3 each or £5 pair. Cheque/PO to H.S.S., 18 London Road, Camberley, Surrey GU15 3UZ.

SOFTWARE EDUCATIONAL

JOURNAL INDEX SYSTEM (JiSyS)

MANAGES your OWN Journal Article Database.

HOLDS Journal Name, Month/Year, Author(s), Title and Comment and 8 keywords for up to 700 Articles.

SEARCH by Author, Journal and/or user-defined Keyword Dictionary of 250 words.

A truly professional program already used in Universities and other Educational Institutions.

40 track disk — state Single/Double sided. Single/Double drive. Price: £25.00 inc. manual.

K. A. Spencer, 74 Dovers Park, Bathford, Nr Bath, Avon.
Tel: Bath 858484

DON'T LEAVE IT TO CHANCE. BOOST YOUR BUSINESS NOW. PHONE JASON ON 01-437 0699 TO ADVERTISE

S/W GAMES

BIT TWIDDLERS

Get more out of your existing games with our upgrades.

CHUKEE KILLA MONSTER for Chuckie Egg*, Killa Gorilla & Monsters # state BBC or Electron. £3.25 each. 2 or 3 upgrades per cassette £5.00 or £7.00.

Dept AB12, 158 Church End, Harlow, Essex CM19 4PF. * & # are trade marks of A & F Software and Acorn Soft.

THE MICRO PULSE EXTERNAL ROM BOARDS

For the BBC computer



£49.95 + VAT

Trade enquiries welcome

- ◆ BRITISH MANUFACTURE
- ◆ ALLOWS 8 ROMS ON LINE
- ◆ HARDWARE-BASED ROM SELECTION AVOIDS SOFTWARE INTERACTION BETWEEN UTILITY ROMS
- ◆ SWITCH TO REQUIRED ROM USING MANUAL SWITCH OUTSIDE THE UNIT
- ◆ RED LIGHTS INDICATE THE SELECTED ROM
- ◆ HIT "BREAK" TO ACCESS ROM, NO NEED TO USE SOFTWARE COMMAND
- ◆ INCLUDES ZIF SOCKET, FOR INSTANT CHANGING OF A SELECTED ROM
- ◆ INCLUDES BBC CABLE AND ROM SOCKET CONNECTOR
- ◆ INCLUDES SIMPLE FITTING INSTRUCTIONS, JUST PLUG IN AND GO!

please contact: Gareth Littler
Mark Howard or
Judith Allen at
Micro Pulse
Division

northern computers

Churchfield Road,
FRODSHAM
Cheshire WA6 6RD
Tel: 0928 35110

SOFTWARE GAMES



Cygnus Two

COMPUTER GAMES
WE ONLY SELL THE BEST

BBC		ELECTRON	
Elite	Tape £14.25	Blogger.....	£7.25
.....	Disc £17.25	Guardian	£7.25
Frak	£8.25	Gunsmoke	£7.25
Son of Blogger.....	£7.25	3-D Bomb Alley.....	£7.25
Tarzan.....	£7.25	Super Pool.....	£7.25
Jet Pac.....	£7.25	Nightmare Maze.....	£7.25
Mini Office (BBC & Electron) Database.....	£5.95		
Wordwise (BBC) Computer Concepts.....	£36.00		
Cheetah Sweet Talker (BBC).....	£24.95		

Write or phone now for software/accessories brochure. Please state BBC machine. Despatch by return, orders up to £25.00, otherwise allow 3 days.

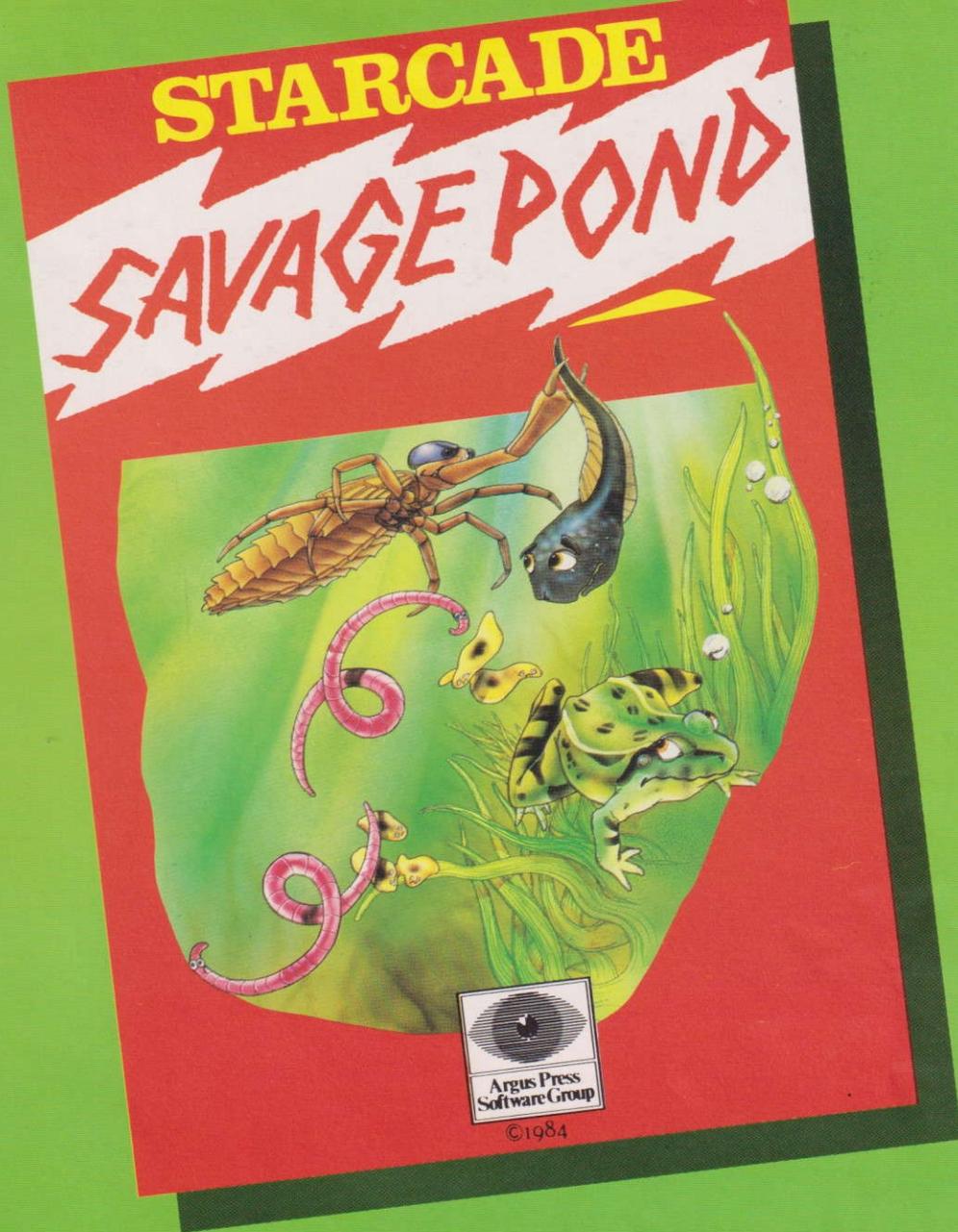
U.K. All prices include p&p. Europe: Please add 75p. Orders with cheque/PO to:

62 Woodland Road, Chingford, London E4 7EU. Tel: 01-529 1891

CORNER THE MARKET
PHONE JASON ON 01 - 437 0699
TO ADVERTISE

AD INDEX

4 Mation.....	4	Kosmos.....	33
ABS.....	43	Logo.....	27
Acorn.....	3	Mayfair Micros.....	33
Adder Publishing.....	103	Miracle Tech.....	89
Addictive Games.....	89	Musicsoft.....	27
Argus Press Software.....	44, 131	Solidisk.....	10, 11
Chaddington Software.....	103	Silversoft.....	61
Cheetah Mktg.....	21	Superior Software.....	132
The Computer Mail Order.....	62	Proxima.....	62
Computer & TV Ltd.....	103	Qualsoft.....	15
First Byte.....	27	Torch Computers.....	38, 39
Flight Deck Software.....	89	Twillsoft.....	47
G.C.C. (Cambridge) Ltd.....	54	Upgrade Tech.....	4
Guardian Software.....	33	Ultimate Play The Game.....	IFC
HCR.....	62	Vialen Disk Drives.....	67, 69



Awesome *in its conception*

Brilliant *in its depiction*

Dynamic *in its execution*

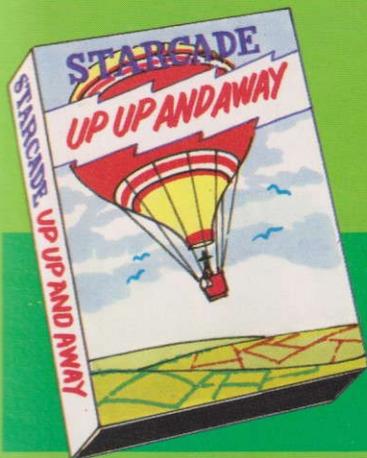
The world you are about to enter bears no resemblance to any arena you ever encountered before. Weapons are of no avail in this small habitat.

The only sources of protection at your disposal are quick wits and fast reflexes. The only reward is to survive against monsters of unbelievable ferocity and cunning, and to avoid hazards more perilous and deadly than any you might find on a trip through the outer universe. This is the real world, populated by the creatures of our own inner universe, where nature is red in tooth and claw. Brace yourself now, and come with Starcade into the still water and deceptive calm of the **SAVAGE POND**.

COMMODORE, ATARI, BBC/ELECTRON (£8.95 each)

On disc for COMMODORE, ATARI, BBC/ELECTRON (£10.95 each)

Now available for SPECTRUM (£7.95) From Boots and all leading retailers



Up Up and Away

COMMODORE, ATARI, BBC
(£8.95 each)

On disc for COMMODORE, ATARI,
BBC (£10.95 each)

STARCADE



produced by

ARGUS PRESS SOFTWARE

No 1 Golden Square, London W1R 3AB

Telephone: 01 437 0626

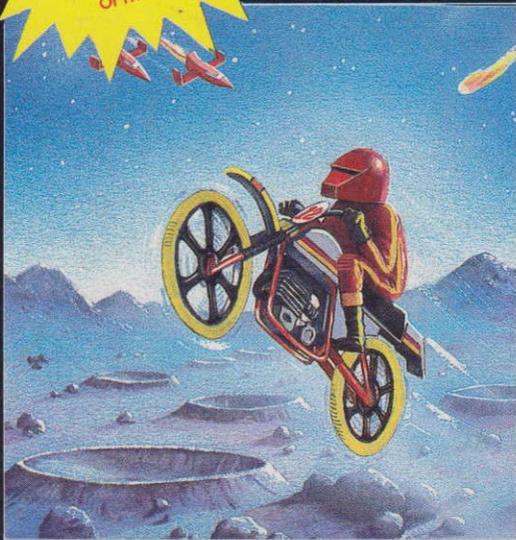
THE BEST BBC MICRO SOFTWARE

* PRODUCED BY AN INDEPENDENT SOFTWARE HOUSE *
* TOP QUALITY MACHINE-CODE PROGRAMS *

**BBC
MICRO**

**SPECIAL
OFFER!**

Deduct £1 per
cassette when
ordering 2
or more



BMX ON THE MOON (32K)

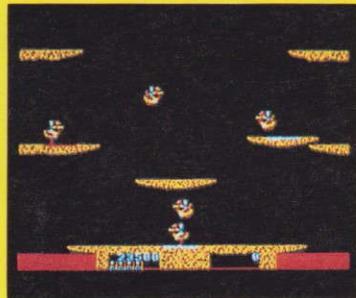
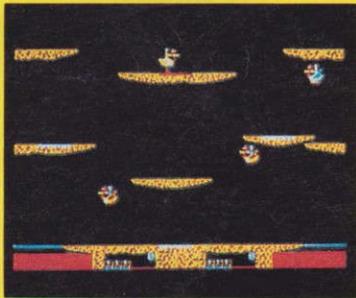
£7.95

Smooth scrolling-arcade action. In this game you control a moon cycle which you use to patrol the surface of the moon. You must avoid the rocks on the surface, and also the monsters bouncing high in the low gravity. You should try to shoot down the spaceships which fly overhead dropping bombs onto the moon surface: A further hazard are the flying barrels which are often just too high to shoot or jump over, and just too low to squeeze underneath.

●●●NEW RELEASE●●●



Many of our titles are available in Boots, W.H. Smiths, John Menzies, Rumbelows, Laskys, Currys, HMV, Greens at Debenhams and Spectrum Shops. Also at all major computer dealers – Eltec Computers, Micro Management, West Coast Personal Computers, Microstyle, Electronequip, 3D Computers, Computerama, GTM Computers, etc. Our software is also available through all the major distributors, and directly from us by mail-order.



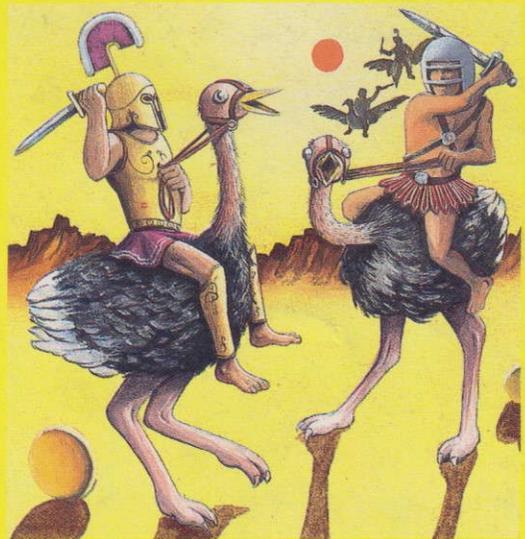
WINGED WARLORDS (32K)

£7.95

A fascinating arcade-style game for one or two players. Each player rides an ostrich, and the aim is to knock the enemy riders off by colliding with them. In a collision the rider with the highest jousting pole will be victorious. If you are successful, the enemy will revert to its original form: an egg. The egg must be collided with to prevent it from hatching. Avoid the lava bath at the bottom of the screen, and remember: you can fly better by using stronger strokes – imagine you are an ostrich trying to fly!

(KEYBOARD OR JOYSTICKS)

●●●NEW RELEASE●●●



WE PAY UP TO 20% ROYALTIES FOR HIGH QUALITY BBC MICRO AND ELECTRON PROGRAMS.



SUPERIOR SOFTWARE LTD.

Dept. AB11 Regent House,
Skinner Lane, Leeds 7
Tel: 0532 459453



OUR GUARANTEE

- (1) All our software is available before we advertise.
- (2) All our software is despatched within 48 hours by first-class post.
- (3) In the unlikely event that any of our software fails to load, return your cassette to us and we will immediately send a replacement.