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Computing today

AUGUST 1983
80p

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COMMANDS					
RUN	LOG	KEY	?	RANDOM	SGET
SIZE	SQR		*	ENTER	MAG
CONT	SYS	STATEMENTS	UNIT	LIST	TOF
MON	TIC	IF	BAUD	PURGE	TON
	SQN	ELSE	CALL	NUMBER	DIM
FUNCTIONS	BIT	ON	DATA	RENUM	DEF
ABS	CRB	GOTO	READ	BCOT	NEW
ADR	CRF	GOSUB	RESTOR	GRAPH	END
ASC	MEM	POP	RETURN	TEXT	BIT
ATN	MWD	REM	STOP	PLOT	CRB
SIN	LEN	FOR	TIME	UNPLOT	CRF
COS	MCH	NEXT	WAIT	CCLOUR	MEM
EXP	POS	ERROR	SAVE	CHAR	MWD
FRA	COL	INPUT	LOAD	SPRITE	BASE
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CONTENTS

VOL 5 NO 6 AUGUST 1983

EDITORIAL & ADVERTISEMENT OFFICE
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CONSUMER NEWS 6
Newsworthy products on the home computer front.

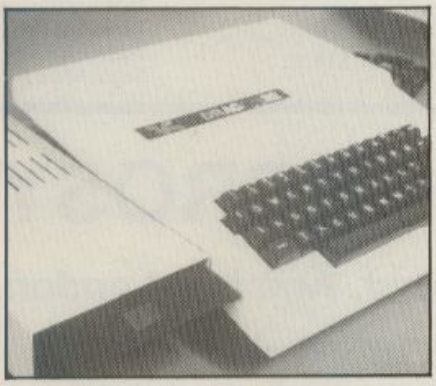
BUSINESS NEWS 10
Up-market products for the small business environment.

SOFT WARES 14
Looking at what's new in commercial software.

MICRO INTERRUPTIONS 21
The final part in our series on interrupts includes a space game for two players on two computers!

SHARP SPEED UP . . . 28
Find out how to speed up your Sharp by implementing this simple circuit.

DRAGON DISCS 31
We take a look at the first disc drive available for the Dragon 32.

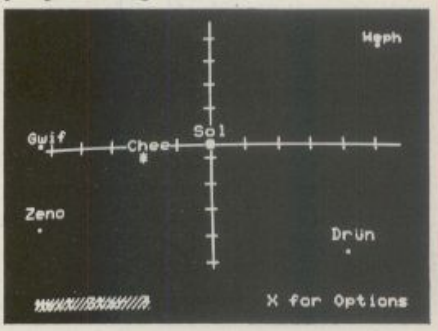


SORD M5 REVIEW . . . 36
Does the latest inscrutable offering from Sord really cut into the opposition?

PROBLEM PAGE 46
More ways of solving problems by using your ZX Spectrum.

BBC STRING STORE . 48
Save yourself a lot of bother with strings with this neat program for the BBC Micro.

PLANETFALL 52
An interplanetary trading game for theSharp MZ-80K, which also explains the principles involved in structured programming.



PRINTOUT 64
Our readers get the chance to air their views in public.

Next Month's Computing Today 18
Planetfall 20
Games of the Unexpected 63
Computamart 67
Froglet 69
Computing Today Book Service 70

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Origination and design by MM Design & Print.

ABC **Member of the Audit Bureau of Circulation**

ISSN 0142-7210

Computing Today is normally published on the second Friday in the month preceding cover date. Distributed by: Argus Press Sales & Distribution Ltd, 12-18 Paul Street, London EC2A 4JS. 01-247 8233. Printed by: Alabaster Passmore & Sons Ltd, Maidstone, Kent.

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Subscription Rates : UK £12.70 including postage. Airmail and other rates upon application to Computing Today Subscriptions Department, 513 London Rd, Thornton Heath, Surrey CR4 6AR.

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All material should be typed. Any programs submitted must be listed (cassette tapes and discs will not be accepted) and should be accompanied by sufficient documentation to enable their implementation. Please enclose an SAE if you want your manuscript returned, all submissions will be acknowledged. Any published work will be paid for.

All work for consideration should be sent to the Editor at our Charing Cross Road address.

AVAILABLE NOW

DRAGON 32 OWNERS

AVAILABLE NOW

Now you can buy a professional disk system to turn your Dragon into a real computer!

DELTA DISC SYSTEM

THE DELTA DISK SYSTEM gives you ....

* An affordable disk system
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DELTA contains the following powerful new words, all accessible directly from BASIC:-

SAVE"	SAVEM"	LOAD"
LOADM"	RUN"	RUNM"
CHAIN"	APPEND"	DIR
INIT	CONFIG	KILL
ASSIGN	VERIFY	SELECT
COPY	BACKUP	CREATE
FLUSH	OPEN	CLOSE
FILES	END#	RESTORE#
DIM#	BOOT	INPUT
PRINT	FIND	BUILD
DO		IF EOF(x) THEN

DELTA CARTRIDGE - contains DELTA Disk Operating System, User Manual, demonstration diskette.	£99.95
DELTA 1 - DELTA Cartridge, User Manual, a single-sided 40 track (100K) drive plus free cable	£299.95
DELTA 2 - as DELTA 1, but with a double-sided (200K) drive	£345.95
Disk Interface cable (supplied free with DELTA 1 or 2)	£9.95
ENCODER 09 assembler/disassembler/editor - integral with DELTA	£34.95
INFORM - Data Base Management System commissioned especially for DELTA systems	£39.95

SCRIBE - true lower case on DRAGON!

Below is a live 'screen dump', generated by our HIPRINT program. It clearly shows the features and display potential of SCRIBE!

SCRIBE for the DRAGON 32

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* Black on white text display option
* A new PRINT@ command extending to 1008 thus almost doubling screen area

Cassette £13.95 DELTA disk £14.95

ENCODER 09 - is a full symbolic assembler using standard mnemonics and pseudo op-codes. Source code can be incorporated into BASIC programs. The monitor section contains commands to allow memory display, modification and execution. Memory block move, breakpoint handling, full disassembly and a full editor are only a few of its many features. The most powerful assembler/disassembler/editor available for the DRAGON 32. Available as either an integral DELTA fitment or on cassette.

Tape £29.95.Disk - see above

HIPRINT - screen dumper

- will dump the entire contents of your DRAGON 32 high-res screen to a high resolution printer. Can be used for design, display etc (see left). Available at present for EPSON printers only. Other modules to follow shortly.

Tape £13.95 DELTA disk £14.95

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Software News

INNOVATIVE TRS 80-GENIE SOFTWARE

from the professionals

£250 REWARD

Below you will find described a new program entitled Enigma. It is a true simulation of the German wartime cypher machine of that name. It will encipher messages which may be communicated to third parties by any means who, assuming they have the key, will be able to use their Enigma program to decipher.

We will pay the sum of £250 to anyone [who has purchased the program] who can demonstrate an infallible method of deciphering the coded message supplied in the program's instructions. We consider Enigma to be the best program of its kind on the U.K. or U.S. market; contestants may therefore use any orthodox means to crack the code, including microcomputer programs other than Enigma.

The original message and keys will be lodged with our Solicitors for safe keeping in a sealed envelope. In the [hopefully] unlikely event that the code is cracked by more than one person, the reward will be paid to the first customer who demonstrates to us that he has succeeded.

MOLIMERX LTD.

During the 1939/45 war the German Army and Intelligence used a deciphering machine called Enigma. It was a fascinating machine and the stories that have surrounded it are equally interesting. There have been some four or five books written about the machine, and with regard to the way in which the British counter intelligence managed to crack the code.

That they did so was the culmination of some fortuitous circumstances, a lot of luck, but mainly it was due to the fact that the people who did it were extremely clever mathematicians. The fact that it took so much brain power, plus a rudimentary type of computer and a specimen of the machine in order to crack the code is an indication of how complex that code is.

The Enigma microcomputer program that we are selling is a simulation of the original machine, together with one or two improvements which were suggested by Gordon Welchman, who wrote the book "The Hut Six Story" last year and was also the leader of the team that cracked the code.

Although the machine and, therefore, the program is so complicated, its use is amazingly simple. One simply inputs a key and a message and the code is supplied. To decipher, the message is input again with the key and if the key is correct then the decoded message is displayed. With the cassette version it is necessary to input from the keyboard but with disks both inputs and outputs may be to disk files if required. A printer is of course supported.

The code may be transmitted in any way which the written word can be transmitted. Companies who wish to fully protect their communications will no doubt have the program generate the code and then tap it into a telex. Tape users will have to send either the output from their printer or write down the code direct from the screen.

Enigma is a fascinating program designed, not only for those people who are interested in encryption professionally or as a hobby, but also for companies or private persons who wish to communicate with others in an entirely secure manner. As is shown by the above Reward Notice, we have great faith in the powers of this piece of software.

ENIGMA (Tape) ... **£17.25**
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CONSUMER NEWS

SMALL IS BEAUTIFUL ▲

Texas Instruments have added yet another compact computer to their range: the Compact Computer 40 (CC-40), the first in a new series of portable computers for professionals. The CC-40 has an integrated LCD display, is programmable in Enhanced BASIC, and can run pre-programmed applications software loaded from either plug-in solid state cartridges or from small tape cartridges. The system is battery operated and fits unobtrusively on a desk or into a briefcase; it is designed to be used as a small desk-top personal computer and for data communications.

The computer console has a 34K built-in ROM that contains a BASIC language interpreter; the BASIC is compatible with the TI BASIC used in TI's Home Computer family. Calculator functions are easily available through immediate equation evaluation; the computer contains 6K of user-addressable RAM and can be expanded to 16K. The CC-40 has a suggested retail price of £169.95.

A plug-in module port is provided for application software of up to 128K of ROM, and can also be used for expansion of the RAM. The back of the console houses a Hex-bus intelligent peripheral interface connector. Three low cost Hex-bus peripherals are available: an RS232 interface, a printer/plotter and a Wafertape digital tape drive.

For more details of these or other TI products, contact Texas Instruments Limited, Manton Lane, Bedford MK41 7PU.

CONGRATULATIONS

Congratulations go to Mr Wolstenholme of Deansgate in Manchester who gave the first correct answer to the little (or should I say micro) competition that we held on these pages in the May issue of *Computing Today*. We asked you to identify the computer into which Cambridge Microelectronics' MIMEC L.2 was plugged in the photo we showed. Most of you guessed the correct answer: it was an Apple, but lucky Mr Wolstenholme was the first to be picked and should be receiving his MIMEC L.2 shortly. Thank you to all those who entered the competition and thanks also to Cambridge Microelectronics for generously donating the prize.

LINKING TOGETHER ▼

The success of the LINK 480Z micro has enabled Research Machines to reduce its price. The list price of the basic LINK 480Z with 64K RAM, BASIC in ROM, 40/80 character line lengths and network interface board, drops down to £596 from £685. The L4 system with high resolution colour graphics drops from £907 to £722 while the dedicated network server with dual 5¼" discs drops from £2290 to £2141.

Research Machines are offering a 10% discount on the new prices to schools and colleges so taking into account the local Education Authority quantity discount arrangements, a typical education price of a LINK 480Z system L2 is £483. Research Machines computers are already in use in over half of UK secondary schools and most colleges, so if you are interested in more information, write to Research Machines Microcomputer Systems, Mill Street, Oxford OX2 0BW or 'phone on 0865-249866.

GAMES PEOPLE PLAY

If you have an IBM PC you might be interested in the new joysticks from Kraft. Precision linear potentiometers have been included for more accurate cursor control and quicker response. The toggle switches give instant selection of spring centreing or free floating operation, and the patented stick mechanism gives smooth fingertip control. Dual axis trim controls are included in the design for fine tuning the joystick to individual software, and the two fire buttons are conveniently placed for fast action.

With a retail price of £37.95 plus VAT you can get more details from Pete & Pam Computers, New Hall Hey Road, Rossendale, Lancashire BB4 6JG.

STICK WITH IT

Following its success with the ZX Spectrum, the Competition-Pro Joystick is now available for the VIC-20 and Atari 400 and 800

computers. The Joystick has eight direction commands and two large fire buttons and costs £25 for the ZX Spectrum, plus stylish interface, and £16.50 for the VIC-20 and Atari versions.
You can now link your ZX Spectrum to Centronics-type printers with the use of a Kempston Centronics interface. The interface comes complete with connecting lead and is priced at £45 including VAT (mail order £1 for postage and packing), this price including a 12 month guarantee.

For more information on any of the above please contact Kempston (Micro) Electronics, 180a Bedford Road, Kempston, Bedfordshire MK42 8BL or 'phone 0243-852997.

SATISFACTION GUARANTEED

By the middle of the year 50% of all personal computers in use in the country will be beyond the protection of their manufacturer's guarantee. This forecast comes from insurance brokers Graham Brown and Company who in May introduced the first specialist insurance scene to be designed specifically for personal computers.

The Personal Computer Insurance Scheme covers computers and their peripherals in the home, in education establishments and while in temporary use at the office. It goes well beyond the normal protection of a 12 month guarantee to provide 'all risks' cover against both internal breakdown and accidental loss or damage, including damage during transit. The cost of the scheme starts at £7.50 per year for a system worth up to £100, and increases progressively with the value of the equipment. For a £500 system the annual cost would be £15. To be eligible, the computer must be no more than two years old at the time the insurance policy is taken out. The policy can be kept in force for as long as the equipment is owned.

Full details about the scheme can be obtained from Graham Brown & Co (Guildford) Ltd, Pannells Court, Guildford, Surrey GU1 4EY or 'phone 0483-65651.

FOOLED YOU

VIC-20 owners will be aware that, due to idiosyncrasies of the machine's memory mapping, games which require a 3K expansion will not necessarily work with 8K or 16K expansion cartridges. Many solutions to this problem have appeared and Mr Micro have come up with an adaptor called RAM DAM which, when used in conjunction with a Commodore 8K or 16K RAM pack will 'fool' the VIC-20 into believing that it only has 3K fitted. This means that those VIC-20 owners who have previously purchased a 16K or 8K Commodore expansion will not have to buy a 3K expansion in order to obtain access to the wide range of programs which only require 3K expansion. To add value and demonstrate the effectiveness of the new package Mr Micro have included a new game (Microinvaders) and a memory test program.

The RAM DAM package is available directly from Mr Micro Limited, 69 Partington Lane, Swinton, Manchester M27 3AL for £13.95 including VAT or from good Commodore stockists.

SOUNDS INTERESTING ▼

Timedata are expanding their business to cover hardware add-ons for Sinclair computers; the first in the range is the ZXM Sound Box. Retailing at £29.95 inclusive of VAT and postage and packing, it uses the 8912 three channel sound generator chip to give a huge range of programmable sound effects. The ZXM can be used with either the ZX81 or ZX Spectrum (no adaptor being needed) and has a nine pin I/O socket which can be used with low cost Atari/Commodore joysticks. Other Sinclair add-ons can be plugged into the back of the ZXM. The built-in amplifiers and loudspeaker can also be used to boost the ZX Spectrum's 'beep'.

For more information, contact: Timedata Limited, 16 Hemmells, High Road, Laindon, Basildon, Essex SS15 6ED or 'phone 0268 418121.

BRIEFING

A new type of joystick interface for the ZX Spectrum, the **TE 122 Joystick Interface,** is available: it mimics the operation of the ZX Spectrum keyboard, enabling a vast range of commercially available software to be used without any software or hardware modifications. An eight-way switch network has been added to allow a degree of 'customization' to other program requirements. The unit is supplied with one stick and a further stick can be added if required. The TE 122 is supplied fully packaged with full instructions, a free game of Snakebyte and one stick. It costs £24.95 including VAT and a second stick is available for £7.95. Mark your order TE 122 for the basic package or TE 123 for the second stick and send off to **Thurnall Electronics,** 95 Liverpool Road, Manchester M30 5BG.

All 260 branches of **Dixons** will now be stocking the **Oric 48K.** Already stocking the micro are W. H. Smith, Greens, Laskys and Micro C as well as specialist outlets all over the country. Also, by the time you read these words of wisdom, the 16K Oric should be available. Although Oric originally had intended both versions to be available earlier in the year, delay in the 16K's introduction was caused partly by the unexpectedly high demand for the 48K machine and also due to some technical problems.

A catalogue is available from Redditch Electronics on all their mail order products for Sinclair computers. All sorts of goodies are included such as various connectors, I/O ports, ribbon cable, RAM packs and more. For more details please write to **Redditch Electronics,** 21 Ferney Hill Avenue, Redditch, Worcestershire B97 4RU.

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COMPUTERS

Gemini Galaxy 2

"I would place the Galaxy at the top of my list"
(Computing Today, April 1983)

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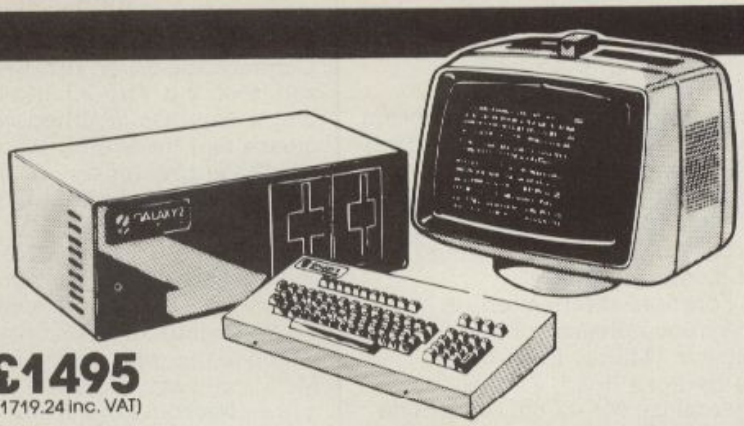
- ★64K Dynamic RAM
- ★800K Disk Capacity
- ★80x25 Video Display
- ★Serial and parallel printer interfaces
- ★Cassette and light pen interfaces
- ★User definable function keys
- ★Numeric key pad
- ★12" Monitor included



£1495
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Total support for Gemini & nascom Products

nascom 3 available from MicroValue

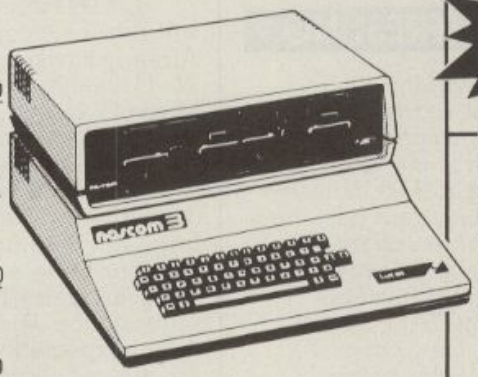
Based around the successful Nascom 2 computer, this new system can be built up into a complete disk based system. Supplied built and tested complete with PSU, Nas-Sys 3 and Nas-Gra.

48K System
£549 (£631.35 inc. VAT)

CP/M 2.2
£100 (£115 inc. VAT)

NASCOM 2 KIT
£225 (£258.75 inc. VAT)

Built & Tested
£285 (£327.75 inc. VAT)



80x25 Video for nascom

£125
(£143.75 inc. VAT)

Nascom owners can now have a professional 80x25 Video display by using the Gemini G812 Intelligent Video Card with on-board Z80A. This card does not occupy system memory space and provides over 50 user controllable functions including prog character set, fully compatible with Gemini G805 and G815/809 Disk Systems. Software supplied on Gemini system disks. Built and tested.

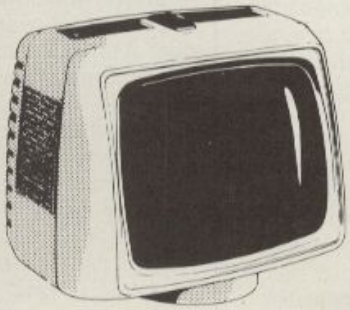
The **Microvector 256A** is a high performance graphics display interface on an 80-BUS and NASBUS compatible card. Various graphic primitives such as vector and character generation are executed in hardware by a Thompson EF9356 Graphic Display Processor. Plotting rates are typically 1 million pixels per second giving full animation capability. Various vector and character types can be selected. Characters can be scaled to give 256 different sizes.
MV 256A Suitable for TV use (PAL-UHF) **£199.00** + VAT
MV 256B Suitable for TV or RGB monitor **£220.00** + VAT

SHARP MZ80A

£475
(£546.25 inc. VAT)

Electronic magnificence from Sharp

Z80A C.P.U. · 48K RAM · 4K ROM · Industry standard Qwerty keyboard with numeric pad · 9" GREEN C.R.T. · 1200 baud cassette · Music and sound · Real time clock · Enhanced BASIC · Full editing facilities · Internal expansion.



Phoenix P12 Monitor

A high quality data display monitor, ideal for all Nascom and Gemini systems. 20MHz resolution. Available in amber or green phosphor.

£110
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PRINTERS

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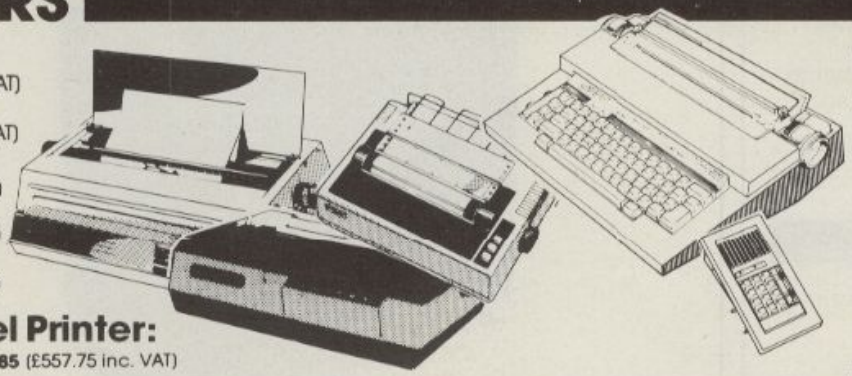
Epson MX100 Type III
£496 (£569.95 inc. VAT)
NEC 8023A
£339 (£389.95 inc. VAT)
SEIKOSHA GP100A
£215 (£246.95 inc. VAT)



Olivetti Praxis 41

Complete with RS 232 interface and numeric key pad. This module enables the Praxis 41 to be used as:

- ★ a Personal Computer console
- ★ a quality, low volume printer
- ★ a typewriter communicating point-to-point, or via modem, or acoustic coupler.

£595 (£684.25 inc. VAT)

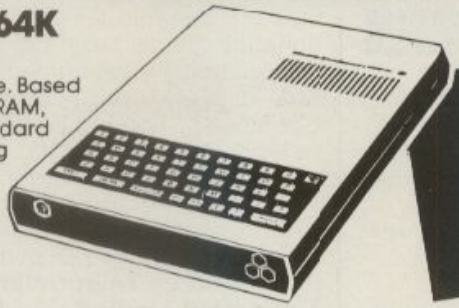
Daisy Wheel Printer:

Smith-Corona TP-1 **£485** (£557.75 inc. VAT)

Value - MicroValue - Micro

LOW COST SYSTEMS

NEW **Micro Professor MPF II 64K**



MPF II is a most exciting addition to our range. Based on 6502 microprocessor this machine offers 64K of RAM, high resolution 6 colour graphics, and sound. Standard BASIC interpreter is Applesoft compatible, allowing MPF II to read and write tapes in Apple format. Complete with excellent 600 page manual.

★ Micro Professor	**£233.92**	(£268.99 inc V.A.T.)
★ Joystick	**£13.00**	(£14.95 inc V.A.T.)
★ MPF II printer	**£161.53**	(£185.75 inc V.A.T.)
★ Software Cassettes	**£4.34**	(£4.99 inc V.A.T.)

BUY FROM THE COMPUTER PROFESSIONALS

Dragon 32

A powerful colour computer for under £180
★ 32K RAM
★ 6809E Microprocessor
★ Extended Microsoft Colour BASIC
★ 9 Colour, 5 Resolution Display
★ Sound through TV 5 octaves, 255 tones
★ Advanced Graphics
Full range of Dragon software available.

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★ Sinclair ZX81 Computer	**£43.43**	(£49.95 inc. VAT)
★ Sinclair ZX Printer	**£34.74**	(£39.95 inc. VAT)
★ ZX81 Learning Lab	**£17.35**	(£19.95 inc. VAT)
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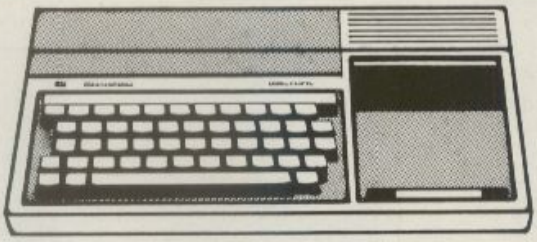

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BUSINESS NEWS

BRIEFING

Zenith Data Systems has appointed **Maplin Electronic Supplies** to handle the distribution of its range of electronic kit products marketed under the Heathkit brand-name. This appointment allows Zenith to concentrate on its rapidly expanding microcomputer operation. Included in the Zenith microcomputer product range is the **Z100** series of 8/16 bit microcomputers, which are available in 'low-profile' and in-one' versions with either Winchester or flexible disc configurations; colour and monochrome monitors; and the **Z29** 'smart' terminal. The systems are primarily sold in the UK through OEMs, dealers and systems houses. Zenith Data Systems Ltd is at Bristol Road, Gloucester GL2 6EE (telephone 0452-29451). Maplin Electronic Supplies Ltd is at PO Box 3, Rayleigh, Essex SS6 8LR (telephone 0702-552911).

A diskette drive head cleaning kit, using a safe and effective cleaning medium, is now available from **Eyecote (Data Devices) Ltd.** The cleaning element is contained in a diskette jacket and cleans the heads when inserted in the normal way. A cleaning solution is used, which is non-harmful to the machine, clothing and skin and is applied to the medium through a window in the jacket. Thus the head is cleaned alternately by dry and wet surfaces. Versions for 5¼" and 8" drives are available, for single and double sided discs.

The kit has been approved by a number of major diskette drive and media manufacturers and specific endorsements are available on request. Eyecote (Data Devices) Ltd are at Saltcoats House, Cutlers House, Cutlers Road, South Woodham Ferriers, Essex (phone 0245-329966).

A new plug-in mains filter from Roxburgh Suppressors — the **LF6** — is now available from Stotron. The LF6 is compact and ideal for equipment such as desk-top computers, VDUs, printers, instrumentation and so on, and is manufactured to meet the safety requirements of British and European specifications. The unit is designed for use with CEE22-style appliance inlet connectors, and the simple plug-in operation makes it suitable for use in labs, colleges, offices, etc. For further information please contact **Stotron Ltd,** 72 Blackheath Road, Greenwich, London SE10 8DA (telephone 01-691 2031).

A daisy wheel printer costing just £675 but offering high quality print for word processing and other applications has been introduced by **Teleprinter Equipment Limited.** The **CAE 550** and is compatible with all major micros, word processors and minis and is designed to offer users an all-purpose printing facility. Print speed is 16 characters per second and the full range of word processing functions include subscript, superscript and bold typing. For further information, contact Teleprinter Equipment Limited, Akeman Street, Tring, Herts HP23 6AJ (telephone 044-283 4011).

STANDING ROOM ONLY ▾

Many applications are being found where it is more convenient to have access to the VDU without having to sit down and continually stand up again. With this in mind DNCS have launched an extra addition to their popular standard range of computer and terminal furniture.

The new "stand up VDU table"

is 39" high and is normally 30" x 30" but any size can be manufactured to special order. DNCS say that these tables are made to the same high standards of strength and reliability as the normal standard range. They are delivered in knock-down form, being simple to assemble in just a few minutes with one small spanner. A 96-page colour catalogue of all computer furniture, accessories, magnetic media and supplies is available free upon request from DNCS, West Croft Industrial Estate, Manchester Old Road, Rhodes, Middleton, Greater Manchester M24 4PJ (phone 061-643 0016).

THE XIONIC MEN

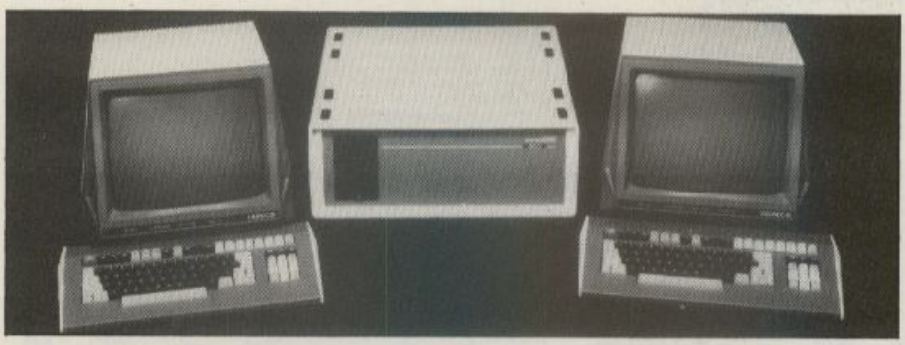
Xionics is claiming a major breakthrough in electronic office technology with the announcement of a totally new system called 'MicroNode'. MicroNode brings the versatility of Xionics' corporate level automated office systems to individual 'Work Groups', which can be the departments of large companies or independent business units.

MicroNode provides over 200 easily used options covering paperless electronic mail, word processing, filing and retrieval and personal computing. It is especially valuable for the comprehensiveness of its communication facilities. A basic star-configured MicroNode can be linked to remote MicroNodes via public switched telephone network (PSTN) leased lines, or PSS connections. MicroNodes at the same site can be networked via Xionics' well-established Local Area Network, XINET, which operates at 10,000,000 bits/second.

A minimum MicroNode system comprising MicroNode itself and two workstations costs under £10,000, including software, bringing sophisticated and professional office automation systems within the means of a small business unit.

Each workstation has its own processor with 128 or 256K bytes of memory, and downloads from MicroNode any required software or data. Various letter-quality and matrix printers can be attached to workstations.

Xionics is currently working on additional facilities for MicroNode which include digitised voice communication as implemented on bigger XIBUS systems. In addition, Xionics has plans to provide a 16-bit 68000 processor as an upgrade with a



UNIX-based operating system.

The MicroNode control unit can be fitted with disc drives of five, 10, 20 and 40 megabyte capacity with the choice of either a floppy disc or cartridge tape drive for backup. Workstations can be sited up to 150 metres away from a MicroNode unit. Xionics are at Dumbarton House, 68 Oxford Street, London W1N 9LA, (phone 01-636 0105).

PRICE ADVANTAGE ON THE HORIZON

The entry-level retail price of North Star ADVANTAGE and Horizon business microcomputers is now less than $3,000 as a result of price reductions announced by North Star. The reductions make the North Star ADVANTAGE the lowest priced integrated desktop workstation supporting graphics, word processing and business applications in the market. The company reduced the price of the microcomputers to $2,999 from $3,599. Prices were also reduced on five megabyte hard disc versions for both products and on the 8/16 co-processor upgrade board for the North Star ADVANTAGE.

The North Star ADVANTAGE is an integrated desktop microcomputer with 64K of RAM, two 360K floppy disc drives, a 640 × 240 pixel bit mapped display screen, an 87-key Selectric-style keyboard, an eight-bit Z-80A processor and six expansion slots. The Horizon, an S-100 bus computer that can be used in a multi-user configuration, features a Z-80A microprocessor and two 360K floppy disc drives.

TI PRICE CUTS

Texas Instruments has made significant price reductions on all models in its Business System 300 family. Cuts of up to 24% have been made on specific models, with an average reduction of 20% across the range. First introduced in September last year, the Business System 300 family is part of TI's full range of business systems, and includes the smallest of the multi-user/multi-tasking systems which replaced TI's earlier range of DS990 minicomputers. They are designed for use both as stand-alone systems for small to medium users or as part of distributed processing networks in larger companies.

Based on the TMS99000 central processing unit and coupled with a range of Winchester disc sub-systems, prices now start from £8995 for a 5Mb Winchester system with 128K bytes main memory, to under £15,000 for the 43 Mbyte System 372. All models in the family can support up to seven workstations, each consisting of a visual display terminal and an impact printer.

HEADINGS FOR SUCCESS

The use of word processors is becoming more and more widespread throughout the business world, with circular letters, invoices, mail shots and so on now personalised by the computer. There can be several drawbacks, however, in that the printing of continuous business stationery can take anything up to four or five weeks and the resulting perforations give the paper edges a jagged look. The alternative of preprinted cut sheets are laborious to feed into a printer without an expensive cut sheet feeding device.

Inmac now offer a rapid printing service, called StreamPrint, that guarantees to have the order printed within four days and their express delivery service means that it will arrive on the fifth day. Personalised stationery can be produced in any format to a customer's specification for layout on an A4 sheet, even incorporating a logo. There are six typefaces including Helvetica Regular, Times Roman and Plantin Roman to choose from and five types of paper: 100 gsm wove in white, vellum or grey; 80 gsm white bond and lastly NCR paper (No Carbon Required) consisting of 80 gsm white top copy and a 56 gsm yellow tinted copy for filing. Separation of the sheets is not only easy but also gives a clean, smooth edge on all four sides identical to a regular letterhead.

Overprinted continuous envelopes are also available in white or can be supplied to matching colours as individual envelopes. These cost from £91.60 per 1000 envelopes and the paper itself costs from £39.80 per 1000 sheets in convenient print quantities of 1000, 2000 and 5000 sheets; these costs include free delivery to UK mainland and all origination costs. Plain continuous listing paper and envelopes to the same specifications are available from £22.50 for 1000 sheets with next day delivery.

Reruns can be produced even faster in two or three days, provided there are no changes to the original artwork.

A special design and order form is available with full details in Inmac's free full colour catalogue, along with information on the rest of their range of cables and computer accessories. All Inmac products are available on a 30-day risk-free trial, carry a guarantee of at least one year and can be delivered the same day, if required. Further information can be obtained from Inmac (UK) Limited, Davey Road, Astmoor Industrial Estate, Runcorn, Cheshire WA7 1PZ. Telephone: 09285-67551. Telex: 629819 INMAC G.

TRS80 (LEVEL 2)
ZX SPECTRUM — ZX81
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Here are descriptions of just a few of the games:

HOUSEBREAK You enter a house at night in an attempt to rob it of money and any gold and silver items you can find. Your object is to clean out the house. In the dark you must avoid bumping into the furniture. After an interval of time an alarm will sound and a short while later the lights will be turned on. A vicious dog is then released and you have to use all your skill and cunning to avoid getting bitten as he chases you around the house. Any injuries caused by the dog will slow down your escape. The game is played in real time, has excellent graphics and is very exciting. A new house is generated each time the game is played

CORRIDORS OF DOOM! A dungeons & dragons type game that is very addictive. You can never win this game by chance. A lot depends on discovering the secrets of just how you have to deal with each individual monster in the game. There is a liquid which will destroy the Werewolf — but which one? How can you tame the giant spider? Will you ever learn the secret of how to defeat the Blood Devil? All of the monsters have treasures for those who are both brave and wise enough to overcome them, but to escape alive you must first cross some very nasty pits. Play it again and again.

AMAZING 3D MAZES Wander through the giant 18x18x18 mazes collecting treasures, you know where they are, but how do you get to them? Extra points are awarded for finding the shortest routes. Don't get too frustrated by apparent dead ends.

3D NOUGHTS & CROSSES Played inside a 4x4x4 cube, this is a game for the intellectual. Great graphics. It plays a mean game and wins about nine out of every ten games it plays.

TOWERS OF HANOI You will welcome this classical puzzle which is a must for anyone with a computer. The problems difficulty depends on how many disks you use. It might only take you a few minutes with four disks, but with all nine it could take all day. Two variations of the game are included. There is a constant display of Hours : Mins : Secs, so that you know how well or how badly you are doing at any particular stage. If you find you cannot work the problem out! The computer will show you the shortest possible solution.

THE VAULT A high security vault in Oxford. (The game can be changed to centre around your own home town) has ten doors, each with its own five figure combination. The combination of the nine inner doors are known, but only the manager knows the combination of the outer door. Unfortunately the manager has got himself locked in the Vault. It is your job to get him out before all the Oxygen is used up. The computer will give you metaphorical clues to how near you are getting. The time switches which change the combination every so often can prove a problem. This is a case which really puts your powers of logic to the test.

POPULATION SIMULATION This is a game for two players, each becoming the leader of one of the planets 'Techno' & 'Primo'. It is a battle to survive. Each decade a player must decide various things in governing his planet, he must carefully balance production and technology against consumption and population. He can either negotiate with his opponent or declare war on him. How about sending out an exploration party in search of new wealth. Only the experienced last very long.

TIME WARRIOR You are an experienced time warrior and you have been sent on a mission to rid the Universe of imposters who have taken up key positions in ten different time sectors. In this adventure you will face the gladiators in Ancient Rome, find yourself in a gun fight in Old America, help Hillery climb Everest, joust with the Black knight. It's all to be done in 'Time Warrior'.

The full cassette of 25 programmes is sent to you for only **£8.95** inclusive.

Please feel free to write or phone for details of other programmes.

Trade enquiries welcomed

Telephone John Wilson on **0608 3059**

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25 SUPERB GAMES ONLY £8.95!

THE WIZARD'S WARRIORS: A fast moving game that matches developments in your skill as a player by becoming increasingly more devious. By offering to you the full range of options you can choose how to control your warrior through the maze. A full implementation of this program enables such features as a continuous series of sound effects, arcade quality graphics, double-point scoring, and--for the very artful --bonus lives. **Spectrum £4.95**

FORTH: A full implementation. Ideal for writing fast moving arcade type games. Allows the full colour and sound facilities of the Spectrum to be used. Future Microdrive enhancements will be made available. **Spectrum 14.95**

ADVENTURE ONE: Features a save game routine as the game can take months to complete. 'a remarkably good version....well worth the money.' ...*Sinclair User*... **ZX81 £5.95**

MAZEMAN: A fast action m/c game that reproduces the spirit of the original. '..is very accurate and fast.' ...*Which Micro?*... **Spectrum £4.95 ZX81 £4.45**

CHESS 1.4: Ten levels of play with this m/c program. Good graphic screen display. 'In a class of it's own.' ...*Your Computer*... **ZX81 £5.95**

INVADERS: Very fast m/c action. Includes mystery ship and increasingly difficult screens. **ZX81 £4.45**

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The Acorn User Exhibition at the Cunard, Hammersmith will house the largest display of Acorn products ever assembled under one roof. It will be four days of non-stop entertainment and education for parents and children alike.

The new Electron, the second processors for the BBC micro, the BBC Buggy, all the new software and hardware will be on show. There'll be competitions, prizes, Acorn experts to answer your technical questions, demonstrations and lots and lots of bargains.

If you are an Acorn owner, or just thinking about being one, you can't afford to miss it.

Opening hours: August 25th-27th, 10am-7 pm; August 28th, 10am-4 pm.

Admission charges: Adults £2 per ticket, Children £1 per ticket.

We have arranged for nearly every exhibitor to redeem the cost of your ticket when you buy something from their stand.

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For details of exhibition stands and advance ticket sales contact Computer Marketplace Ltd, 20 Orange Street, London WC2H 7ED. Tel: 01-930 1612.

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SOFT WARES

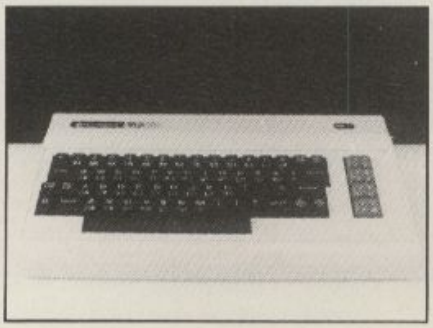
HITTING BASE

Qbase is a new data base available for the IBM PC and Apple II. You can instruct the computer to accept only certain data in certain fields and you can request that data entered is checked for possible errors before it is accepted. In this way, it is claimed that Qbase actually 'corrects' errors before they happen by refusing to accept many types of erroneous entries. It 'beeps' its warning and then points out your error. You will be stopped, for example, if you omit important information such as a job number. You can optionally select any data for inclusion in your reports. Reports are formatted in columns allowing up to 200 spaces on a single line. Once you have defined the reports you want, Qbase keeps the designs for future reference and use. Qbase is upwardly compatible to the popular Versaform, the full system business form processor.

The cost of Qbase is £139 plus VAT and more details can be obtained from Pete & Pam Computers, New Hall Hey Road, Rossendale, Lancashire BB4 6JG.

I HEAR YOU

Audiogenic have a range of home application software for the VIC-20. Six programs have been introduced: Car Costs, a program to aid in the monitoring of automobile costs under five categories (fuel, insurance, payments, maintenance and repairs); Loan Analyser, which is two programs to analyse all types of loans; Home Inventory, a package enabling the listing and cataloguing of possessions and collections; Decision Maker, which allows users to take decisions based on as many as 11 different factors; Household Finance, providing all the basic functions required to produce a thorough accounting of a family's finances; and Home Office, a word processor and a data base storage and retrieval system. Each individual program, complete with comprehensive and easy-to-follow documentation, costs £14.95 with the exception of Home Office which costs £12.95. All are available from Audiogenic or via the nationwide dealer network. Audiogenic are at PO Box 88, Reading, Berkshire.



TYPE CASTING

Another aid is here for us 'amateur' typists: this time as Microtype Typing Tutorial Software or Learning to type the Easy Way. The software uses the Sharp MZ-80A and includes exercises from the McGraw-Hill book 'Typing First Course' by A. Drummond and A. Coles-Mogford. Microtype places considerable emphasis on accuracy and rhythm using the sound ability of the MZ-80A to inform the student of good and bad progress.

Priced at £34.50 plus VAT you can get more information from Kuma Computers, 11 York Road, Maidenhead, Berkshire, or you can call them on 0628-71778.

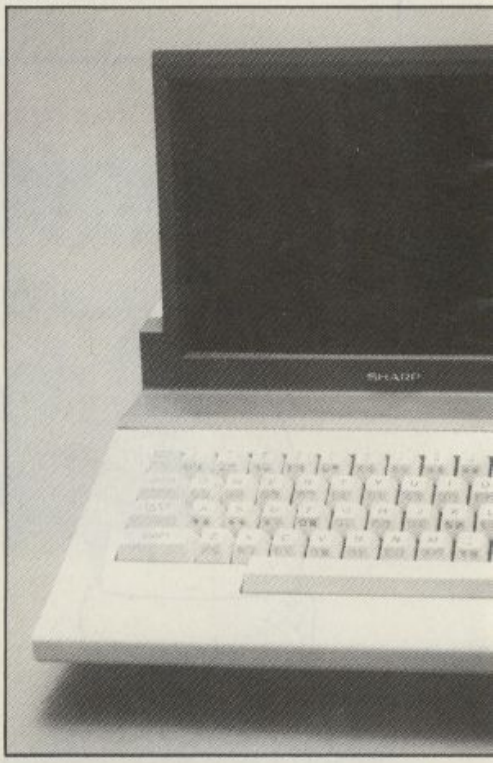
IT FIGURES

CalcResult is now available for the Commodore 64. As you may have guessed this is a spreadsheet; it works to a three dimensional format, simplifying the creation of layouts, the extension of data handling and the addition of pages, while displaying an overview of the work in progress. Completely compatible with files from the CBM 8000 version, CalcResult features such facilities as horizontal and vertical page splitting, window facilities, powerful editing functions and full graphics output capabilities.

CalcResult costs £94 and is available from Kobra Micro Marketing, Duramark House, Farm Road, Henley-on-Thames, Oxon RG9 1PF.

GOING IT ALONE ▼

Solo Software is a specialist house dealing in cassette programs for the Sharp MZ-80K and MZ-80A machines only, and although they have been supplying software through outsice marketing companies for over a year they have recently started selling directly to the end user by telephone and mail order. Some of the packages they offer include games such as Super-mouse (£4.95), Aladdin's Cave (£4.95), Tombs of Karnak (£7.95), Fisherman Fred (£4.95), Nightmare Park (£7.95), Space Chase (£4.95), Ace Racer (£4.95), Five-a-Side Soccer (£4.95), Mountain Rescue (£7.95), Minefield (£4.95), Encounter (£7.95) and Snaker (£4.95), educational programs like Rocket, a maths trainer (£4.95) and business packages like Data Base Filer (£14.95). A catalogue is produced so if you want to know more contact Solo Software at 192 Malvern Road, St John's, Worcester or ring them on 0905-424152.



OPEN WIDE

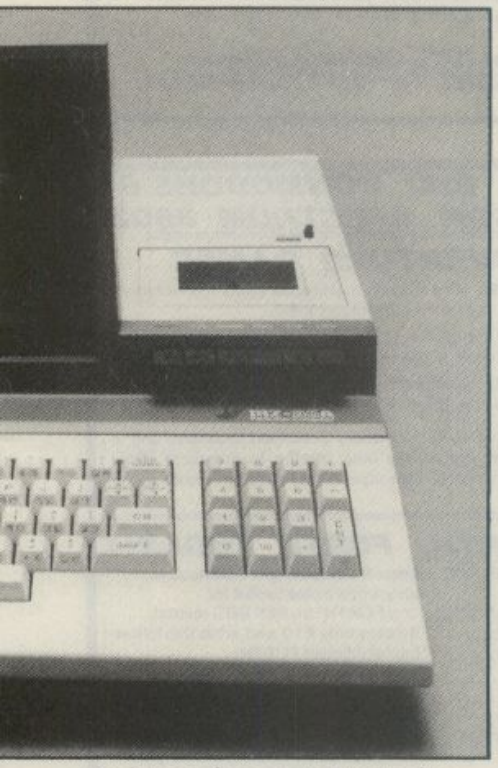
Jaws Revenge is a somewhat gory all-action game where, under the player's direction, Jaws is attempting to eat everything in sight including jellyfish, boatmen, scuba divers, fish and hapless swimmers. In order to prevent Jaws and the unsuspecting player from achieving this, though, there are some hazards, such as an

undulating seabed. Boatmen are armed with harpoons and depth charges, scuba divers are also armed and many of the juicy morsels floating on the tide are booby trapped. Of all the ways to describe this game such as violent, bloodthirsty, fast, addictive and gory, it is apparently not sexist since Jaws will eat anything of any shape and any gender.

So if you think you're ready to take the plunge you can buy the program for the 16K and 48K ZX Spectrums for £5.95 including VAT and postage. I suppose you'll have to buy your own first-aid kits but don't let that put you off! Jaws Revenge is available from Work Force at 140 Wilsden Avenue, Luton, Bedfordshire, 'phone number 0582-454456, or from their normal retail outlets.

TAXING TASK

Microtax, which consists of a set of programs on tape or disc and supporting manual, is claimed to be the first comprehensive easy-to-use microcomputer system for



completing those tax returns for last year's income, that ominously drop through your letterbox when you're least expecting it. Developed by two tax consultants, Microtax can be used on most popular micros (48K ZX Spectrum, VIC-20 with 16K RAM pack, Commodore 64, Commodore PET 4000 series (disc or tape), Dragon 32 and BBC Model B).

At a price of £24.94 including postage and packing Microtax is available by mail order from Microtax Limited, Barratt House, 7 Chertsey Road, Woking, Surrey GU21 5AB.

SINCLAIR SELECTION

New products from Flowchart include: IQ Test, Joker and Home Budget. IQ Test is a compelling and accurate way of measuring your IQ, making maximum use of the graphics available on the ZX Spectrum. The program comprises two tests each of 25 questions and you are allowed 20 minutes for each test; an on-screen clock ticks the seconds away. Suitable for the 16K or 48K Spectrum, IQ Test costs £5.75.

Joker is a fun program with nc serious use at all and the user has to do next to nothing! Purely for laughs the program consists of jokes, puns, riddles and nonsense, interspersed with graphic displays to dazzle and amaze, and it runs for over 60 minutes. Again suitable for the 16K or 48K ZX Spectrum Joker costs £5.75.

Home Budget is designed to enable a personal data record to be created of estimated monthly expenses and income, thus calculating the financial position for the year ahead. At the end of each month real expenses and income are entered, the program then updating the totals. Suitable for the 48K Spectrum with a second cassette required for files, Home Budget is priced at £5.75.

A pack of eight blank C10 cassettes with precision screwed housing complete with library case, inlay cards and blank self-adhesive labels on a role are also available for £5.75.

All of these products are available from Flowchart Limited, 62 High Street, Irthlingborough, Northamptonshire NN9 5TN and the prices quoted include VAT and postage.

BRIEFING

The first **Griffin Software Catalogue** has been published, covering a specially selected range of educational software. The range covers major areas of the school curriculum and supports the ZX81 and ZX Spectrum. All the software has been evaluated by teachers and recommended age ranges are given for each cassette. New software is being added to the range to increase the subject areas and support other micros like the BBC. The catalogue also contains some business and utility programs and games and if you are interested you should write to **Griffin & George,** 285 Ealing Rd, Alperton, Wembley, Middlesex HA0 1HJ or ring 01-997 3344.

The first batch of Oric's specially commissioned software is now available from dealers: **Oric Multigames,** a set of five games (£7.95) **Oric Flight,** aircraft landing simulation (£7.95), **Zodiac,** an adventure game (£7.95), **Oric Chess** (£9.99) and **Oric Base,** a data management program and manual (£9.99). All programs require a 48K Oric and a FORTH tape is expected soon which will cost £17.95 including the manual.

Terror-Daktil 4D is a new game for the 48K ZX Spectrum from **Melbourne House** and the price for entering the lost world is just £6.95.

Data Design is a new data base management system for the IBM PC. Your data base is structured into a collection of tables which you define, and you can construct one or more input/output forms. These display forms are used to view the information in a table using any format you design, hence the name. The price is £150 plus VAT and you can get more details from **Pete & Pam Computers,** New Hall Hey Road, Rossendale, Lancashire BB4 6JG.

A new series of accounting packages is available for the Alphatronic P2 range of 48K and 64K micros, providing a comprehensive business system for accounts departments including packages for Sales Ledgers, Stock, Sales Invoicing, Purchase Ledger, Batch Invoicing, Nominal Ledger and Payroll. Prices for each module range from £150-£350 and you can get more details from **Triumph Adler Limited,** 27 Goswell Road, London EC1 or 'phone 01-250 1717.

An answer to the time consuming job of keeping track of video tapes is provided by Impetus Computers with their micro package to deal with all indexing, filing and book-keeping chores necessary for the efficient running of a cassette hire business. Called the **Video Hire Service** it runs on a Commodore such as the 8096, plus 8250 and a printer. Costing £19 per week, the package will maintain 13,000 films. Full information on any aspect of the hire system can be obtained from **Impetus Computer Systems,** Classic Office, Hendon Central, London NW4 3NN or 'phone 01-202 7638.

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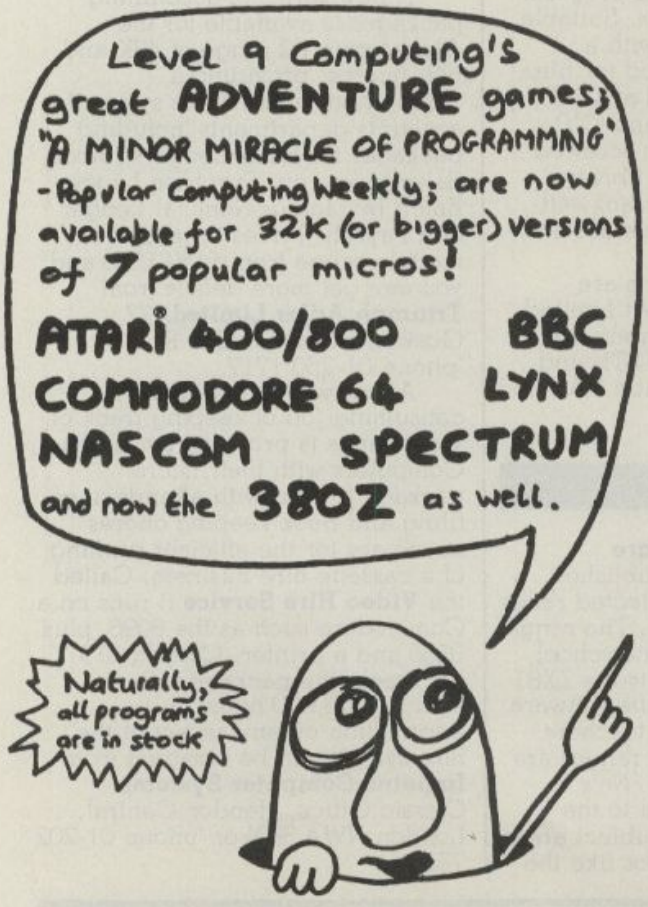

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In addition to the disc pack a second processor is supplied. This is a Z-80A with its own 64K RAM card, communicating with the 6502A in the BBC computer through the 'Tube'. Typically the speed of execution of programs under the twin-processor system is increased by up to 50% compared with a conventional single-processor computer. A third processor, the 16 bit 68000, will shortly be available.

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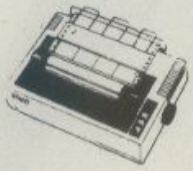

PRINTERS

The Epson MX80FT/3 has been replaced by the almost identical CTI CP80 £262 (£282) and the very similar Star DP510 £262 (£282). Epson FX80 £378 (£408). Epson MX100/3 £425 (£465). New Star DP515 15" carriage printer £374 (£414). Seikosha GP100A £199 (£219). Oki Microline 80 £207 (£227). Oki Microline 82A £360 (£400). Oki Microline 84 £730. Oki Microline 92 £470. The Silver Reed, the latest miracle: a combined daisy wheel printer and electric typewriter for only £385 (£425). Juki 6100 proportional daisy wheel printer £373 (£413). MCP 40 colour printer £139 (£159). Star STX 80 thermal printer £139 (£159). We can supply interfaces to run all the above from Sharp computers.

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UK prices are shown first. UK customers must add postage (£1 on Sinclair products, £3.50 on other computers and disc drives and £4.50 on other printers) and the 15% VAT. The bracketed prices are European export prices and include insured airmail postage to all the countries of Europe including Norway, Sweden, Finland, Denmark, Spain and Italy. No VAT should be added to export prices. We are THE leading computer export specialists. Official UK credit orders welcome from government laboratories and educational establishments.

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SEPTEMBER ISSUE ON SALE AUGUST 12th

BACKGAMMON

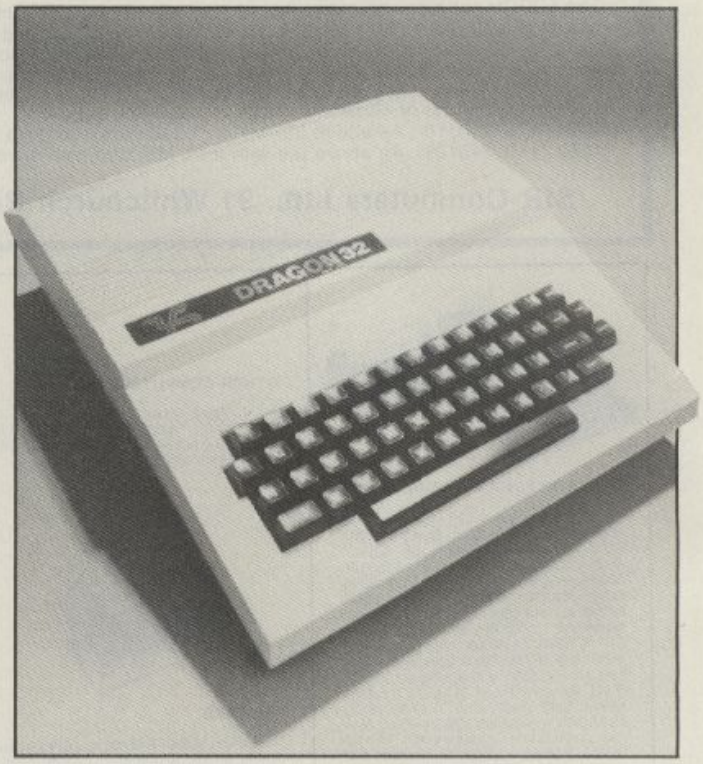
Now you can indulge in this cut-and-thrust pastime without losing either your shirt, or your pride, when the dice are against you. The ZX81 may not have the charisma and sex appeal of Omar Shariff but once you've entered the program in next month's CT, it does play a pretty good game of Backgammon. The program is fully documented with hints for converting it to other machines; and remember that a copy of CT costs an awful lot less than a backgammon board!

DRAGON CHARACTER DEFINER

Take the drudgery out of redesigning your character set on the Dragon 32 by running our utility program in the September CT. A large eight-by-eight grid corresponding to a character block is displayed on screen, and you use a joystick to move a cursor about and paint in the pixels. It's almost like playing Space Invaders while you're designing them.

FELIX KNOWLEDGE SHOP

At the end of May a revolutionary new shop opened in the centre of London. It sells knowledge. For a modest sum of money anyone can walk in and take a course of instruction on the subject of their choice, and because the shop uses a system of computer-aided teaching you can work at your own pace and without any inhibitions about looking stupid in front of a human tutor. The editor went along to the opening to try out a few packages, and reveals all about his job skills!



SOFTWARE PROTECTION

Gone are the days of cutlass and grappling irons: today's pirates make use of cassette recorders, EPROM copiers and sophisticated programming techniques to plunder helpless software companies becalmed in a sea of confusing legislation. Over-the-top imagery apart, software piracy is a major problem facing commercial programmers and the ill-gotten gains amount to millions of pounds. Next month's CT examines the scale of the problem and some of the measures that are being taken to combat the thefts.

Articles described here are in an advanced state of preparation but circumstances may dictate changes to the final contents.

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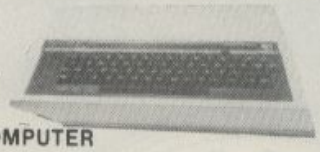
BBC Microcomputer System



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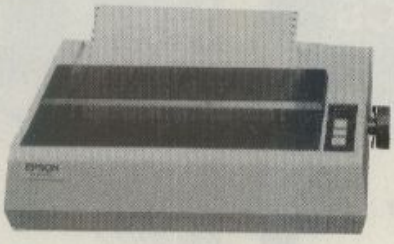

EPSON FX80: 80 column, 160 CPS, normal, italic and elite characters, 256 user definable characters, superscript, subscript, 11 × 9 matrix, bidirectional logic seeking, hi-res bit image printing (960 × 8 dots/line), friction and pinfeed, 9 international character sets, Centronic parallel interface.

FX80 PRICE ..... £379 + VAT = **£435.85**

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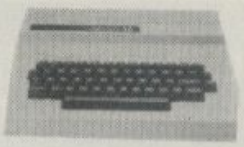

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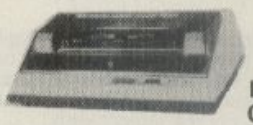

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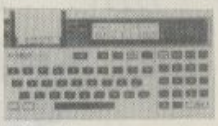

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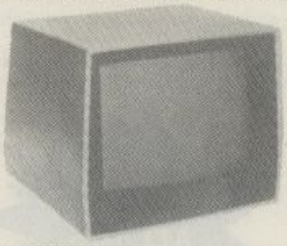

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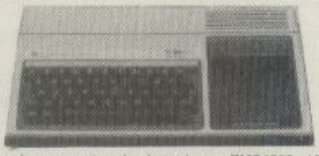

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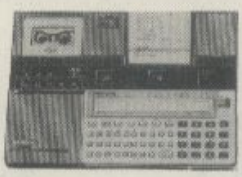

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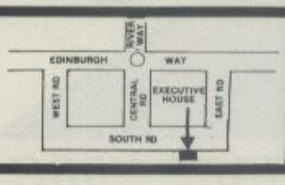

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Phil Cornes and Tony Cross

MICRO INTERRUPTIONS

We conclude our brief look at the way in which micros can be made to talk to one another by presenting a two player, two computer space game that demonstrates interrupt techniques to the full.

This month we are going to describe the implementation of a real time game, which uses two computers communicating over the PIO interface described last month.

The actual communication is done over PIO port A, using bits 0-3 as output bits (bit 3 as the interrupt bit) and bits 4-7 as inputs (bit 7 as the interrupt bit). The cable connecting the two machines must, therefore, have a four-bit twist in it to ensure that the output bits of one machine go to the input bits of the other machine. The PIO is programmed in the same way that we described last month, that is in Mode 3, using the Z-80 in interrupt Mode 2.

To obtain real time operation, all the software must be written in machine code. The version which we have written is in Z-80 code, and runs on a NASCOM 2 under the NAS-SYS 3 monitor. A Hex dump of this version is included at the end of this article.

ZAP THAT ALIEN

The game, called 'Starfighters', is a space war type game. The screen is a 'window' on space, around which you can 'fly' by using the four cursor control keys. Three alien spacecraft can be seen through the 'window', one of which is under the control of the other player. This ship is called the 'flagship', the other two are decoys and move around at random. All three ships look identical, but only the 'flagship' is armed, and only the 'flagship' has a defence shield. This means that a decoy alien will be destroyed if you hit it, but the 'flagship' will only be slightly damaged. You must hit the 'flagship' 10 times, in order to penetrate its shield and destroy it. Each time the 'flagship' is hit, any decoy ships which have been destroyed will be replaced.

Your photon cannons can be fired by pressing the Space bar. Their trajectories are such, that in order to hit an alien, you must manouevre him under your 'sights' before and during firing.

Your ship can only carry enough photon energy to fire twenty blasts from the cannons. You can, however, restore this energy level by 'docking' with the stationary 're-arming' satellite at any time. This is done by manouevering the satellite under the 'sights', where it will automatically 'lock on'. Once you are 'locked on' to the satellite you cannot move away until re-arming is complete. When the re-arming process is complete, the satellite will automatically 'unlock' itself and move a short distance away.

If you are hit, then you will suffer some damage. Each hit will damage about 10% of your systems, so if you are hit ten times, you will be destroyed!

The status of your ship is displayed on the top line of the screen. The status information given is:

1. The number of times you have hit the 'flagship'.
2. Your photon energy level remaining.
3. The extent of damage to your ship.

Other information is occasionally displayed on the top line, such as an indication that an alien spacecraft has been hit, or a warning that you have been hit.

SUB SPACE

In overview, the game consists of a number of subroutines which are called from a main loop. The main loop constantly scans the keyboard, and the subroutines perform the various functions required by each of the keys pressed. The main subroutines required are:

1. A routine to enable us to 'fly' around in space.
2. A routine to fire the photon cannons and detect a hit on an alien.

▶

3. A routine to transmit information to the other player.
4. A routine to receive, and act upon, information from the other player.
5. A routine to control the re-arming satellite and the re-arming process.
6. A routine to control the 'flagships' movements.
7. A routine to control the decoy ships movements.

1. Flying around in space.
Flying around in space is achieved by moving the stars, aliens and re-arming satellite, one screen location in the direction appropriate to the cursor key pressed. For example, if the left cursor key was pressed then everything must be moved to the right. Similarly, if the up cursor key was pressed then everything must be moved down.

The current position of the stars, aliens and satellite are stored as 16-bit screen addresses, the aliens and satellite in two byte variables and the stars in a two byte by 20 element array. These variables are read and updated by the four 'movement' routines, one for each cursor key.

The 'movement' routines all perform similar functions:

1. Read the current positions of stars, aliens and satellite.
2. Erase the stars, aliens and satellite by writing the 'space' character at their current positions.
3. Calculate new positions for the stars, aliens and satellite.
4. Update the current position variables.
5. Redraw the stars, aliens and satellite at their new positions.

In addition, the new position of each star is tested to see if it has gone off screen. If it has, then its position is re-calculated to position it at the opposite edge of the screen. Similarly, the new positions of the aliens and the satellite are tested to see if they have gone off screen. If any have, then their new positions are ignored and their 'old' positions are re-used. This prevents them from ever going off screen. (We discovered that if they are allowed to go off screen and 'wander through space', it is very easy to 'lose' them completely!).

For additional 'realism', an auto key repeat facility will allow you to move around by holding the cursor control keys down, rather than having to press the keys for every move. Fortunately, the NAS-SYS 3 monitor on the NASCOM

```
1000 8D 1A 31 00 10 F3 ED 5E 3E 10 ED 47 3E CF D3 06
1010 3E F0 D3 06 3E B7 D3 06 3E 7F D3 06 3E 01 D3 06
1020 AF D3 06 AF 32 42 1D 32 43 1D 3E 0C F7 EF 53 54
1030 41 52 46 49 47 48 54 45 52 53 20 2D 2D 20 43 6F
1040 70 79 72 69 67 68 74 20 28 63 29 20 41 2E 4C 2E
1050 43 72 6F 73 73 20 31 39 38 32 0D 0D 0A 57 65 6C
1060 63 6F 6D 65 20 74 6F 20 53 74 61 72 66 69 67 68
1070 74 65 72 73 21 20 20 41 20 72 65 61 6C 20 74 69
1080 6D 65 2C 20 64 75 61 6C 0D 0A 75 73 65 72 20 73
1090 70 61 63 65 20 77 61 72 20 67 61 6D 65 2E 0D 0D
10A0 0A 00 11 D6 06 CD 60 19 EF 44 65 63 69 64 65 20
10B0 77 69 74 68 20 79 6F 75 72 20 6F 70 70 6F 6E 65
10C0 6E 74 20 77 68 69 63 68 20 47 61 6C 61 63 74 69
10D0 63 0D 0A 45 6D 70 69 72 65 20 79 6F 75 20 77 69
10E0 73 68 20 74 6F 20 73 65 72 76 65 20 75 6E 64 65
10F0 72 2E 20 59 6F 75 20 6D 75 73 74 2C 20 6F 66 0D
1100 0A 63 6F 75 72 73 65 2C 20 65 61 63 68 20 63 68
1110 6F 6F 73 65 20 61 20 64 69 66 66 65 72 65 6E 74
1120 20 45 6D 70 69 72 65 2E 0D 0D 0A 54 68 65 20 74
1130 77 6F 20 45 6D 70 69 72 65 73 20 61 72 65 20 2D
1140 0D 0D 0A 20 20 20 20 31 2E 20 54 68 65 20 41 6C
1150 64 65 62 61 72 61 6E 20 56 49 49 20 43 6F 6D 70
1160 6C 65 78 2E 0D 0A 20 20 20 20 32 2E 20 54 68 65
1170 20 52 69 67 65 6C 20 49 49 49 20 53 74 61 72 20
1180 53 79 73 74 65 6D 2E 00 21 8A 0B 06 30 3E 20 77
1190 23 10 FC 21 8A 0B 22 29 0C EF 45 6E 74 65 72 20
11A0 79 6F 75 72 20 63 68 6F 69 63 65 20 6F 66 20 45
11B0 6D 70 69 72 65 20 3E 00 DF 7B FE 31 28 06 FE 32
11C0 28 1F 18 C4 3E 0C F7 21 DC 09 22 29 0C EF 50 6C
11D0 65 61 73 65 20 77 61 69 74 00 21 FE 11 22 44 1D
11E0 E9 3E 0C F7 21 DC 09 22 29 0C EF 50 6C 65 61 73
11F0 65 20 77 61 69 74 00 21 2F 12 22 44 1D E9 31 00
1200 10 3E 05 D3 04 11 1E 00 CD 60 19 DB 04 E6 F0 FE
1210 60 20 EE ED 5F E6 0E D3 04 16 00 5F 21 FF 1B 19
1220 54 5D CD 50 19 22 39 1D AF 32 3E 1D C3 6B 12 31
1230 00 10 DB 04 E6 F0 FE 50 11 0A 00 CD 60 19 20 F2
1240 3E 06 D3 04 11 64 00 CD 60 19 DE 04 CB 2F CB 2F
1250 CB 2F CB 2F E6 0E 16 00 5F 21 0F 1C 19 54 5D CD
1260 50 19 22 39 1D AF 32 3B 1D D3 04 ED 5F E6 0E 16
1270 00 5F 21 1F 1C 19 54 5D CD 50 19 22 3C 1D ED 5F
1280 E6 0E 16 00 5F 21 2F 1C 19 54 5D CD 50 19 22 3E
1290 1D 11 7D 00 ED 53 40 1D 21 31 0A 22 34 1D 21 4C
12A0 04 22 36 1D 3E 14 32 33 1D AF 32 38 1D 3E 07 32
12B0 30 1D 3E 0F 32 31 1D AF 32 32 1D 11 35 1B ED 53
12C0 2E 1D 3E 45 32 30 0C AF 32 2F 0C 3E 45 32 2E 0C
12D0 3E 0C F7 CD B1 19 CD 08 1A CD 6F 19 CD A0 18 FB
12E0 CD 95 16 CD AC 16 CD 22 15 CD F4 16 3A 38 1D FE
12F0 01 28 ED AF 0F 62 FE 11 CA 32 13 FE 12 CA A9 13
1300 FE 13 CA A0 14 FE 14 CA 1E 14 FE 20 CA 11 13 18
1310 CF 3A 33 1D FE 00 28 C8 3A 32 1D FE 00 20 C1 FD
1320 21 3F 1C CD 22 19 3E 01 32 32 1D 21 E0 12 E5 C3
1330 22 15 11 51 1B 06 14 CD 50 19 3E 20 77 23 7E FE
1340 94 CC A0 13 1B 3E 2E 77 CD 58 19 13 10 E9 2A 39
1350 1D CD 4C 19 CD 91 17 CD 46 19 22 39 1D 3E 0A D3
1360 04 3E 02 D3 04 2A 3C 1D 7C B5 28 0C CD 4C 19 CD
1370 91 17 CD 46 19 22 3C 1D 2A 3E 1D 7C B5 28 0C CD
1380 4C 19 CD 91 17 CD 46 19 22 3E 1D 2A 34 1D CD 4C
1390 19 CD 91 17 3E 0F 77 22 34 1D CD 6F 19 C3 E0 12
13A0 D5 11 2E 00 AF ED 52 D1 C9 11 51 1B 06 14 CD 50
13B0 19 3E 20 77 2B 7E FE 94 CC 17 14 1B 3E 2E 77 CD
13C0 58 19 13 10 E9 2A 39 1D CD 4C 19 CD 7E 17 CD 46
13D0 19 22 39 1D 3E 0C D3 04 3E 04 D3 04 2A 3C 1D 7C
13E0 B5 28 0C CD 4C 19 CD 7E 17 CD 46 19 22 3C 1D 2A
13F0 3E 1D 7C B5 28 0C CD 4C 19 CD 7E 17 CD 46 19 22
1400 3E 1D 2A 34 1D CD 4C 19 CD 7E 17 3E 0F 77 22 34
1410 1D CD 6F 19 C3 E0 12 D5 11 2E 00 19 D1 C9 11 14
1420 00 CD 60 19 11 51 1B 06 14 CD 50 19 3E 20 77 D5
1430 11 40 00 AF ED 52 D1 7E FE 98 CC 99 14 1B 3E 2E
1440 77 CD 58 19 13 10 E2 2A 39 1D CD 4C 19 CD 85 17
1450 CD 46 19 22 39 1D 3E 0B D3 04 3E 03 D3 04 2A 3C
1460 1D 7C B5 28 0C CD 4C 19 CD 85 17 CD 46 19 22 3C
1470 1D 2A 3E 1D 7C B5 28 0C CD 4C 19 CD 85 17 CD 46
1480 19 22 3E 1D 2A 34 1D CD 4C 19 CD 85 17 3E 0F 77
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1490 22 34 1D CD 6F 19 C3 E0 12 D5 11 40 03 19 D1 C9
14A0 11 14 00 CD 60 19 11 51 1B 06 14 CD 50 19 3E 20
14B0 77 D5 11 40 00 19 D1 7E FE 98 CC 19 15 1B 3E 2E
14C0 77 CD 58 19 13 10 E4 2A 39 1D CD 4C 19 CD 98 17
14D0 CD 46 19 22 39 1D 3E 09 D3 04 3E 01 D3 04 2A 3C
14E0 1D 7C B5 28 0C CD 4C 19 CD 98 17 CD 46 19 22 3C
14F0 1D 24 3E 1D 7C B5 28 0C CD 4C 19 CD 98 17 CD 46
1500 19 22 3E 1D 2A 34 1D CD 4C 19 CD 98 17 3E 0F 77
1510 22 34 1D CD 6F 19 C3 E0 12 D5 11 40 03 AF ED 52
1520 D1 C9 3A 38 1D FE 01 28 0F 3A 33 1D F5 DD 21 D7
1530 0B CD F7 18 F1 FE 00 C8 3A 32 1D FE 00 C8 FE 02
1540 28 28 ED 5B 2E 1D 3A 31 1D 4F CD 50 19 3E B8 77
1550 13 CD 50 19 3E B8 77 0D 79 32 31 1D FE 00 C0 3E
1560 02 32 32 1D 3E 0A 32 31 1D C9 ED 5B 2E 1D 3A 30
1570 1D 47 3A 31 1D 4F CD 50 19 3E 20 77 13 CD 50 19
1580 3E 20 77 0D 79 32 31 1D FE 00 C0 13 05 78 FE 00
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15B0 3E 0A 32 31 1D AF 32 32 1D 3A 33 1D 3D 32 33 1D
15C0 2A 39 1D CD A4 17 30 44 3E 0F D3 04 3E 07 D3 04
15D0 CD 1F 1A CD 8C 18 3A 42 1D 3C 32 42 1D CD B3 17
15E0 21 D6 0B 22 29 0C EF 45 6E 65 6D 79 20 66 6C 61
15F0 67 73 68 69 70 20 64 61 6D 61 67 65 64 21 21 00
1600 11 08 07 CD 60 19 2A 44 1D E3 F3 C9 2A 3C 1D CD
1610 A4 17 30 3D CD 1F 1A 21 00 00 22 3C 1D CD 8C 18
1620 21 D4 0B 22 29 0C EF 45 6E 65 6D 79 20 64 65 63
1630 6F 79 20 73 68 69 70 20 64 65 73 74 72 6F 79 65
1640 64 21 21 00 11 08 07 CD 60 19 CD 8C 18 CD A0 18
1650 C9 2A 3E 1D CD A4 17 D0 CD 1F 1A 21 00 00 22 3E
1660 1D CD 8C 18 21 D4 0B 22 29 0C EF 45 6E 65 6D 79
1670 20 64 65 63 6F 79 20 73 68 69 70 20 64 65 73 74
1680 72 6F 79 65 64 21 21 00 11 08 07 CD 60 19 CD 8C
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16A0 17 CD 46 19 22 39 1D AF 32 3B 1D C9 ED 5B 40 1D
16B0 1B ED 53 40 1D 7A B3 C0 2A 3C 1D 7C B5 28 13 CD
16C0 4C 19 ED 5F CB 2F E6 03 3C CD 6D 17 CD 46 19 22
16D0 3C 1D 2A 3E 1D 7C B5 28 13 CD 4C 19 ED 5F CB 2F
16E0 E6 03 3C CD 6D 17 CD 46 19 22 3E 1D 11 7D 00 ED
16F0 53 40 1D C9 2A 34 1D 3E 0F 77 3A 38 1D FE 01 28
1700 2A 2A 34 1D CD A4 17 38 05 AF 32 38 1D C9 CD 8C
1710 18 21 DB 0B 22 29 0C EF 2A 20 52 45 2D 41 52 4D
1720 49 4E 47 20 2A 00 3E 01 32 38 1D 2A 36 1D 2B 22
1730 36 1D 7C B5 28 0B FD 21 29 1D CD 22 19 CD 6F 19
1740 C9 21 4C 04 22 36 1D 2A 34 1D CD 4C 19 ED 5F CB
1750 2F E6 03 3C CD 6D 17 3E 0F 77 22 34 1D AF 32 38
1760 1D 3E 14 32 33 1D CD 8C 18 CD A0 18 C9 FE 01 28
1770 14 FE 02 28 1C FE 03 28 1F FE 04 28 01 C9 2B 7E
1780 FE 94 C0 23 C9 11 40 00 AF ED 52 7E FE 98 C0 19
1790 C9 23 7E FE 94 C0 2B C9 11 40 00 19 7E FE 98 C0
17A0 AF ED 52 C9 7C FE 09 20 07 7D FE E1 20 02 37 C9
17B0 37 3F C9 3A 42 1D FE 0A 30 08 3A 43 1D FE 64 30
17C0 4A C9 3E 0C F7 21 1D 09 22 29 0C EF 57 65 6C 6C
17D0 20 64 6F 6E 65 21 0D 0D 0A 20 59 6F 75 20 68 61
17E0 76 65 20 74 6F 74 61 6C 6C 79 20 64 65 73 74 72
17F0 6F 79 65 64 20 74 68 65 20 65 6E 65 6D 79 20 66
1800 6C 61 67 73 68 69 70 2E 00 18 44 3E 0C F7 21 1D
1810 09 22 29 0C EF 42 61 64 20 6C 75 63 6B 0D 0D 0A
1820 20 20 59 6F 75 20 61 72 65 20 6E 6F 77 20 6A 75
1830 73 74 20 61 6E 20 65 78 70 61 6E 64 69 6E 67 20
1840 63 6C 6F 75 64 20 6F 66 20 67 61 73 21 21 00 21
1850 1A 0A 22 29 0C EF 41 6E 6F 74 68 65 72 20 67 61
1860 6D 65 20 28 59 2F 4E 29 3F 00 3E 50 32 30 0C 3E
1870 02 32 2F 0C 3E 80 32 2E 0C DF 63 21 23 00 19 7E
1880 FE 59 20 06 21 02 10 E3 ED 4D DF 5B F5 C5 D5 E5
1890 06 30 3E 20 21 CA 0B 77 23 10 FC E1 D1 C1 F1 C9
18A0 E5 DD 21 CA 0B 3A 42 1D CD F7 18 21 CD 0B 22 29
18B0 0C EF 2D 20 48 69 74 73 00 DD 21 D7 0B 3A 33 1D
18C0 CD F7 18 21 DA 0B 22 29 0C EF 2D 20 50 68 6F 74
18D0 6F 6E 20 65 6E 65 72 67 79 00 DD 21 EE 0B 3A 43
18E0 1D CD F7 18 21 F1 0B 22 29 0C EF 2D 20 25 44 61
18F0 6D 61 67 65 00 E1 C9 C5 DD 22 29 0C 0E 01 06 0A
1900 90 38 03 0C 18 FA 80 CD 1A 19 0E 01 06 01 90 38
1910 03 0C 18 FA 80 CD 1A 19 C1 C9 F5 79 3D C6 30 F7
```

already has this facility. Non NASCOM users can, of course, write their own auto key repeat routines, if required.

2. Firing the photon cannons

There are two photon cannons, and they are angled so that their 'shells' coincide under the centre of the 'sights'. From first being fired, to the point where they coincide each 'shell' occupies seven separate positions on the NASCOM screen. Since the game is to run in real time, the 'shell' trajectories cannot be drawn all in one go, because this would take too long. To overcome this problem, the current status of the photon cannons (ie firing or not) is stored in a status variable, and the current positions of the 'shells' is updated. To obtain a realistic speed of firing, the 'shells' are repositioned every 15 times round the main loop.

When the Space bar is pressed, the status variable is 'set'. The photon cannon routine tests this variable every time and returns immediately if it is not 'set'.

At the end of the photon cannon routine, if the 'shells' are at their coincident position, the status variable is 'reset'. Every time the 'shells' reach their coincident position, the current position of each of the aliens is tested. If one of them is currently under the centre of the sights, then it has been hit, and the routine which draws an alien exploding is called. If the alien hit was the 'flagship', then the 'flagship hit' variable is incremented. If this variable reaches the value 10, then the game is over and you have won. If the alien hit was a decoy, then it is 'flagged' so that it is not redrawn until the 'flagship' has been hit.

3. Transmitting information to the other player.

There are only five data items that need to be sent to the other player. They are, the four possible directions of movement, and whether the other player has been hit. They are sent as a one byte code per item, and are coded as follows:

Move to the left	— 0A Hex
Move to the right	— 0C Hex
Move up	— 09 Hex
Move down	— 0B Hex
Hit on the other player	— 0F Hex

The direction information is sent during the appropriate movement routine, and the 'hit on the other player' information is sent during the photon cannon routine, if the 'flagship' has been hit. ▶

```
1920 F1 C9 F5 C5 D5 E5 FD 46 00 FD 23 FD 6E 00 FD 23
1930 FD 66 00 DF 5F 7C FF 2D 7D FE 00 20 F6 FD 23 10
1940 EA E1 D1 C1 F1 C9 F5 3E 0E 77 F1 C9 3E 20 77 C9
1950 F5 1A 6F 13 1A 67 F1 C9 F5 7D 12 13 7C 12 F1 C9
1960 F5 C5 06 E8 00 10 FD 1B 7A B3 20 F6 C1 F1 C9 F5
1970 3E 88 32 1F 0A 32 A3 09 3C 32 9F 09 32 23 0A F1
1980 C9 F5 C5 D5 E5 21 0B 08 3E 98 06 2E 77 23 10 FC
1990 21 8B 0B 06 2E 77 23 10 FC 21 4A 08 11 40 00 06
19A0 0D 3E 94 77 19 10 FC 21 79 08 06 0D 77 19 10 FC
19B0 3E 90 32 0A 08 3C 32 39 08 3C 32 8A 0B 3C 32 B9
19C0 0B E1 D1 C1 F1 C9 F5 C5 D5 E5 11 79 1B 06 0D C5
19D0 CD 50 19 06 2E 3E 80 77 23 10 FA C1 13 10 F0 E1
19E0 D1 C1 F1 C9 F5 C5 D5 E5 06 0D 11 79 1B C5 CD 50
19F0 19 06 2E 3E 20 77 23 10 FA C1 13 10 F0 CD 08 1A
1A00 CD 6F 19 E1 D1 C1 F1 C9 F5 C5 D5 E5 11 51 1B 06
1A10 14 CD 50 19 3E 2E 77 13 10 F7 E1 D1 C1 F1 C9 F5
1A20 C5 D5 E5 11 F5 1B 06 05 3E 80 CD 50 19 77 13 10
1A30 F9 FD 21 60 1C CD 22 19 11 F5 1B 06 05 3E 20 CD
1A40 50 19 77 13 10 F9 3E D4 32 E2 09 32 E0 09 11 93
1A50 1B 06 04 3E D1 CD 50 19 77 13 10 F9 11 9B 1B 06
1A60 07 3E E0 CD 50 19 77 13 10 F9 11 A9 1B 06 26 3E
1A70 2E CD 50 19 77 13 10 F9 FD 21 7F 1C CD 22 19 CD
1A80 E4 19 CD 08 1A CD 6F 19 E1 D1 C1 F1 C9 F3 08 D9
1A90 DB 04 E6 70 FE 70 C2 06 1B CD C6 19 FD 21 A8 1C
1AA0 CD 22 19 11 2C 01 CD 60 19 CD E4 19 CD 08 1A CD
1AB0 6F 19 3A 43 1D C6 0A 32 43 1D CD B3 17 CD 8C 18
1AC0 21 CA 0B 22 29 0C EF 4D 69 73 73 69 6C 65 20 69
1AD0 6D 70 61 63 74 21 20 20 20 20 20 20 20 20 53 68
1AE0 69 70 20 73 74 61 74 75 73 20 2D 20 4F 70 65 72
1AF0 61 74 69 6F 6E 61 6C 00 11 DC 05 CD 60 19 2A 44
1B00 1D E3 D9 08 ED 4D CB 2F CB 2F CB 2F CB 2F E6 07
1B10 32 3B 1D D9 08 FB ED 4D 86 DE E0 F2 E4 D2 CE D0
1B20 E8 40 50 C6 52 40 82 5C 98 5C 86 E4 EF DE E6 E6
1B30 40 62 72 70 64 5B 0B 67 0B 1C 0B 26 0B DD 0A E5
1B40 0A 9E 0A A4 0A 5F 0A 63 0A 20 0A 22 0A E1 09 E1
1B50 09 4F 08 6B 08 76 08 D6 08 B1 08 E1 08 50 09 6B
1B60 09 9D 09 D3 09 F1 09 1F 0A 27 0A 4B 0A B8 0A D9
1B70 0A E8 0A 4F 0B 6D 0B 61 0B 4B 08 8B 08 CB 08 0B
1B80 09 4B 09 8B 09 CB 09 0B 0A 4B 0A 8B 0A CB 0A 0B
1B90 0B 4B 0B E1 09 A1 09 A4 09 DE 09 DF 09 E3 09 9F
1BA0 09 A2 09 A4 09 20 0A 22 0A 20 09 22 09 E1 08 1F
1BB0 09 24 09 DE 0E 28 09 5F 09 5C 09 57 09 63 09 65
1BC0 09 6B 09 9D 09 9A 09 A3 09 A7 09 DB 09 D9 09 E5
1BD0 09 E7 09 EA 09 1C 0A 19 0A 24 0A 26 0A 5E 0A 5C
1BE0 0A 64 0A 67 0A 6C 0A A1 0A 9E 0A 9B 0A 96 0A A5
1BF0 0A E0 0A E9 0A E0 09 E1 09 E2 09 A1 09 21 0A 4F
1C00 0B E4 0A 29 09 71 0A 97 09 CE 08 B6 08 30 0B 4F
1C10 08 25 09 AA 0A 73 09 17 0A CF 0A 77 0B AF 08 17
1C20 0A CF 0A 73 09 4F 08 AA 0A AF 08 CF 0A 17 0A 73
1C30 09 77 0B 17 0A CF 0A 25 09 73 09 4F 08 AA 0A 10
1C40 20 01 20 0C 20 04 20 08 20 01 20 0C 20 04 20 08
1C50 20 01 20 0C 20 04 20 08 20 01 20 0C 20 04 20 08
1C60 0F A0 02 05 03 12 06 A1 04 12 03 24 04 54 03 76
1C70 02 14 03 18 04 32 02 65 01 13 02 64 01 05 04 14
1C80 FF 01 FF 04 FF 01 FF 04 FF 01 FF 04 FF 01 FF 04
1C90 FF 01 FF 04 FF 01 FF 04 FF 02 FF 05 FF 02 FF 05
1CA0 FF 03 FF 06 FF 03 FF 06 40 50 01 50 0C 50 04 50
1CB0 08 50 01 50 0C 50 04 50 08 50 01 50 0C 50 04 50
1CC0 08 50 01 50 0C 50 04 50 08 50 01 50 0C 50 04 50
1CD0 08 50 01 50 0C 50 04 50 08 50 01 50 0C 50 04 50
1CE0 08 50 01 50 0C 50 04 50 08 50 01 50 0C 50 04 50
1CF0 08 50 01 50 0C 50 04 50 08 50 01 50 0C 50 04 50
1D00 08 50 01 50 0C 50 04 50 08 FF 09 FF 0A FF 0B FF
1D10 0C FF 0B FF 0A FF 09 FF 08 FF 07 FF 06 FF 05 FF
1D20 04 FF 03 FF 02 FF 01 FF 01 02 08 04 02 0F 35 1B
1D30 07 0F 00 00 00 00 00 00 00 00 00 00 00 00 00 00
1D40 7D 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

The complete listing for Starfighter in Z-80 Hex format.

For those who don't have the time to type in all this code, the program is available in NASCOM 2 (CUTS) format at 300 baud from ASP Software for £5.99. Orders to ASP Software at 145 Charing Cross Road, London WC2H 0EE marked "Starfighter".

4. Receiving information from the other player.

Because there is a four-bit twist in the cable connecting the two machines, the data is received reversed from that shown above. For example, a move to the left is received as A0 Hex, and a move to the right is received as C0 Hex. In each case the high bit is set, and this causes the PIO, which has been programmed to look for this bit set, to generate an interrupt. When the interrupt has been acknowledged, the interrupt service routine will be called.

The interrupt service routine tests the received data to see if it is direction information (ie, not code 0F Hex). If it is, then it is stored in the 'alien direction' variable and a 'return from interrupt' is executed. If it is code 0F Hex (ie hit code received), then the routine which draws the missile strike flash, is called and the 'hit on yourself' variable is incremented. If this variable reaches the value 10 decimal, then the game is over and you have lost, otherwise a 'return from interrupt' is executed.

5. Controlling the re-arming satellite.

The re-arming satellite is unable to move under its own power, so the only way the satellite can move, is when any of the cursor keys are pressed, and the four movement routines already take care of this for us.

All the re-arming routine needs to do then is to test the position of the satellite to see if it is under the 'sights'. Since the movement routines can change this position each time the main loop is executed, the re-arming routine must also be called each time round the main loop.

If the satellite is not under the 'sights', then no action is needed, and the routine 'returns' immediately, otherwise a flag is set which prevents the keyboard from being scanned, and a counter variable is decremented. Each time the re-arming routine is called whilst the satellite is in this 'locked on' state; the counter variable is decremented. When this counter reaches zero, the re-arming process is complete and several things happen:

1. The 'movement routine disabled' flag is reset.
2. The 'counter' variables original value is restored.
3. The 'number of photons' variable is set to 20 decimal.
4. The satellite is moved, one screen location, in a 'random' direction.

The satellite is moved so that it is not detected as being under the 'sights', immediately the routine ends. The 'random' element consists of selecting, at random, one of four possible directions of movement. This has been implemented on the NASCOM, by loading the accumulator with the contents of the refresh register, and then using only the low two bits. Unfortunately for us, the low bit of the Z-80 refresh register is always 0. To overcome this, the contents of the accumulator are shifted one bit to the right. The accumulator is then incremented by one, for reasons which will become apparent later, to give a range of values between 1 and 4. The effect of each value is:

1 — Move up
2 — Move left
3 — Move down
4 — Move right

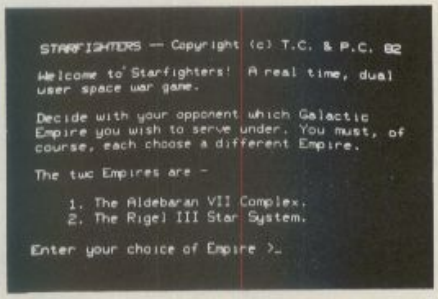
The satellite is now moved, one screen location, in the direction appropriate to the contents of the variable. This is done by calling a set of 'universal move' routines, which test the value in the accumulator, and then move the 'calling' object in the appropriate direction. (It was to enable us to use these universal routines, that we incremented the 'random' value in the accumulator earlier).

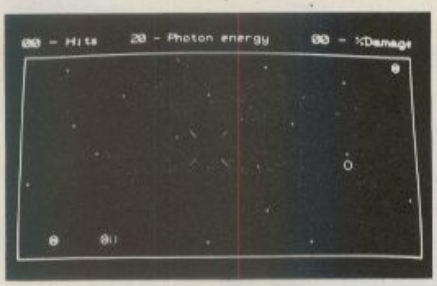
Non-Z-80 users could achieve the same effect by reading a table which contains the digits 1 to 4 in a 'random' sequence, and calling the 'universal move' routines with the value read. Even with a fairly small table, it will be very difficult for the user to anticipate the direction in which the satellite will move.

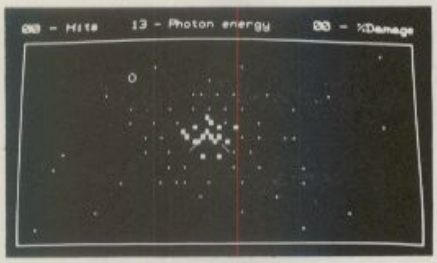
6. Controlling the 'flagship'.
As we have seen, the 'flagship' is under the control of the other player, and we can tell in which direction he has moved, by reading the 'alien direction' variable. This variable will contain either the digits 09 to 0C Hex, or 0, which is the value it is initialised to. When the variable has been read, the high bit is reset, since it is no longer needed, leaving five possible values 00 to 04. These values mean:

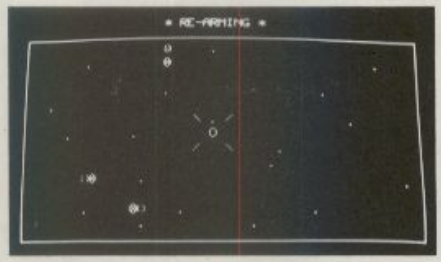
00 — Do not move 'flagship'
01 — Move 'flagship' up
02 — Move 'flagship' left
03 — Move 'flagship' down
04 — Move 'flagship' right

The 'flagship' is now moved, one screen location, in the direction









appropriate to the contents of the variable. This is done by calling the 'universal move' routines, unless the value is 0, in which case the 'flagship' is not moved at all.

Just as in the four movement routines, the 'flagship' is tested to see if its new position is off the screen. If it is, then its new position is ignored and its old position is re-used.

At the end of the 'flagship' routine the 'alien direction' variable is set to 0, so that if no further directions are received from the other player, the 'flagship' will remain stationary. (Except when any of the cursor keys are pressed, of course).

7. Controlling the decoy aliens.
There are two decoy aliens, although you can have as many as you like, and they serve no purpose other than to cause confusion.

The decoy routine, which is called each time round the main loop, moves each of the decoy aliens in a separate 'random' direction. The decoys are not moved every time the routine is called, because they would then move much faster than the 'flagship', which would defeat their purpose! Instead a counter, which has an initial value of 150, is decremented each time the routine is called, and the decoys are only moved when this counter reaches zero.

When it is time to move the decoys, one of the four possible directions of movement is chosen, at random, for each of the decoys. They are then moved, one screen location, in their respective directions.

The 'random' choice of direction is implemented in the same way that it was for the re-arming satellite, ie by reading the value in the Z-80 refresh register. Non-Z-80 users could use the table principle again, as described earlier.

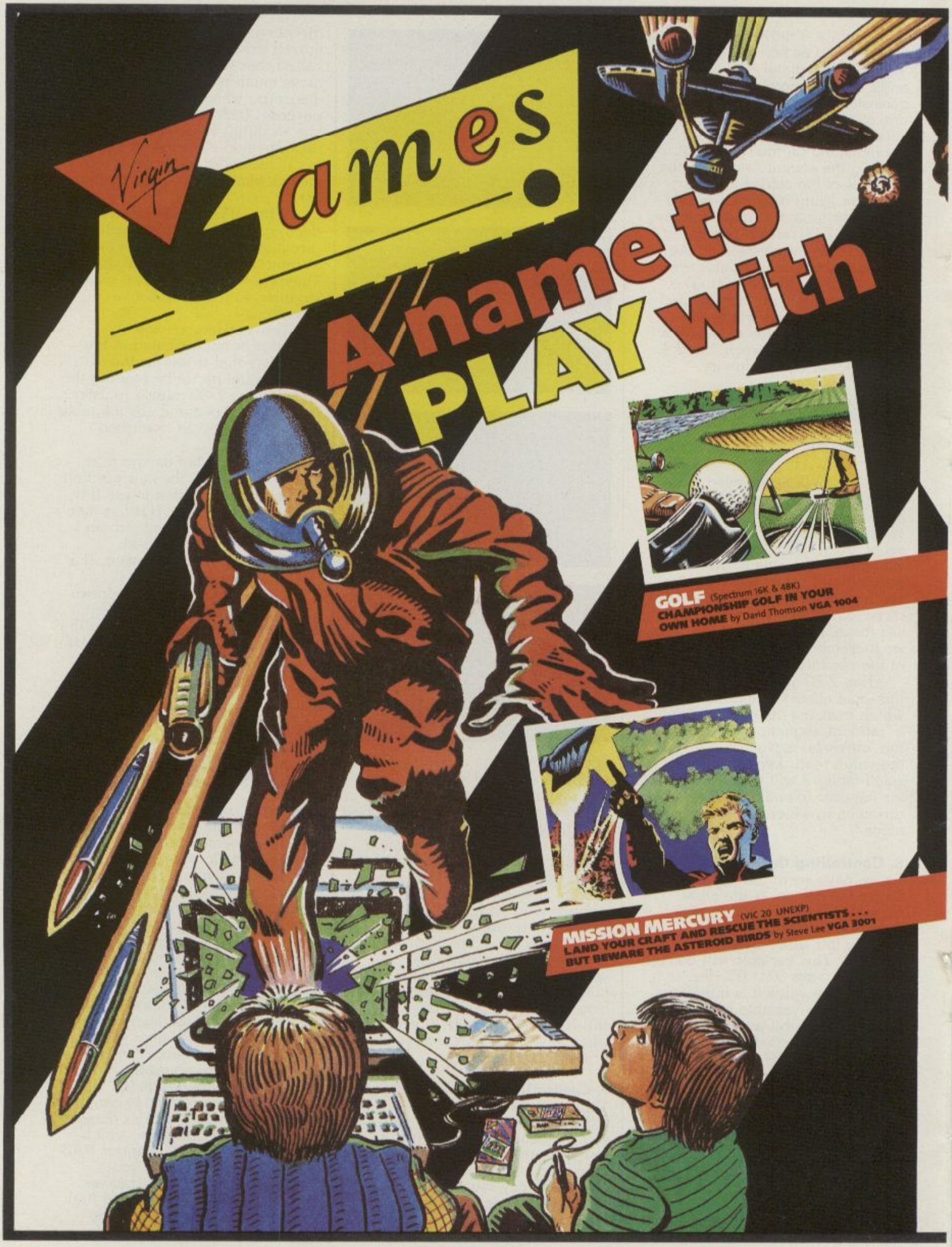
To prevent the decoys from going off screen, the new position of each alien is tested to see if it has gone off screen. If it has then the new position is ignored, and the old position is re-used.

As we mentioned earlier, if a decoy alien is hit, then it is 'flagged' so that it is not redrawn until the 'flagship' has been hit. What this really means, is that the decoy alien's position is set to0 if it has been hit. The first thing that the decoy routine does is to test the positions of the decoy aliens. If either, or both, of them have been 'flagged' as hit, then they are ignored.

DELVING DEEPER

There are, of course, a whole host of 'lower level' subroutines, such as the 'universal move routines', and routines to output the scores etc, which have not been described because of space limitations (out of politeness the Editor is choosing to ignore this feeble attempt at a pun!). The routines which we have described, however, form the 'guts' of the game, and with the descriptions of the PIO programming, and the use of interrupts, which we described last month, they should give you a fair idea of how to go about writing this sort of game for yourself.

To show you how much more exciting this sort of game can be, we have reproduced a Hex dump of our version of the game, which runs on a NASCOM 2 under NAS-SYS 3. (Incidentally, if you connect a small 8 ohm speaker across the tape LED you will find that our version also has some limited sound effects!)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SHARP SPEED UP

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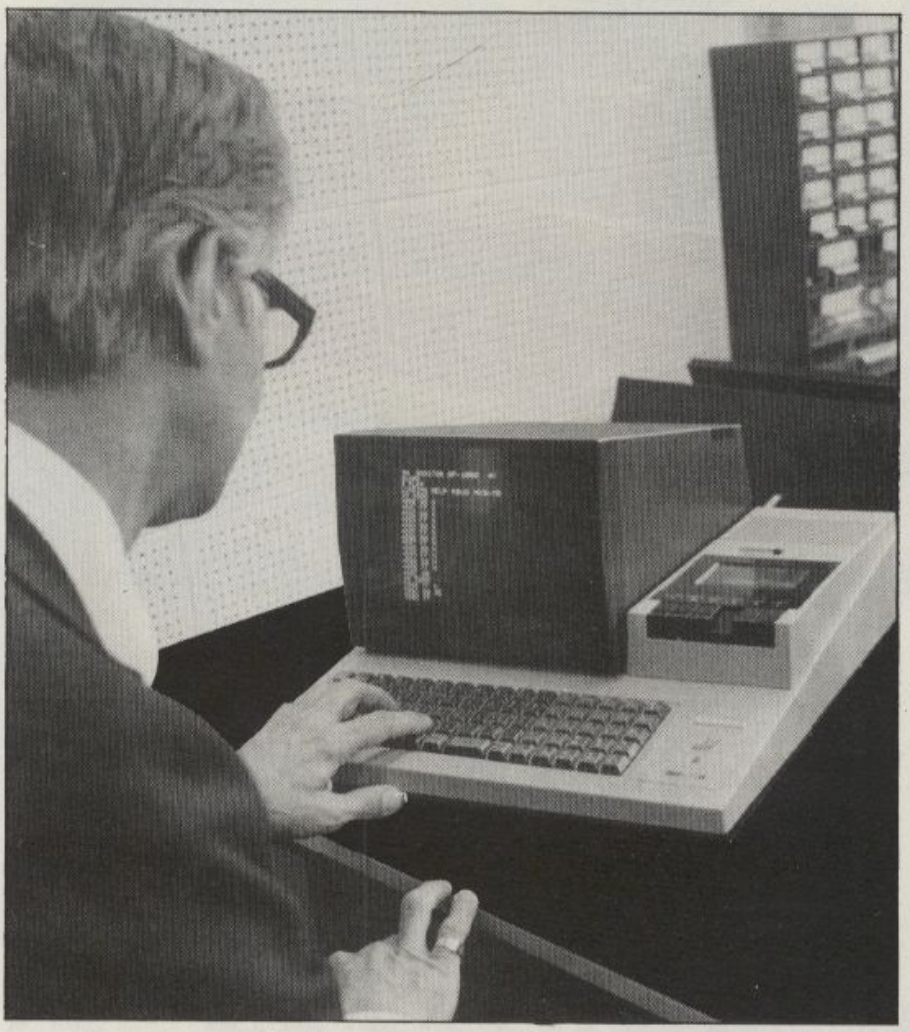


Improving the speed performance of the modern micro seems to have recently occupied the minds of many computer owners. There would appear to be two main schools of thought, those who believe in purchasing one of the piggy-back boards for between £50 and £100 which will receive no comment in this article, and those who believe in modifying the existing circuitry.

Those who follow the second course face a number of practical problems. If the micro is set for the faster speed it is not possible to load programs saved at the original, slower speed and if the speed is changed after loading at the original speed the program is likely to crash when switching takes place.

The solution which is described here is, I would suggest reliable, inexpensive and readily adaptable to other systems which work in a similar manner to the MZ-80K.

CLOCK THAT

Sharp generate their clock from an 8 MHz crystal which is divided by a 74LS93; pin 8 gives the output at 2 MHz which then goes off to disappear into the bowels of the gubbins. At pin 9 a 4 Mhz output can be obtained though this pin was not used in the original Sharp design.

It will be necessary to cut the track where it leaves the 74LS93 (IC9). Care is needed here and I should not need to remind the reader that any guarantee might well be invalidated by performing this minor piece of surgery. Nor should it be attempted by the inexperienced or those of nervous disposition.

A length of thin, flexible wire is connected to pin 8, a second length, preferably of a different colour to pin 9 and a third to the other side of the cut track. Joining the pin 8 and cut-track wire should restore all as before and a quick test can be made. If all is not well do not continue until the fault is rectified.

Originally the Z-80 was intended to have an operating speed of 1 MHz (hence the division), but it is possible that the one in residence may well operate far in excess of this and not need replacing. The Z-80A is a direct replacement for the Z-80 and apart from the usual care needed when dealing with 40 pin beasties no problems should be encountered. (The cost of a Z-80A is something in the order of £4-£5 which is not enough to deter the enthusiast or require a second mortgage.)

WHAT A SWITCH

The circuit shown switches the clock from one speed to the other in such a way that switching takes place when the clock cycle goes low which reduces the possibility of crashing programs. Switching can be done while running a program, indication of clock speed is clearly displayed and at switch-on, the computer comes to life in the original way as the makers intended. This is a great advantage if used by less experienced members of the family for they can just ignore the little switch.

Construction is straightforward, construction on a piece of 1mm copper strip-board (Veroboard) makes a neat job and provided good construction practice is followed no problems should be encountered.

The switching circuit of the 74LS00 is quite conventional. The 74LS73 acts as a standard JK flip-flop with CLR tied to the RESET line. The problem of false triggering on a non negative cycle was solved by using the 74LS74 as a one shot pulse circuit which delivers its one pulse when and only when the switch is pressed and this is timed to fit into the computer's normal timing.

The switch should be of the momentary action type which is normally connected to V_{cc} and grounded when the change over is required. The pulse so delivered flips the JK and so on via the 74LS00's to the micro's main timing circuit.

The bi-coloured LED indicator is something of a luxury as a

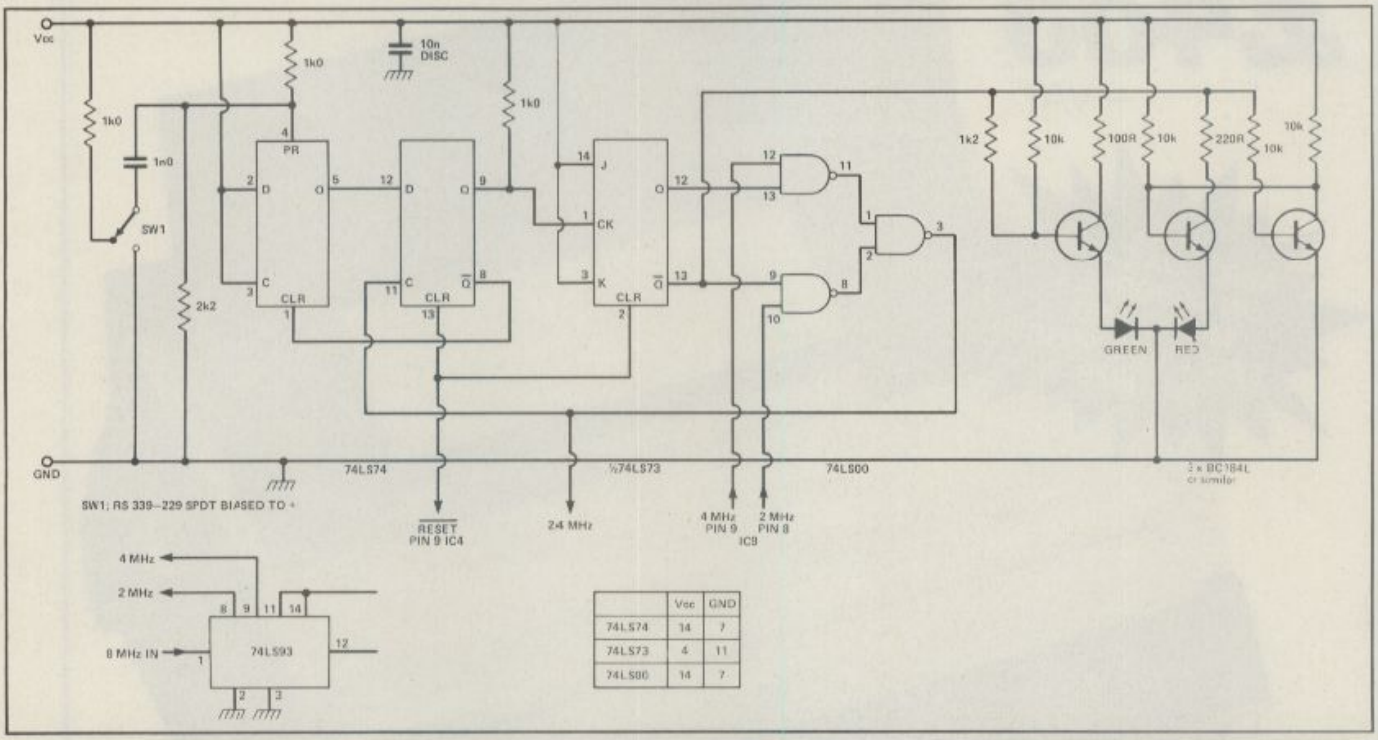
simpler system could be easily designed but this circuit has one particular advantage in that it does ensure the computer always comes up at 2 MHz from cold as previously described when the LED shows green turning red to indicate 4 MHz.

During use this modification has proved itself as being reliable, programs can be saved and run at either speed and for such a modest outlay has proved a most valuab.e improvement to this already excellent micro.

A WORD OF WARNING

If your Sharp has had extra RAM fitted since you purchased it, you must ensure that this memory is sufficiently fast to operate with the higher clock speed.

This circuit switches the clock from one speed to the other



	Vcc	GND
74LS74	14	7
74LS73	4	11
74LS00	14	7

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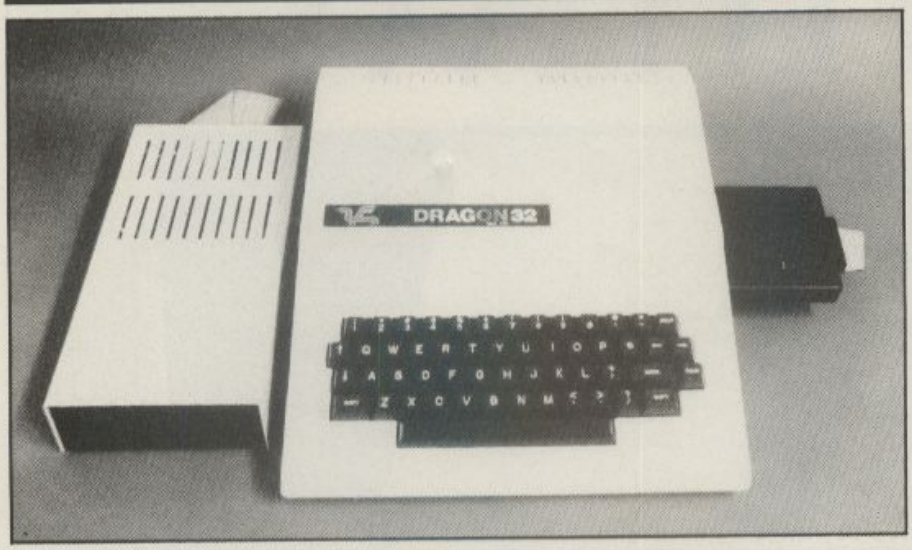
DRAGON DISCS

For frustrated Dragon 32 owners awaiting the long-promised disc drives, here's good news in the form of a pre-emptive strike by an independent company.



The Dragon 32 computer is one of the almost fairy-tale success stories of the British microcomputer scene. Launched mid-way through 1982, it sold spectacularly well in the period leading up to last Christmas and now has an established user base which must be fast approaching the 100,000 mark. Before we take a look at the disc system which is the subject of this review (not a Dragon Data product, incidentally), it is worth trying to establish why the system was, and continues to be, so successful.

A HYBRID COMPUTER

As a product specification, the Dragon 32 already existed in the form of the Tandy Color Computer. This is not to say that they are the same computer, far from it, but they are built around the same basic set of parts. The Tandy product, in this country at least, received very little attention, partly as a result of its different approach and partly because of its high price. On the other hand the Dragon 32 was very attractively priced, and despite a brief hiccough when Mettoy sold off their holding in the company and the high rate of sales forced a move to new and bigger premises, the system has always been available. Dragon's shift from a mail-order marketing philosophy to a direct High Street sell through retail outlets like Boots and Laskys has also made the product much more accessible, in that it can be tried before you buy it. The odd specification has not, apparently, caused any problems to the company, although a lack of software in the early days was noticeable.

The reason that I call the specification 'odd' is not that it is a technically flawed machine, but that it uses an unfamiliar CPU and a version of BASIC which is only seen on one other computer, Tandy's Color Computer. The Dragon 32 is based around Motorola's second generation eight-bit processor, the 6809. Very few companies in the UK have made any real use of this CPU, which is a pity in many ways as it has a lot of support in the States. Primarily produced as a direct competitor to Zilog's Z80, the 6809 is fully compatible with the much underrated S-50 bus system and the excellent FLEX Disc Operating System. In theory, at least, there should be no problem in connecting a Dragon 32, through its cartridge port, to the S-50 bus and hence giving it immediate access to a vast array of add-ons from discs down to speech synthesisers. But, curiously, no such move has yet taken place. Even as this review was being compiled it was announced that the arrival of Dragon Data's own disc drives was, once again, delayed. Technically there is no reason why they should have any problem at all, as the product tested here shows. Indeed, it could be that Dragon Data may well have missed the boat.

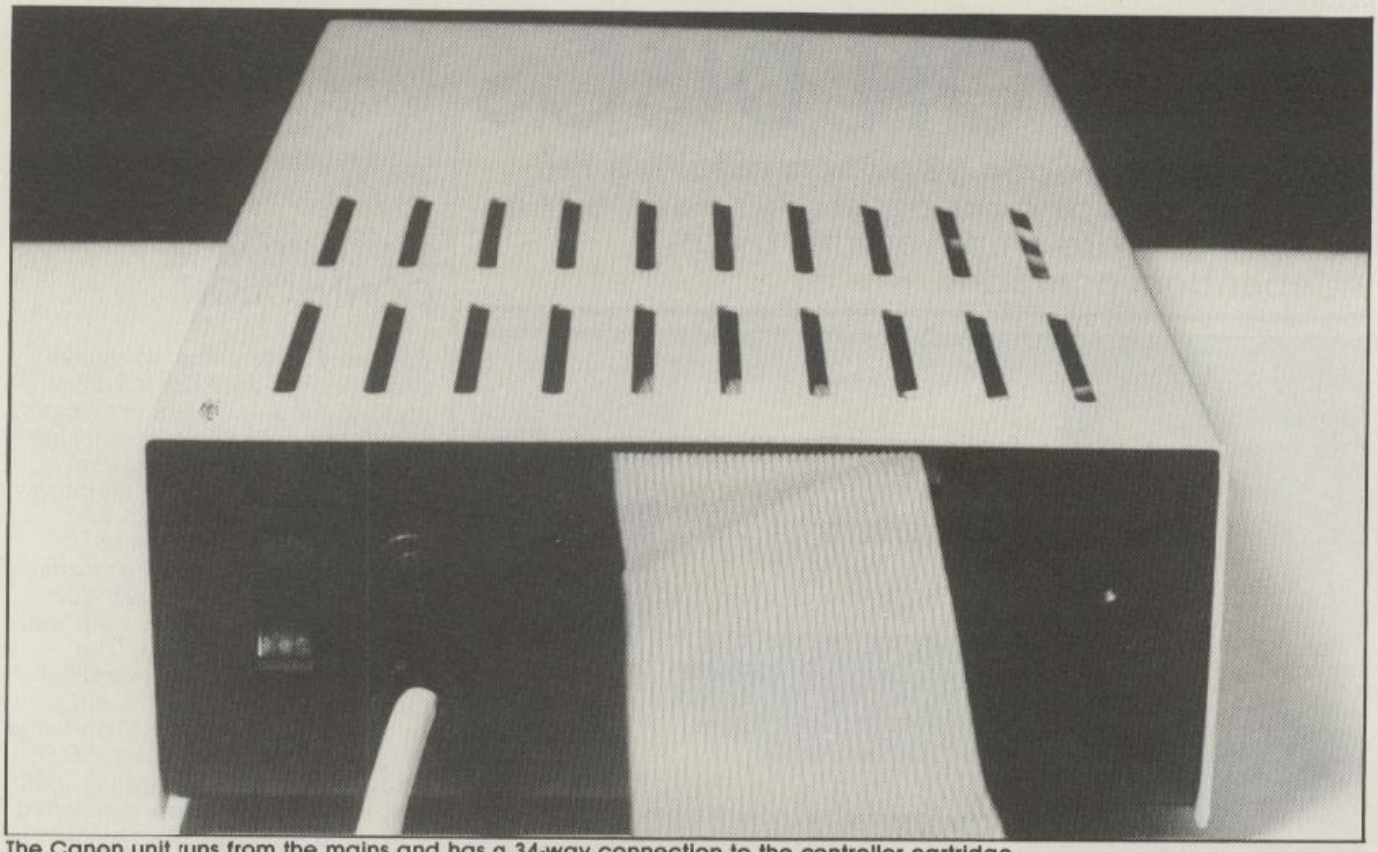
THE HARDWARE CONNECTION

Premier Publications, who have produced the first Dragon 32 compatible discs, were previously known for their range of software rather than for their hardware designs. However, the first thing that should be said about the product is that their lack of pedigree in the hardware world certainly doesn't show; the disc drive and controller are both well designed and packaged. The controller is a slightly oversized cartridge assembly which plugs into the slot on the right-hand side of the computer and costs £99.95 on its own or £299.95 with a 100K disc drive. This is then connected by a single 34-way ribbon cable to the drive itself, a Canon unit housed in a neat white casing along with its own power supply.

Installation is, to put it mildly, a doddle. The only point to note is that the ribbon cable plug needs a hefty push to mate it with the connector at the end of the controller, as the hole cut in the case is fractionally undersized. The manual contains clear and concise instructions with plenty of good diagrams, although it does suggest that there should be a second socket at the disc end whereas the cable is terminated inside the drive.

As manuals go the Premier Publications team have certainly produced a winner. Nearly 80 pages of well laid out, neatly typed and reproduced copy housed in a ring binder with the demonstration disc tell you everything you want to know about the DOS and how to use it. You even get hardware notes so that you could connect your own drives to the controller — it happily supports 8" and 5¼" drives in a wide variety of densities from 100K to 400K, as well as the Bats MCDI 3" drives.

Earlier on I mentioned that the 6809 had its own DOS, called FLEX. Premier Publications have chosen to go their own way and have provided a ROM-based DOS, called DELTA, which assumes control of the Dragon as soon as the power is turned on. Unlike many systems it steals only 1.8K of user RAM for the file buffers; a ▶



The Canon unit runs from the mains and has a 34-way connection to the controller cartridge.

very economical beast indeed compared with some. Inside the cartridge there is room for another ROM, which Premier will fill with their ENCODER 09 assembler/disassembler and monitor ROM. However, it could perhaps be used to take an extended version of DELTA, if one is planned, or maybe they will offer FLEX at a later date.

UP AND RUNNING

The first thing that DELTA demands is that a disc be placed in drive A and the system then boots on its own. To begin with this will be the demo disc, containing a simple menu which allows you to get a quick idea of the facilities offered. The demo disc contains an INTRO program, which is auto-booted, and also has a pair of programs which allow you to create a simple data base and then search it for entries. By the time you have reached page 10 of the manual you will already be using many of the commands that are available. Table 1 has the full list.

DELTA is fully compatible with the Dragon's Microsoft BASIC; LOAD and SAVE are used for disc access rather than the CLOAD and CSAVE you will be used to with cassettes. It should be noted that SAVE automatically overwrites an existing file with the same name; it would be nice to have a check first but then you can't have everything. These two commands are also extended to allow the user to LOAD and RUN in one operation, RUN"INTRO" for example, and also to save blocks of memory or machine code programs. One of the examples given in the manual is to save the entire BASIC interpreter onto disc; now if one could replace that ROM by RAM...

Another useful idea that the 'block saves' suggest is that you can save text and graphics screens on disc, great for games and animations. The final program-oriented options offered by DELTA are CHAIN, which loads in a new program without losing the variables created by the old program, and APPEND, which merges a disc program onto the program currently held in RAM. Precautions are necessary with both of these options but these are simply common sense rather than annoying restrictions.

One interesting point is that DELTA seemed slow to SAVE, both with machine code and program files. The reason for this is that it automatically verifies the save for you. If you don't want to wait, or trust your disc never to fail, you can deselect this facility by typing VERIFY D. However, as it's such a good idea I think that you should always turn it back on as soon as possible with VERIFY E; after all you don't really want to lose that vital program, do you?

SYSTEM OPTIONS

At the systems level DELTA requires that all blank discs are formatted by the INIT command, and you can use the CONFIG command to store your drive's parameters prior to initialising if you are using a non-standard system. Interestingly, Premier have added the option of common sense to the INIT command. If DELTA finds that there is already information on the disc it checks back to see if you really do want to scrub it clean. Such a simple facility to incluce, but so few DOSs bother. Individual files may be protected against accidental alteration by using the ASSIGN option, which has the delightfully named 'Sanctify' and 'Desecrate' extensions to indicate the file's status as well as providing a renaming facility.

Bulk copying of a disc's contents is achieved by the BACKUP command, which quite happily copes with a single drive copy by providing all the necessary prompts (although it is a very good idea to stick a write protect label on the source disc!). A COPY command is also available for copying single files between discs, but sadly it lacks the wild card facility. This option is built into

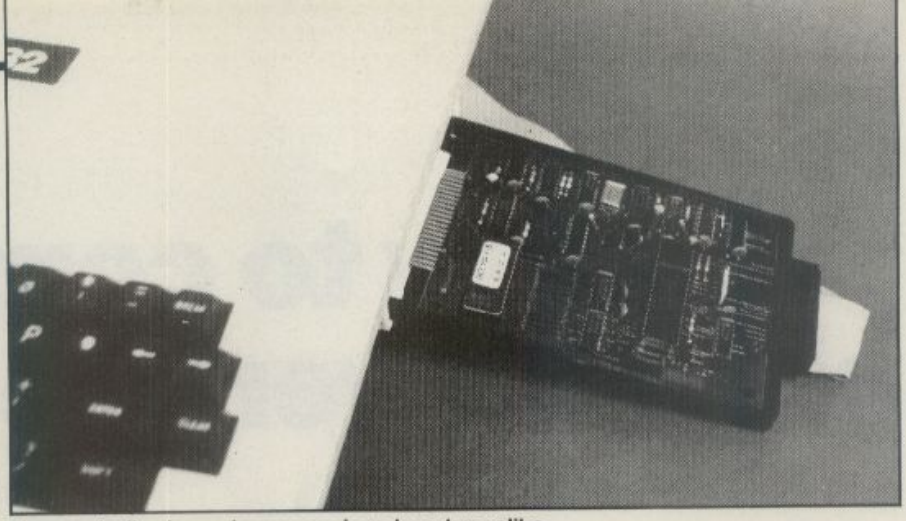
DELTA for use with the FIND command — ie a search for gr**n will produce green, groin and groan — so it's a little sad that it got missed from the system commands section. A whole section at the back of the manual is given over to explanations on how to copy your cassette-based programs onto discs, and there would appear to be no problem provided these are just BASIC. If machine code has been included, then there may be problems if the addresses occupied by the machine code clash with DELTA's living space, so some conversion may be necessary. Premier also point out that you cannot copy cartridges onto disc as the controller lives, both physically and address-wise, in the same space, and there would be no point as cartridges are ***faster*** than discs anyway!

The final portion of DELTA is given over to file handling and in this respect both serial and random access data files are supported, with the manual providing a very good grounding in the techniques needed. You always need to CREATE a file area on disc before you start to fill it with data; remember to be generous or you could run out of space! Temporary files which act as buffers, a common requirement in data base operations, can be given a name and then continually re-used by making use of the FLUSH command which deletes all the data. All the usual commands such as OPEN and CLOSE are available in DELTA, together with the requisite pointer commands to make random access filing a relatively simple task. One useful command that I mentioned in passing earlier in this piece is the FIND option. This will search any file for a specified item, which can then be retrieved by an INPUT operation.

EXECUTIVE ACTION

As if all the above facilities were not enought to convince you that Premier meant business with their DELTA system, they also allow you to create an 'executive' file on disc. Effectively this means that you can make a self-demonstrating system by handing control of your Dragon 32 to an 'invisible' typist; all the commands are saved on a disc file which the computer treats as direct inputs from the keyboard. You could, for example, get the file to LOAD a program, LIST it and then RUN it, all without any apparent operator being present. To make the system even more powerful it can be combined with the BOOT command which specifies a file to be automatically RUN when the disc is booted or selected by the system.

To help the first time disc user cope with all the above commands and their various options, Premier's manual provides not only a clear and concise description of each but also offers many short routines to let you try them out. The demo disc contains a pair of simple programs that illustrate the file handling commands even more thoroughly, and you can LIST them to see just how they work. I was unable to find an example of a bad or unclear explanation, nor could I discover any mistakes in the examples, other than those that Premier themselves had spotted and provided on an errata sheet! If only certain other DOS manuals were as good . . .



The controller innards are neat and workmanlike.

THE LAST WORD

In conclusion it seems only fair to remark on the one or two shortcomings of the system, having praised it so highly up to now. None of these points really constitutes a major problem; maybe they could be cleared up on a second issue of the ROMs. The criticisms are that the wild card facility has not been implemented where it is most needed, ie in the COPY and KILL options; SAVE should check first before overwriting an existing file; and finally, that CREATE limits the flexibility of the system when used with data files, and would be much better as a dynamic command rather than as a predetermined limiter.

On the hardware side, the only quibble I have is that the Canon drives don't eject their discs. I have never liked machines that use them, the Adler Alphatronic for example, for the simple reason that it is possible to forget that there is a disc in there, and attempts to stuff a second disc in always seem to meet with disasters of major proportions. In fairness, however, the drives do seem robust and never gave a moment's trouble during the review period.

Overall, then, a totally excellent offering for Dragon 32 users that delivers exactly what it offers and would meet virtually all the requirements of any user of the system that I can possibly imagine. If you don't want the drives supplied by Premier you can add your own, of any size, quite simply and this, in itself, is an attitude that you seldom find. I just hope that they continue the good work with either an uprated second edition ROM or move on to offer a FLEX-compatible system together with the software to run on it.

BASIC keywords
LOAD SAVE RUN CHAIN APPEND LOADM SAVEM RUNM

System keywords
DIR INIT CONFIG KILL ASSIGN VERIFY SELECT COPY BACKUP

Data and file keywords
CREATE FLUSH OPEN CLOSE FILES
END # DIM # INPUT # PRINT # FIND # EOF RESTORE #

Executive keywords
DO BUILD BOOT

Table 1. The DELTA command set.

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Don Thomasson

SORD PLAY

The Japanese have now unsheathed the Sord M5. Is this a new star rising in the East?

Designing an adventure playground needs careful thought. If it is too simple and straightforward, it will lack excitement. A scary element is desirable, but confusion is to be avoided, because it can be really frightening. One way of avciding confusion is to provide signposts and explanatory notices.

Much the same considerations apply to the design of small computers that are likely to fall into inexperienced hands.

The Sord M5 is a typical Japanese product — well conceived, nicely made, and provided with totally inadequate documentation — so that the signposts and notices are missing, and confusion is more than just possible. The machine has many interesting features which are a delight to explore for those who know how to find their way round, but some of the best facilities are barely mentioned in the manual.

There may be a simple reason for this. Unlike the leopard, which is stuck with its spots, the M5 can change its ROM, or more accurately part of it, and it then becomes a totally different machine. The documentation consists of two books; a slim volume that deals with setting up and running the demo tape, and a thicker manual for the ROM pack which is supplied as standard. This leaves out the fixed ROM and interface system, which determine many of the machine's most important characteristics.

However, patient exploration unearthed some of the missing data, allowing the capabilities of the machine to be explored in full. No doubt such information will soon be available, either from Sord or an independent source, and then it will be possible to use the machine without risk of confusion. Even without that, the M5 is a real fun machine.

SETTING UP

The main unit is beautifully styled, as can be seen from the photographs, but in order to insert the ROM pack it is necessary to lift a flap at the back of the keyboard, which exposes an area of bright yellow plastic and rather spoils the image of the thing. A width of just over 10" means that the keyboard is rather small, with a horizontal and vertical pitch of 15 mm between keys, where a typewriter uses a pitch of around 20 mm. The moulded rubber keys were eyed dubiously, but proved to be more effective than some similar arrangements.

The separate power pack is quite sizeable, about 8" long and 2½" square, and it is provided with a switch and a mains plug. As the plug is of the small two-pin variety, an adaptor normally serving an electric razor had to be pressed into service.

The next problem looked like being more difficult to solve. A large diagram showing interconnections offered several ways of using the metal switch box to connect up the television set and aerial, gaily referring to 75 ohm coax and 300 ohm twin feeders. The only way of connecting up the television set was via a pair of spade terminations, which is convenient in America, but not in this country. The manual explained that 'antenna converters are commercially available'. Not at seven on a Monday evening, they aren't!

In the end, a bold decision was made to connect the computer directly to the set, as usual, and there was much relief when this worked perfectly. Some users might have been wary of trying such a simple solution.

The cassette leads also caused a minor query, because the diagram just showed three plugs, without saying which was which. The motor control was obvious, and for the ear and mic connections there were only two possibilities. Murphy's Law said the first guess would be wrong.

It was. (White for ear, in case you need to know).

The 'joypads' (joysticks without sticks, not love nests) were set aside for later investigation, and there was no need to worry about the direct video and sound links, as there was nowhere to connect them.

Switch on. The power warning light stays out. Oh, dear . . Ah, we haven't plugged in the ROM pack. Perhaps . . . Yes, the light now comes on. The fixed ROM is evidently not usable on its own.

After some fiddling with the television set tuning, a nice steady picture was obtained. It was rather wide in relation to its height, with an aspect ratio of about 1.8 to 1, whereas the overall screen has a ratio of 1.3 or thereabouts, but most of the available width was used. The 'black' was a slightly reddish dark brown, quite easy on the eyes, and the lettering was subdued, being officially 'grey'.

DEMONSTRATION

It seemed sensible to begin by running the demo tape, which started with a 'TV adjustment program'. This was a little worrying, as the accompanying text advised the user to change the receiver settings, which might upset anyone wanting to watch Dallas later in the evening. (Do such people exist? — Ed.) The advice was ignored.

The colours displayed were pastel shades, rather than the bright and almost garish colours produced by other computers on the same TV, and the general effect was restful. More saturation might have been obtained by adjustment, but wasn't really necessary.

An instruction was displayed that any key should be pressed, but that merely cycled through the colour patterns again and again. The manual said 'press Shift and Return', which again did nothing. The inspiration to try Shift and Reset provided the solution.

A distinct metallic click was noted as the tape restarted, indicating that there should be no trouble over tape recorder polarity. Transistor switches only work one way, but a good old-fashioned relay doesn't care.

The second program was a rather simple variety of Space Invaders, complete with sound. The M5 disdains the use of a tiny loudspeaker muffled inside the case, producing its sound via the TV set loudspeaker, which is much more effective.

Some days later, it was discovered by accident that the joypads will work with this game. The only reference to the use of joypads in the manual was a statement that they would not work with the second game, which was a baseball simulation. It was rather better in quality, though the family graphics wizard reckoned it could be improved. The way the players moved against the background was intriguing, and a full investigation of the graphics system was marked for priority attention. First, however, the operator interface needed to be examined.

KEYBOARD

The legend on the top right hand key was Reset, raising false hopes. It was also labelled Halt, and when pressed with Shift it stopped program action, but it seemed to do nothing else. At least there's a switch on the power unit. No need to go to the wall socket when things go haywire.

Just below Reset were Return and Space, there being no space bar. It was found that the little finger of the right hand tended to overreach the Space key, entering a line prematurely, but no doubt that snag would disappear with practice. The two main Shift keys flank the bottom row of the QWERTY layout.

To the left are two more shift keys, Function and Control. The actions available through use of the Control key are manifold. It is possible to move the cursor up, down, left and right, with wraparound in all directions. The whole display can be moved in the same way, but anything disappearing past the edge is lost. There are also several screen control functions which will be described later.

The function key works in two ways. Used with the '1' key, it selects 'typewriter shift', with capitals obtained in Shift, while with '2' it selects the reverse mode. With '3', it

A joypad. Shades of Mattel?

calls up graphics, a different set being given with and without Shift.

With some of the other keys, Function provides single-key word entry, though all words can be typed out in full if that is preferred. There are 22 valid combinations, but although RENUM, MOVE and BYE are marked on the keys, they have no effect. Another disappointment. The lettering of these legends is very small and difficult to read, and the text which is generated does not include the spaces needed to separate one word from another, but the facility was nevertheless found useful.

With 48 keys and multiple shifts, the keyboard can generate a wide range of codes, but there are a number of codes which are not covered, these mostly being international characters.

On the whole, the keyboard was awarded a pass mark. The sheer versatility can cause confusion. Intending to input 'FOR', you press F and what you think is the Function key. The whole display shifts one place right, because you were in fact pressing Control. That is just one example of the oddities that can occur.

A very useful feature is a holding buffer, which will store up characters while the system is too busy to take note of keyboard action. We gave up trying to overfill the buffer, but it must have a limit somewhere.

There is a nicely-timed automatic repeat action, and a nasty little beep as you press each key. Fortunately, the TV set had a mute control to shut off the sound . .

THE EDITOR

The editor finally confirmed suspicions that there was something familiar about the M5. As long-term readers of *Computing Today* may be aware, the Thomassons are, as a family, confirmed addicts for the Ex- ▶

idy Sorcerer, and it would not be at all surprising to learn that the designers of the M5 were aware of the older machine. The keyboard shows strong similarities, and the editor is almost identical with the one Paul Grimshaw designed some time ago for his Sorcerer Toolkit. This similarity to the Sorcerer may have helped us to become used to the M5, since the familiar features looked more friendly.

The concept of the editor is quite simple. If the line you want to enter or execute is on the screen, the cursor is moved to it and positioned at the relevant position in the line. You can then overtype in Control O mode, insert in Control P mode, or erase with Control Delete. Press Return, and the line is entered, if it starts with a number, otherwise being executed.

The system has advantages and disadvantages. It is beautifully simple to use, except that you may find the cursor sitting in the middle of a listing after a correction has been made, and you need to use clear screen for further commands. Not to worry, Control X will clear the line from the cursor onwards. It would be nicer if there were a Control command to clear the screen, but whereas Control L serves that purpose during a program it has no effect in direct mode.

There is another escape route through the use of Control V, as will become evident in discussion of the display.

Once the concept of the editor has been grasped, it becomes very easy to use. A direct statement remains available after use, for example, and can be repeated with or without changes. That would be welcome on some other machines . . .

THE DISPLAY

The information about the display given in the manual is rather cursory, but one reason for that could be the sheer complexity of the system. A full description would double the size of the book, and maybe more. What follows has largely been figured out by investigation and experiment. If it includes any misinterpretations, apologies are offered, but most of the points stated have been proved in practice.

The system, like that of the Sorcerer, is basically of the low resolution type, with features that allow at least a simulation of high resolution. For the main display screens, a character code is stored for each character position, and this is used to look up a set of pattern bytes determining the shape of the character. The patterns can be changed by the user.

At switch-on, the screen offers 32 columns and 24 lines (GI mode), but Control T selects Text mode, which provides 40 columns. In this mode working is quite straightforward. The 960 character codes occupy most of the screen RAM, so there is not enough left spare for colour control. The screen is in white (more correctly grey) on black.

The smaller storage area needed for the 32-column layout allows colour to be introduced on a fairly simplistic basis. Colour can be allocated to a block of characters, the block starting at a character position which is a multiple of eight (the top left-hand corner of the screen is character '0'). There are 15 colours, including black, grey and white, and also a 'no colour' setting, which appears to be transparent.

Control R sets up GII mode, and here the fun really begins. The 32-column display is still present, but it now has company; a totally independent screen which may be populated with 'sprites'. These can be copied from standard characters or modified characters, and up to 32 sprites can co-exist. Their size can be changed. MAG 0 gives the normal single character. MAG 1 doubles the width and height of the sprite. MAG 2 gives a large, composite sprite built up from four characters at normal size. MAG 3 doubles the size of these four characters. These size variations affect all visible sprites.

The shape and colour of a character having been defined by the SCOD and SCOL commands, the sprite may be placed on the screen at any one of 256 horizontal positions and 192 vertical positions. Each sprite can be positioned independently, subject to a limit on the number that can be put in the same horizontal line (four only). The sprite can thereafter be moved to a new position, or taken off screen, to be brought back later if required.

All this can take place against a separate display on the 32-column screen. There is a 'window' control which allows part of the foreground screen to be protected, and the rest can be scrolled freely in any direction.

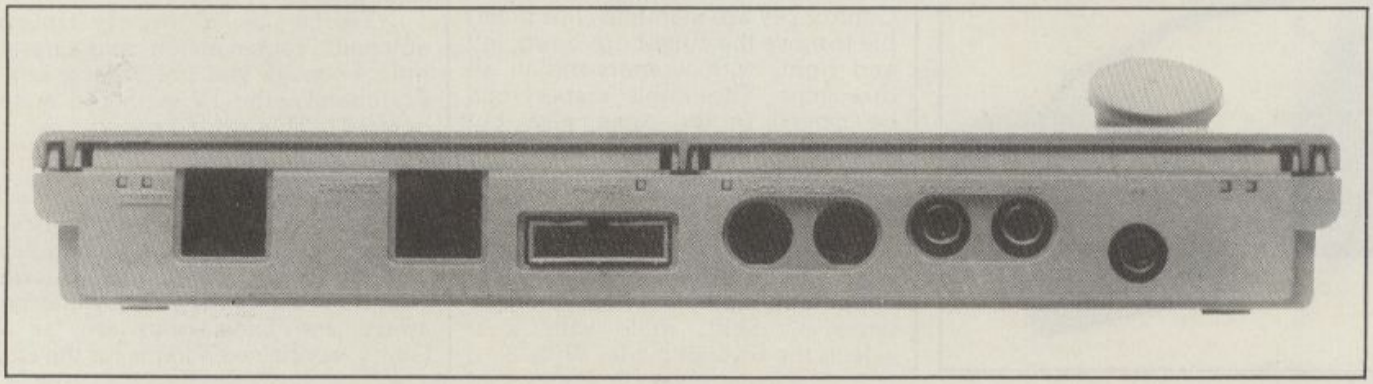
Finally, use of Control V switches over to a complete set of alternative screens. It is possible to look at one screen while making inputs to the other, and the two screens can be in different modes.

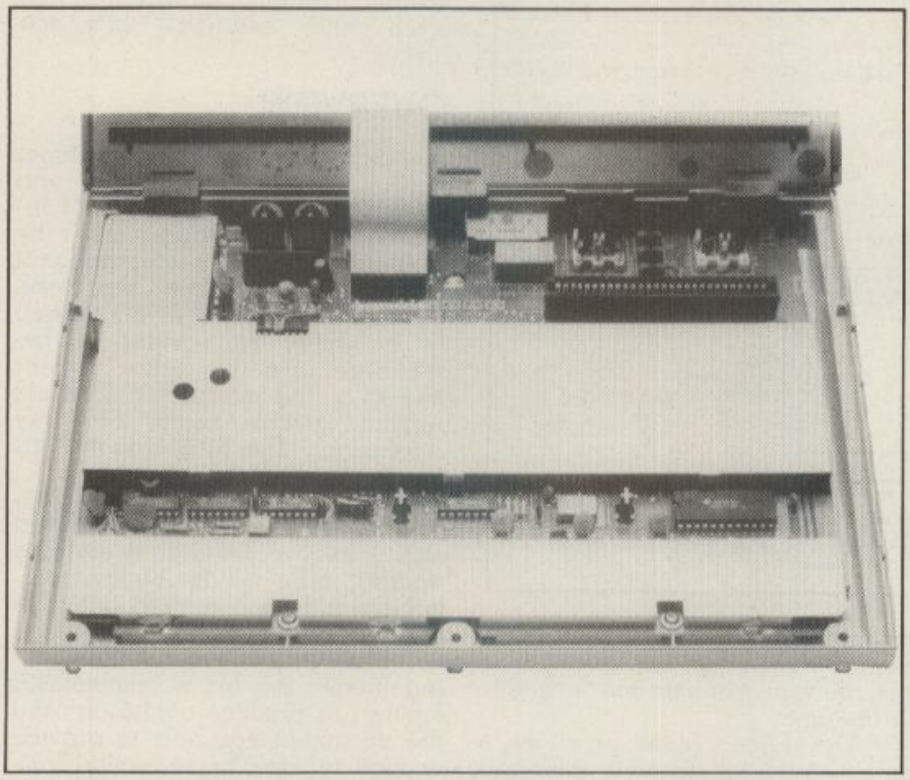
Oh, yes, and there's yet another mode, though its utility seems limited. It is called Multicolour mode, and it allows quarter blocks of colour to be set up by character inputs. We were unable to deduce the relationship between code and colour, and the relationship changes from line to line, so all that can be said is that the effect is very pretty, but not of obvious utility.

If there had not been a deadline on this review, we would still be playing with the M5 screen facilities, instead of writing about them. Working out the best way to use the system may require some hard thinking, but the effort is rewarding.

THE BASIC

An integer BASIC should be fast, and the benchmark figures are confirmation of this. Limitation to whole numbers in the ± 32767 range may irk some maths buffs, and they will miss the trig and log functions, but real mathematicians will realise that there are usually ways round these missing functions. BASIC I is intended for beginners, and should be assessed in that light. Another ROM pack is available for those who want





floating point and all the trimmings.

It seems reasonable to compare BASIC I with the old 8K Microsoft BASIC supplied with the Sorcerer as prime equipment. BASIC I saves a lot of space by discarding the floating point routines and the more esoteric mathematica. functions, but it also lacks ON . . GOTO and FN.

On the other hand, it implements IF . . THEN . . ELSE and CHAIN, an equivalent of LPRINT and LLIST, seven display commands, and hexadecimal number handling. PRINT CURSOR (ie PRINT AT) is proviced, and some minor functions like TIME, which returns the number of seconds since switch-on. It implements AUTO, but not RENUMBER, and covers some error-check functions. None of these were in the 8K Microsoft.

Balancing gains against losses, it must be concluded that the interpreter must be rather wasteful of the available space. However, a detailed examination of the coding would be needed to confirm that. The main point is that the interpreter works, subject to a few minor bugs. The error system is not entirely error-free, sometimes reporting a line number after a direct command error, while FRE consistently reports that 256 bytes of memory have been used, however large the program, and gives very dubious figures for memory still free.

So BASIC I might be described as adequate but not brilliant. It serves its purpose, and serves it quite well, but ought to be able to achieve a little more, which would make it very satisfactory.

The BASIC I ROM pack is supplied as standard, but other packs are available as extras, and will be covered later on.

SOUND

Apart from stating that there are three tone channels, a noise channel and seven special effects, the manual says virtually nothing about the sound system. Working from minimal clues, it was eventually found that there was a fairly straightforward control protocol.

Expressing the rules as briefly as possible, a tone is set up by the sequence;

```
OUT &32,(128 + 32 *A + B)
OUT &32,(C)
```

where A = 0 to 2, and determines which channel is set, B = 0 to 15 and C = 0 to 63, the count set being B + 16 *C. The frequency produced is (111860)/Count Hz.

Once set, the tone can be controlled by

```
OUT &32,(144 + 32 *A + D)
```

where D = 0 to 15, 0 giving maximum volume and 15 silence. If the channels used are not silenced before the program ends, they go on sounding.

The noise channel setting is rather more complex, though a single output suffices;

```
OUT &32,(224 + 4 *E + F)
```

where E = 0 gives synchronous noise and E = 1 gives white noise. F determines the noise frequency.

Some of the above has been checked against a partial translation from the Japanese manual which threatened to increase the confusion! When the translation is complete, it will provide a synthesizer program that looks quite interesting.

CASSETTE SYSTEM

Loading and saving at 2000 baud presented no problems, using a cheap Sharp recorder. The relevant commands are SAVE, OLD, VERIFY and CHAIN, OLD being equivalent to LOAD. SAVE gives no indications other than the terminating ready, which is reasonable, while the others display file names as they are found, adding an asterisk if the file is being read. Simple but effective.

JOYPADS

Finding out how the joypads worked entailed a frustrating search through the input ports, which revealed that port &37 was involved. Both units report to this channel, the left hand unit to the lower nibble and the right hand unit to the upper nibble. The codes generated are shown in Fig. 1.

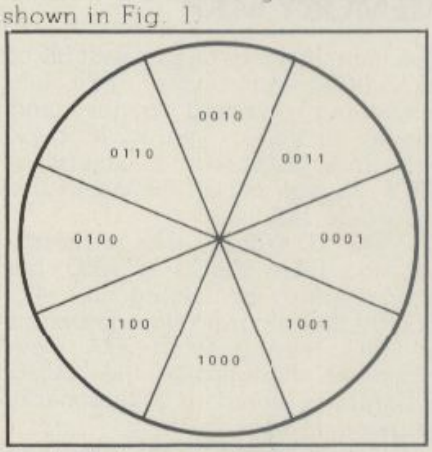


Fig. 1. The joypad outputs.

The 'fire' buttons generate numbers as if the keyboard has been used. The left hand unit generates 1 or 2, according to which end of the button is pressed, and the right hand unit generates 5 or 6.

Once this relatively simple data had been worked out, the joypads were in business. It seemed a pity that the relevant data was not in the manual.

PRINTER

Apart from the problem of getting hold of the necessary connector (eventually cut down from a larger model), there was no difficulty in getting the printer channel working. An adaptor cable was made up to work with the Epson MX80 normally used with the Sorcerer, and after a couple of false starts caused by finger trouble a complete dump was printed with no trouble at all.

The only slight oddity noted was ▶

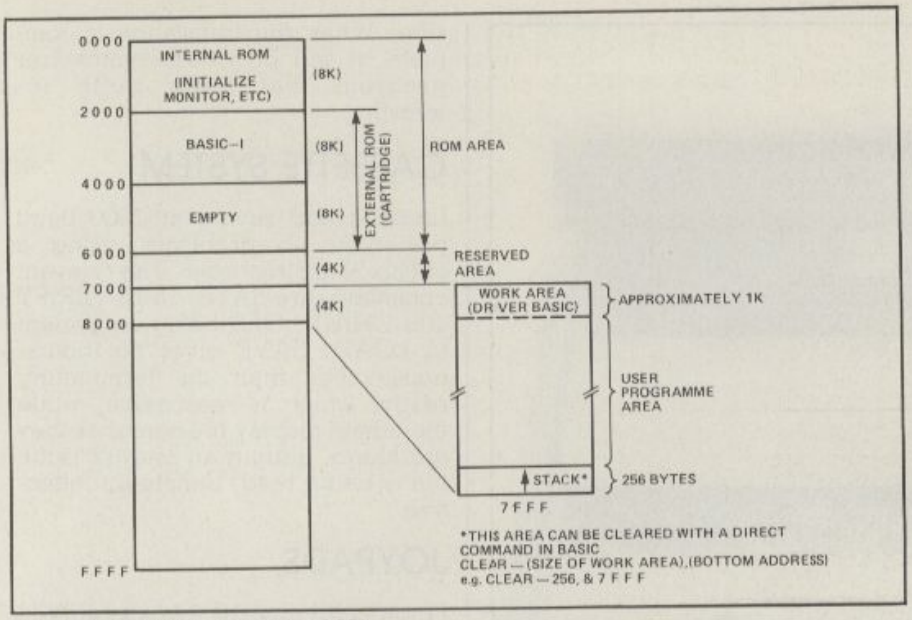


Fig. 2 Memory map of the Sord M5.

that with the printer plugged in, the cassette motor control failed to work. Presumably a common port is involved.

MEMORY MAP

The main memory begins with 8K of fixed ROM, from 0000 to 1FFF, this containing keyboard routines and similar facilities. The ROM pack runs from 2000 to a maximum of 5FFF, though not all the packs use the whole 16K.

The 6000-6FFF area is reserved, and RAM begins at 7000, the main memory containing only 4K. The BASIC program storage begins at 7383, leaving about 3000 locations free. Fortunately, the BASIC program is stored in a reasonably economical way.

A photograph of the promised expansion unit suggests that it will fit into the ROM connector, presumably providing a socket to accept the ROM in use. This will allow 4K expansion blocks to be added to the original RAM.

The 16K display RAM is not on the main memory map, but is accessible by VPEEK and VPOKE. It was difficult to reconcile a dump of this RAM with the diagram in the Japanese manual, especially as the allocation of available space changes with different screen modes, but there appears to be considerable room for expansion of the display facilities. A TMS9918A display chip is used, and obtaining the Texas Instruments data sheet on the device should make life easier.

OTHER ROM PACKS

A brief acquaintance with two of the alternative ROM packs produced some interesting information, a little limited by the fact that only one of the relevant manuals was available at the time.

The FALC ROM produces a spreadsheet, initialised to eight columns and 60 lines, but adaptable by command to other dimensions. Four columns and 20 lines were displayed. In addition to the usual facilities there was provision for sorting entries, and for searching for a particular entry. Full floating point calculations were implemented, with trig and log functions. The manual was helpful, but it was discovered that a paragraph explaining the means of exit from search had been omitted from the translation. Who would have guessed that it involved searching for an asterisk?

In the absence of a manual, only a superficial examination of BASIC-G was possible. This is a 16K ROM combining the features of the integer BASIC with extended graphic manipulation facilities, and some other additional bits and pieces.

OVERVIEW

The Sord M5 is a small machine, aimed mainly at beginners and games players, and it will not interest those who judge merit by memory size or low price, though it should be noted that the basic package includes a pair of joypads. In a sense, the virtues of the machine are to some extent negative. The interpreter does not restrict variable names or array dimensions. The BASIC is not difficult to learn rapidly.

On the positive side, the construction and design are competent and attractive. Almost everything worked, once the necessary information had been worked out. The high working speed was impressive.

However, to return to the opening theme, the M5 is complicated enough to produce confusion, and the documentation fails to provide enough information to escape from this state. A minor keying error can produce bewildering results, and though there may be a recovery route it may not be obvious.

To reach its full potential, the M5 must be supported by improved documentation, whether this comes from Sord or an independent source. Without that, dealers and distributors may find themselves inundated by queries.

CONCLUSION

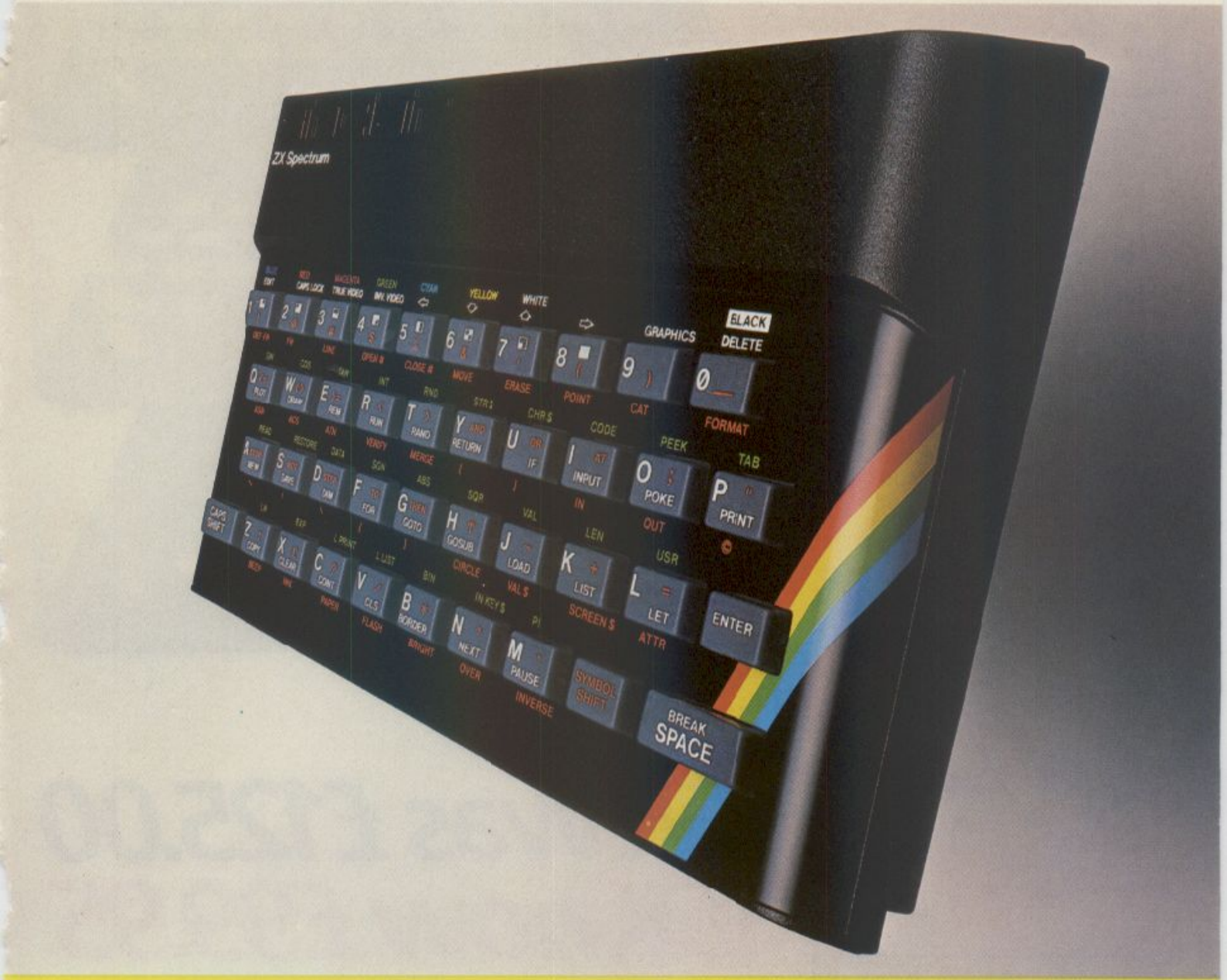
Thanks are due to Sord Computers for useful assistance, and in particular to Yuki Matsushita, who is translating the Japanese manuals and produced some of his drafts to clear up a few mysteries.

BENCHMARK TIME	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Average
	0.58	2.92	7.19	7.05	7.76	11.95	22.36	NA	8.54

FACTSHEET

CPU	Sord M5 Z80A (3.58 MHz)
ROM	8K fixed. 8K-16K plug-in cartridges
RAM	4K, expandable in 4K blocks
Video RAM	16K
Keyboard	QWERTY, 55 keys
Display	Text Mode: 6 × 8 Characters: 40 × 24 screen Graphic I Mode: 8 × 8 Characters: 32 × 24 screen Graphic II Mode: 256 × 192 positions Multicolour Mode: 4 × 4 colour areas: 64 × 48 screen
Cassette I/O	2000 baud: Motor control
	Parallel printer interface (Centronic)
Sound	3 tone channels 1 noise channel
Joypads	Eight-position pads. Dual fire button
Costs	Computer with Joypads: £189
Supplier	Sociis Computer Systems (UK) Ltd., Samuel House, 6 St Alban's Street, London SW1Y 4SQ

sinclair special 2



Inside...
Latest prices round-up...
Latest software...
RAM upgrade...

Introduction

One thing's certain about the Sinclair world – there's never a dull moment.

Every month sees new software and new hardware, produced by Sinclair enthusiasts, or produced by Sinclair itself.

The magazines do a fantastic job of keeping you up to date with the input of enthusiasts. We want to keep you in touch with Sinclair's own developments.

Every month, there'll be a Sinclair Special in this magazine.

Sometimes, inevitably, there won't be anything new to say – we want to break away from the breathless announcements of hardware and software you just can't buy.

But when something new *is* available, we want you to have accurate information – fast. You'll find it here.

This month, we're giving you the latest information on the recommended retail prices of Sinclair equipment. They're *our* prices, and you may well find things cheaper (or dearer) in the shops. If they're cheaper – terrific! Snap them up. Note, however, that from us the ZX81 is down to £39.95.

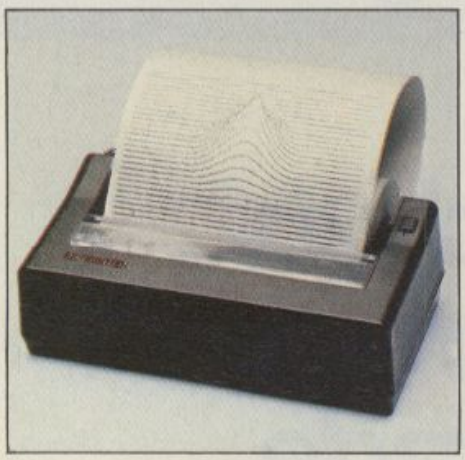
We're also announcing six superb new Sinclair cassettes. There's an order form at the back of this Special.

And at last we're making the 16K Spectrum upgrade to 48K generally available. All registered 16K owners have already been mailed, and we know that the offer is very popular. Again, there's an order form at the back of this Special.

Next month... but there, next month is another story! Watch (as they say) this space.

Nigel Searle

Nigel Searle.
Managing Director,
Sinclair Research Ltd.

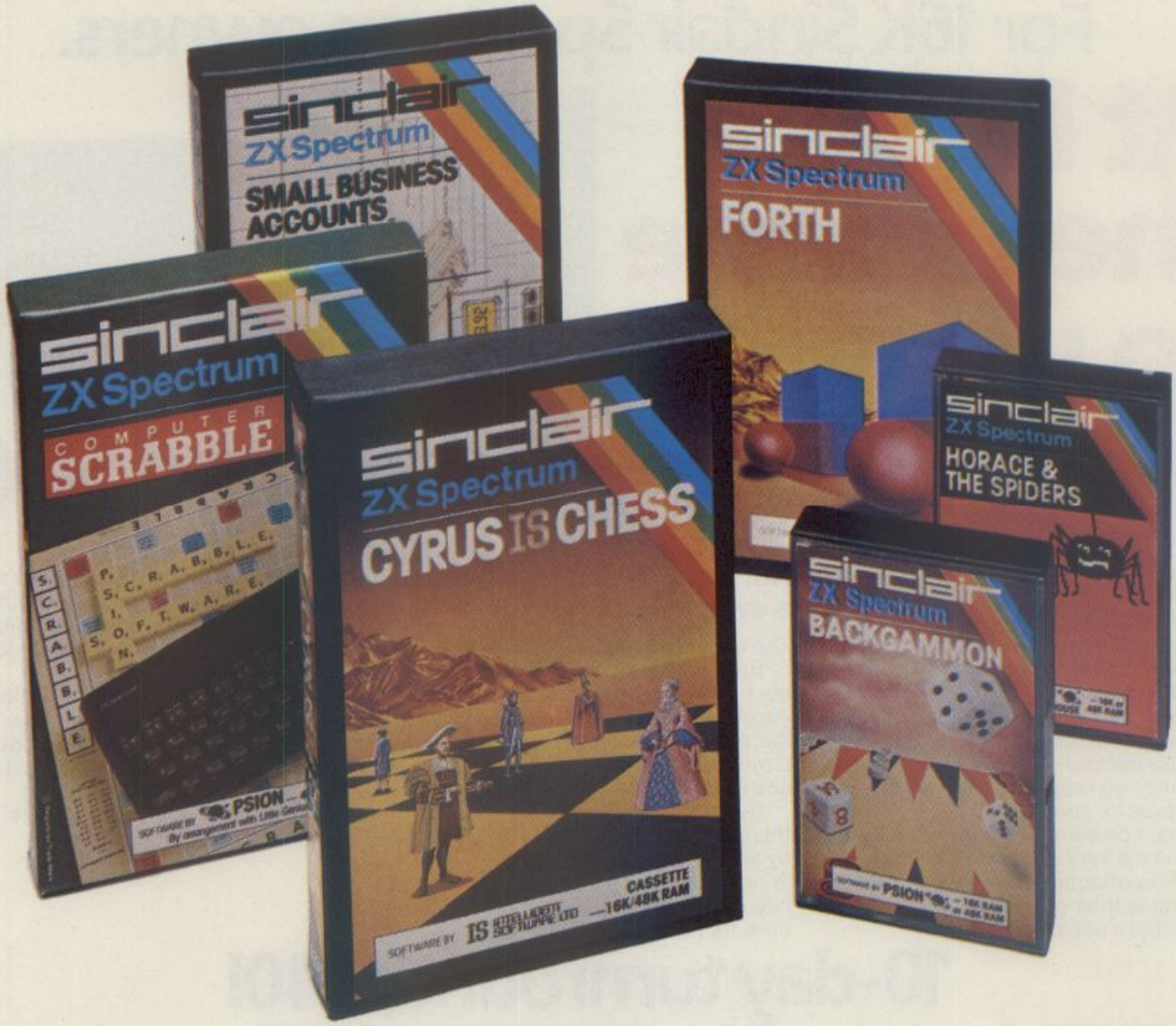


Spectrum – latest recommended retail prices.

16K was £125.00
16K now £99.95

48K was £175.00
48K now £129.95

ZX Printer was £59.95 *ZX Printer now £39.95*
ZX81 was £49.95 *ZX81 now £39.95*



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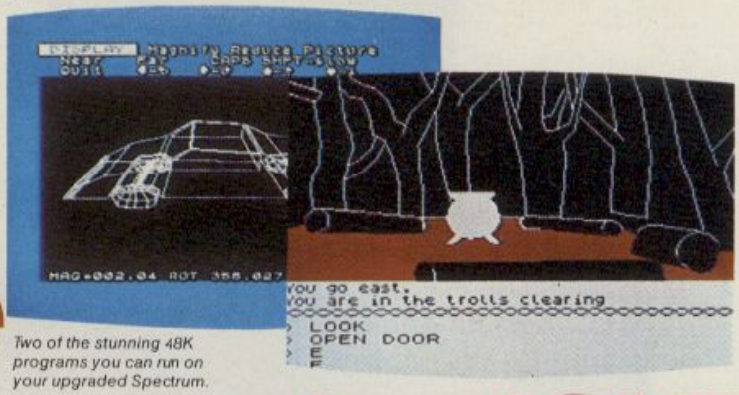

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To: Sinclair Research Ltd, FREEPOST, Camberley, Surrey, GU15 3BR.

ORDER FORM

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			TOTAL £	

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	L1 /S:FORTH	4400	14.95
	B6 /S:Small Business Accounts	4605	12.95
			TOTAL £

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Qty	Item	Code	Item Price £	Total £
	Spectrum upgrade	6998	40.00	
	Spectrum upgrade plus ZX Printer	6999	79.95	
			TOTAL £	

*Remember to obtain proof of posting from the Post Office. Offer applies to UK only.

†I enclose a cheque/postal order made payable to Sinclair Research Ltd. for £ _____

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Prices are correct at time of going to press but may be subject to change.

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PROBLEM PAGE

Using the ZX Spectrum we give a prime example of how to solve puzzles and problems.

This short series examines the capabilities of the computer in solving puzzles and problems, showing that quite a lot of help from the user may be needed in this type of task. The programs are written for the ZX Spectrum, but conversion to other machines should not be too difficult.

Puzzles and problems are usually posed in text, which the computer does not understand. For example:

"Members of the Dooleydale Supporters Club were asked to add 1p to their normal annual subscription, which is less than £4, the extra to be used to buy a farewell present for the retiring club secretary. All the members (except, of course, the secretary) complied, and the total sum paid in was £2088.60. How much was available to spend on the present?"

In theory, it would perhaps be possible to write a very complex program to analyse the text and convert it into symbolic form which the computer could understand, but that would only solve part of the difficulty. Where a human mind would see fairly quickly that the problem is only soluble on certain assumptions, and would contribute extra conditions based on general knowledge, the computer might well find no basis on which to approach the task. The human approach often depends on special knowledge of a mathematical quirk of some kind, such as the characteristics of prime numbers.

PRIMES

Prime numbers are odd, in more senses than one. If a number is not odd, it is not prime, since it is divisible by two. In a broader sense, primes are odd because they tend to exhibit unexpected characteristics. Having little or no meaning in the real world, they exist mainly as a mathematical concept. They could be regarded as being logically negative, in that they are discovered by ruling out all the numbers which are integral multiples of any integral other than unity. This process of elimination is called Archimedes' Sieve, because it sifts out the numbers that are not prime.

The program shown in Listing 1 performs this task. The primes are set up in an array, the size of which must be chosen to suit the amount of memory available. Setting up the array can take some time, so it is a good idea to store the result for future reference, if that is possible.

The first location of the array is set to 2, as a starting point. X, the pointer to the next array location to be set up, is initialised to 2. Y, the next number to be tested, is set to 3. Z, the pointer to the number to be used by the test, is set to 1. A loop is entered at line 150. P = Y/A(Z), and if P is an integer Y is not prime, so the routine drops out to line 210.

Otherwise, the routine loops to line 150 until P is equal to or greater than A(Z). There is no point in taking the process any further, as any integral divisor would have appeared by then.

If line 180 is reached, Y is prime, and it is entered into A(X) and displayed. The display is not essential, but it gives you something to look at and tells you how the process is getting on. X is incremented, and the routine goes on to line 210, where Y is incremented. It could be argued that Y could be increased by two, as only odd numbers are relevant. The routine loops back to line 140 to reset X and start another test.

PRIME PATTERNS

At first glance, a table of primes seems to show some sort of pattern. Numbers ending in 0, 2, 4, 5, 6, 8 have been eliminated, leaving only numbers ending in 1, 3, 7, 9.

When this has been taken into account, the pattern begins to fade away.

However, try Listing 2, which prints out the difference between the squares of successive primes, divided by 24. You might expect to see a jumble of non-integral results, but after an initial flurry the results are all integral. Does this suggest a way to determine primes directly?

Well, no, not really. Put the lower of the two primes as L and the difference between the primes as D and the difference between the squares is D *(2 *L + D), the product of the sum and difference of L and D. Since all primes are odd, D must be even, and L is not a multiple of three.

If L is one more than a multiple of three, D cannot be two, as that would make the upper prime a multiple of three. D must be 6 *X + 4 or 6 *X + 6, where X is an integer. In the first case, the difference of squares works out as:

12 *(3 *X + 2) *(X + Y + 1)

where L = 3 *T + 1, Y being another integer, which must be even, to make L odd. One bracket or the other must be even, so the difference in squares must be divisible by 24. Similar working for the other cases gives the same result, but the reader is invited to confirm that for himself.

The main point of this excursion into mathematics is to suggest that some interesting relationships between primes can be found by those who care to look for them.

```
100  DIM A(3400)
110  LET A(1)=2
120  LET X=2
130  LET Y=3
140  LET Z=1
150  LET P=Y/A(Z)
160  IF INT(P)=P THEN GO TO 210
170  IF P>=A(Z) THEN LET Z=Z+1:GO TO 150
180  LET A(X)=Y
190  PRINT TAB 30*((X-2)/6-INT((X-2)/6));Y;
200  LET X=X+1
210  LET Y=Y+1
220  GO TO 140
```

Listing 1. Archimedes' Sieve. Note that the array is DIMensioned for the 48K spectrum.

```
300  FOR N=1 TO 100
310  PRINT (A(N+1)*A(N+1)-A(N)*A(N))/24
320  NEXT N
```

Listing 2. The difference of prime squares.

```
400  CLS: INK 7: PAPER 0
410  LET X=128
420  LET Y=87
430  LET B=1
440  LET C=0
450  FOR K=1 TO 173 STEP 2
460  FOR L=1 TO K
470  GO SUB 1000
480  LET X=X+1
490  NEXT L
500  FOR L=1 TO K
510  GO SUB 1000
520  LET Y=Y+1
530  NEXT L
540  FOR L=1 TO K+1
550  GO SUB 1000
560  LET X=X-1
570  NEXT L
580  FOR L=1 TO K+1
590  GO SUB 1000
600  LET Y=Y-1
610  NEXT L
620  NEXT K
630  STOP
1000 IF C<>A(B) THEN GO TO 1030
1010 PLOT X,Y
1020 LET B=B+1
1030 LET C=C+1
1040 RETURN
```

Listing 3. Prime spiral.

Note: The three listings should be entered together, and used in turn, starting at lines 300 and 400 by GOTO.

PRIME SPIRAL

Listing 3 shows another oddity of primes. It works best with a computer which will plot single dots, rather than pixels, but can be used to a more limited degree where the pixels are character sized. (A good way to start an argument is to mention pixels, but the meaning here should be unambiguous.)

X and Y initially point to the centre of the screen. B points to the array of primes, and C counts off the points plotted. The succession of FOR loops produces a 'square spiral' plot, and the subroutine lights up each point that corresponds to a prime number. The ZX Spectrum will handle more than 30,000 points, but even on machines with a more limited display it will be evident that the pattern is not entirely random. The primes tend to fall in lines, a fact that has yet to be explained in full by mathematical theory.

The amusing point about the display is that only a few years ago it was cited as a demonstration of the power of big mainframe computers, and now it can be run on a fairly humble micro . . .

LOOKING AHEAD

Next month, a program to solve the Dooleydale problem will be offered. That will give you a chance to try out your own ideas on the subject. You have at least been given a fairly broad hint . . .

Peter Vasey

BBC STRING STORE

Squeezing text into the minimum possible space becomes quite an art with the BBC Microcomputer

Despite its general excellence, the BBC Micro can be very wasteful of memory when storing and manipulating string variables. Strings are allocated a specific memory block when first defined, the block size being the string length plus an eight byte buffer. Once the buffer overflows on re-defining the string, a new memory block is allocated and the previous block is discarded and remains unusable until cleared. Consequently it is possible to have a program which ends up with large chunks of useless memory.

Program 1 demonstrates this waste of memory, requiring almost 4000 bytes to store a 255 character string which has been incremented by one byte at a time. This can be avoided by pre-defining the string to the maximum length expected, as in Program 2 which uses under 300 bytes for the same string.

While this pre-definition technique will take care of the loss of large chunks of memory, there still remains the problem of the loss of bytes in the unused portions of the string buffer. Although this is of relatively little importance for small numbers of strings, it becomes critical in programs using string arrays, particularly for data storage.

STRINGING ALONG

Program 3 examines the way in which strings are stored in arrays. It shows that for strings of up to seven characters, each string requires four bytes extra, but for strings of eight characters and over, each string requires no less than 12 bytes extra. So a string array of 20 strings, each initially 30 characters long, occupies 840 bytes of which 240 bytes are wasted.

Now a very economical method of storing information in a data bank is to arrange it in 'fields' in a string. For example a stores record might be made up of six fields with character counts as follows:

Ref. No.	Description	Stock level	Reorder level	Last issue date	Price
6	20	5	5	9	5

The total string length is then 50 bytes, and the strings can be easily manipulated using string splitting commands to extract the required information.

As is shown by Program 3 above, each string would waste 12 bytes, ie a whole data set every four sets. On most micros there is no easy way around this, but fortunately BBC BASIC possesses the String Indirection Operator, '$'. Strings stored in memory using this operator only require one byte more than their length, consequently we can store much more information in a given amount of memory. The only problem is that the computer must be given the storage address by the program — it is not handled automatically. For strings of varying length this would require a backup store of addresses and be as memory consuming as the original system. But for fixed length strings the addressing is much simpler.

Once again BBC BASIC comes to our rescue with its redefinable 'HIMEM' and its 'FN' definable function command. Program 4 demonstrates the use of these to store and retrieve a set of up to 20 strings of 30 characters, which will now occupy only 620 bytes as against 840 above. The extra program lines will use much of the savings in this case, but for a

larger data bank the savings will be substantial.

Strings are entered on command until either 20 strings have been entered or a null string is entered. These are stored in addresses given by FNdata, within the block of memory reserved in line 80. The String Indirection Operator '$' prefixes the function call each time it is used, so that the statement PRINT $FNdata(X%) will print out the contents of the memory location given by FNdata and defined by X%. The beauty of this system is that provided the memory locations are kept within the allocated block by checks in the program (in this case the main program limits itself, but an example is shown within the FN definition), the programmer can then manipulate $FNdata() as though it were an ordinary string array.

There is a further bonus to this system of data storage. Unlike some micros, the BBC Micro stores its dynamic variables in such a way that whenever a program is altered, no matter by how little, all the variables are lost. Using '$' to place strings into reserved memory means that the data is unaffected by program changes, CLEAR or RUN. Consequently once a data bank has been entered it will only be destroyed by a programmed wipe, a MODE change or of course a switch off. This means that a data handling program can be developed without the constant niggle of re-entering data from keyboard or magnetic store (ie tape or disc) each time the program is amended.

GREAT SAVINGS

This type of space saving can also be extended to the storage of integer variables using the '?' and '!' operators. At the least, the data will be protected, and in the case of single byte variables will again give a substantial gain in available memory — there are many events which can be stored as single byte integers eg football scores, ages, credit ratings etc. and since the normal BBC integer variable occupies four bytes, this again releases memory to be used for additional data or program lines.

You may also care to consider the possibility of handling a very large data bank by using a suite of short programs to load and manipulate the data, since once the data is in its reserved memory it cannot be touched by the Operating System other than by a MODE command, and so programs can be LOADed and SAVEd at will.

```
   10 A$=""
   20 FOR A=0 TO 254
   30 A$=A$+"*"
   40 NEXT
   50 DIM P%-1
   60 PRINT"Memory used = ";P%-TOP;" Bytes."

>RUN
Memory used = 3890 Bytes.
```

Listing 1. Bytes used to store a 255 character string

```
   10 A$=STRING$(255,"*"):A$=""
   20 FOR A=0 TO 254
   30 A$=A$+"*"
   40 NEXT
   50 DIM P%-1
   60 PRINT"Memory used = ";P%-TOP;" Bytes."

>RUN
Memory used = 271 Bytes.
```

Listing 2. Predefining a 255 character string uses less memory.

```
10 DIM A$(9)
20 INPUT A%
30 FOR B%=0 TO 9
40 A$(B%)=STRING$(A%,"*")
50 NEXT
60 DIM P%-1
70 PRINT;A%;" Characters, ";(P%-TOP-8)/10;" Bytes used per string."
80 RUN

>RUN
0 Characters, 4 Bytes used per string.
1 Characters, 5 Bytes used per string.
4 Characters, 8 Bytes used per string.
6 Characters, 10 Bytes used per string.
7 Characters, 11 Bytes used per string.
8 Characters, 20 Bytes used per string.
10 Characters, 22 Bytes used per string.
20 Characters, 32 Bytes used per string.
30 Characters, 42 Bytes used per string.
100 Characters, 112 Bytes used per string.
200 Characters, 212 Bytes used per string.
```

Listing 3. The way in which strings are stored in arrays

```
 10 MODE 7
 20
 30 REM Define data limits
 40 sets=20
 50 length=31 :REM length of string +1
 60
 70 REM Reserve memory
 80 HIMEM=HIMEM-sets*length
 90
100 REM Enter data
110 A%=-1
120 REPEAT:A%=A%+1
130 PRINT '"Enter Data String No. ";A%+1;", max. 30 chars."
140 PRINT" ";STRING$(30,".")
150 INPUTLINE $FNdata(A%)
160
170 REM Reject overlong string
180 IF LEN($FNdata(A%))>30 THEN PRINT "Too long":GOTO 130
190
200 REM End Input
210 UNTIL A%=sets-1 OR $FNdata(A%)=""
220
230 REM Print contents of store
240 CLS
250 FOR B%=0 TO A%
260 PRINT $FNdata(B%)
270 NEXT
280 END
290
300 REM Function to find storage address
310 DEF FNdata(X%)
320 IF X%<0 OR X%>sets-1 THEN PRINT'"Out of range at line 310":END
330 =HIMEM+X%*length
```

Listing 4. Using HIMEM and FN commands to store and retrieve strings.

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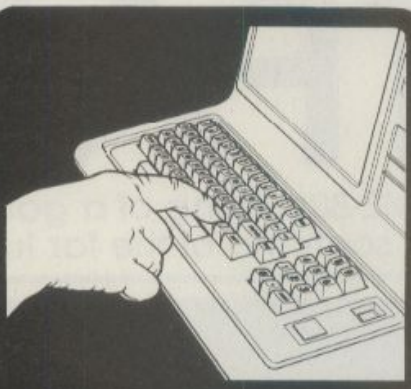

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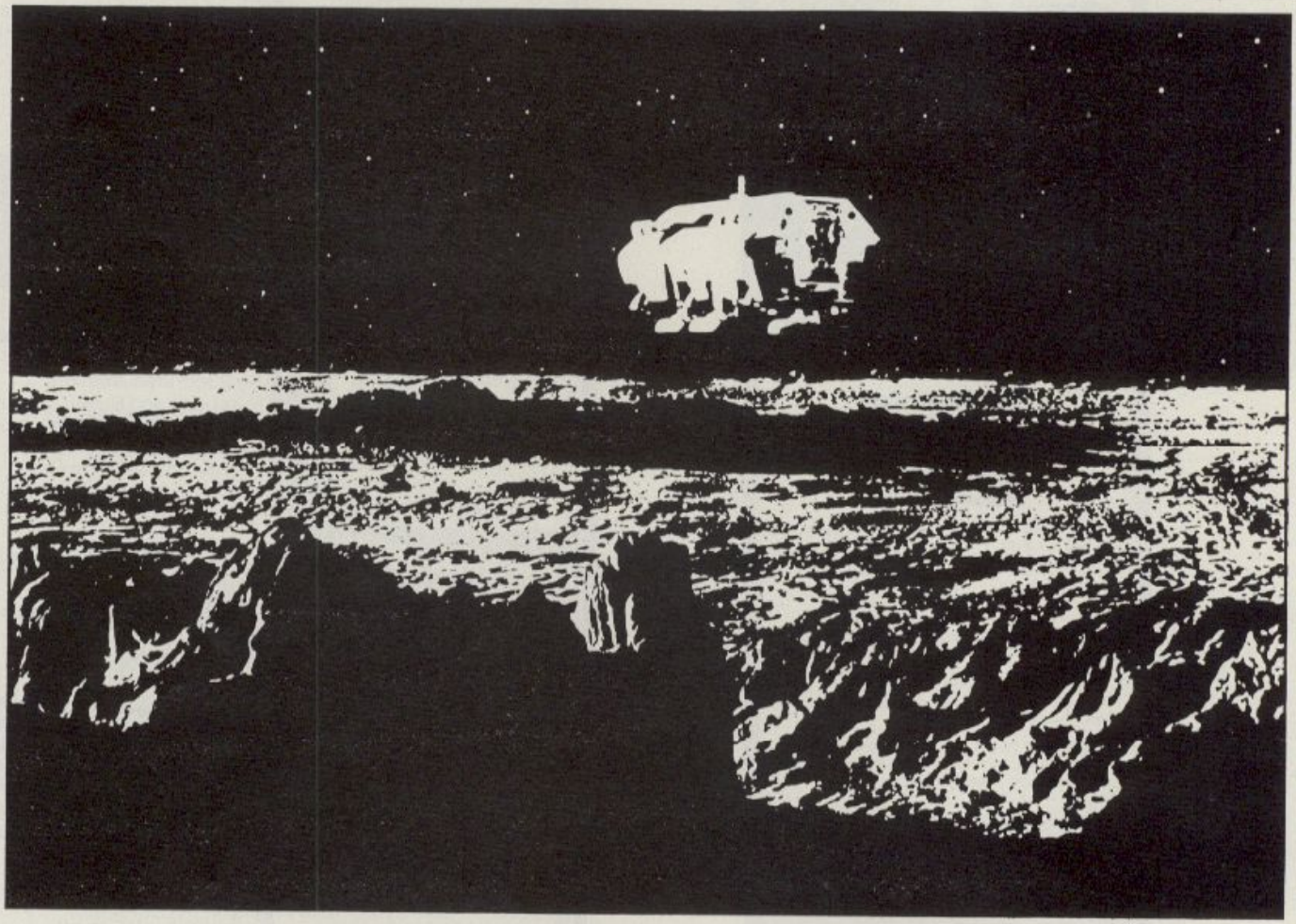
Ian Nicholls

PLANETFALL

CT gets its tenses in a twist with this Sharp MZ-80K listing of a game that harks back to the trading ships of old, in a scenario of the far future.



The ship's intercom warbled its hypnotic five note tune. 'Sparks' Sinclair, the ship's engineer, looked up from his three dimensional crossword puzzle. "It must have been a vintage SF film buff who engineered the intercom system", he mused to himself as he waited to see what come up on the intercom screen. It was Captain Curry.

"Attention, all ship's personnel. The mid-voyage pirate attack has been repulsed, but our ETA at star system Qetz is now delayed by three weeks.

"There is a deep thought computer project on Qetz and they have an urgent need for the ZX2900s in our cargo. I shall need maximum effort from you when we land to unload the cargo as quickly as you can.

"As you all know, we are running neck and neck with the ***Millenium Duck*** in the merchant starfleet's 'Ship of the Galaxy' contest. I am determined that the ***Cutty Sark 47*** will win. It's a free month's holiday on plane: Maplin for the winners: it's up to you. Captain out."

'Sparks' Sinclair had been to Maplin before; those yellow-clad hostesses had been quite something! The ***Cutty Sark 47*** raced on across the galaxy. Meanwhile on Ling, the ***Millenium Duck*** had landed but trading with the Lingans had been unexpectedly tough. What was worse, the ship had not passed pre-departure inspection and had been grounded for two weeks. Over on Juss . . .

That was a short scene from Planetfall, played with just a little imagination! In this article we will look in some detail at how Planetfall has been designed, and the elements that go to make up a captivating game that you will want to return to time and again.

Planetfall was originally written for the Sharp MZ-80K by Tim Garden. The listing that accompanies this article is of that original program. The Sharp machine has, in common with a number of other microcomputers, a character set which includes quite a number of graphics characters. It does not have a true high resolution graphics capability. However, Planetfall makes good use of the in-built graphics characters of the Sharp. The program, which is about 25K bytes long, has also been translated into

BBC BASIC and runs on a Model B or 32K Model A, using teletext characters in Mode 7. Much effort has been expended in this translation to squeeze the maximum visual effects from the colour and block graphics capabilities of the BBC Micro's teletext mode. The author of this article can speak authoritatively on this point, since it was he who undertook the translation!

The BBC translation is available from ASP Software, together with the Sharp version, and we would encourage owners of other machines to consider producing further translations, as happened with 'The Valley' some 15 months ago.

PLAYTIME

Let's turn back to the game itself and review some of the features which make it so rewarding to play.

Planetfall is a trading simulation, set a century in the future when there is a substantial merchant starfleet ploughing back and forth between the major star systems. It is a multi-player game, and your aim is to be the player with the greatest total assets at the end of the game. The skill in it lies in making the best judgments about where to travel, what to buy, what to sell and in balancing the value of cash in hand (or on board ship!) against cash in the bank (which earns interest). There is also significant skill required in the buying and selling process! The process used by the program is that old-fashioned one of 'haggling'. You ask a price for your goods and the dealer on Gwif (or wherever you have landed) will offer you something less. If you don't haggle successfully with him (it?) you will either lose the sale or pay more than you needed to. Similarly, when buying, you should never offer the asking price! It is not a good idea to press unwanted goods on the inhabitants of the planets you visit either: you will get a short but appropriate message!

One of the game's main features is variety. Variety is a very important aspect of good game design. With computer games variety usually takes one of two forms — sight or sound. Planetfall provides variety in both sight and sound, although if you are, perhaps, playing late at night, the BBC Micro version allows you to vary the loudness of the sound, including turning it off altogether! The various stages of play are accompanied by many different sounds, linked to what is happening on the screen.

It is inevitably the visual variety which is most important in a microcomputer game and Planetfall excels in this, having 11 different screen formats:

1. INITIALISATION
At the beginning of the game, you are given the option of recovering a saved game, or starting afresh. The captains have to enter their names and the names of their ships. They also have to choose how many star systems to start with and the length of the game in years (it does not run in real time!).

2. MAP OF THE GALAXY
This shows the relative positions of the known star systems with Sol (that's us) in the centre. Minor modifications have been made to cosmological theory in that the map assumes that space is two-dimensional. This does create compatibility problems with 'Sparks' Sinclair's three-dimensional crossword, but we are working on it.

3. COMMODITY PRICE & TRAVEL TIME DISPLAY
There are 15 possible star systems in the game, although you do not have to choose more than two to begin with. Your starship can carry six commodities; uranium, iron, machinery, medicines, computers and diamond gems. This display shows, for each star system currently in the game, the buying and selling prices for each commodity in that star system: for any commodity, a given star system will be either buying it or selling it, but never both at the same time.

The display also shows you the travel time in weeks from your current location to all the other star systems. In addition it shows your current cargo, your name and that of your ship.

4. TRAVEL PRINTOUT
If, when you have to choose the next system to visit, you want to find where each ship is travelling to, and the expected time of arrival (ETA), you can call up this display.

5. TRADING DISPLAY
This is the most complex screen format of all in Planetfall. Figure 1 is a photograph of the BBC version of this screen display during an actual game, and you will see that it contains a fair amount of information. This is the part of the program that handles the buying and selling of goods once you have achieved planetfall.

At the top of the screen are displayed the elapsed time in hours, minutes and seconds since you started the game, the stardate (the game starts on 1 January 2070) and the captain's name. On the left hand side, a little lower down, are the name of the ship and of the system being visited. The rest of the right hand side is taken up by the 'SHIP'S LOG'. This contains information on delays encountered before planetfall (with the reason), on the amounts of each commodity carried in the cargo hold, and on the cash on board and in the bank. Lastly, it indicates whether you are buying or selling goods.

The left hand side of the display contains six narrow boxes which display a whole collection of different messages as you buy and sell commodities. You are, for instance, informed of the finite capacity of your ship's hold if you become a little over-ambitious!

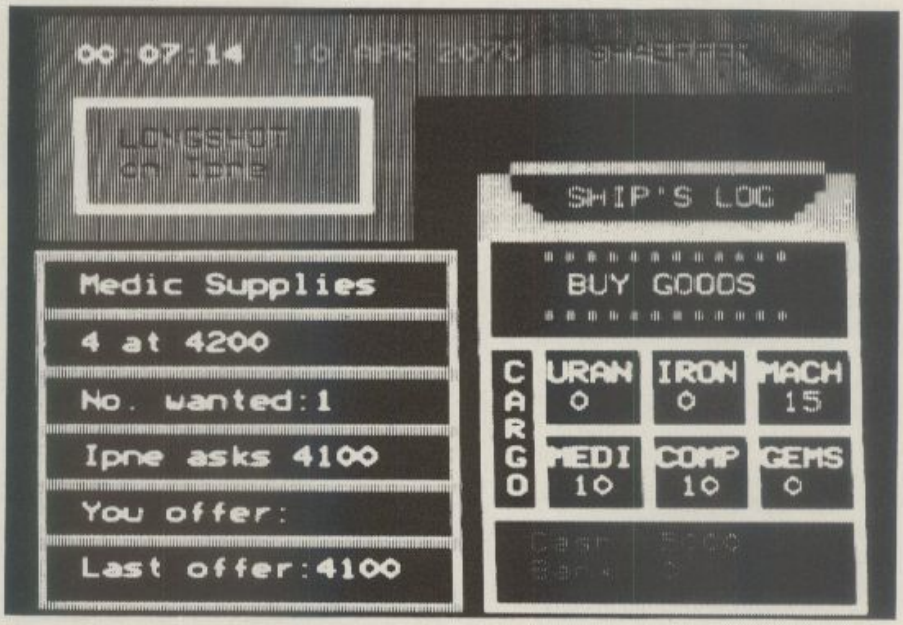


Fig. 1. Trading display on the BBC Micro.

When you have finished trading, the display will usually ask you which system you wish to visit next. If you have forgotten what they are, or their spatial relationship to each other, you have the chance of calling up the 'OPTIONS' display and, from that, the map of the galaxy. Every so often, though, you will first be given the chance of visiting the local bank, where you may deposit or withdraw cash.

6. BANK DISPLAY

With this you are asked whether you wish to visit the local bank; if you answer 'no', then you are asked to choose the next system to visit or to turn to the 'OPTIONS' display. If you answer 'yes' you are told how much money you have in the bank and on board ship. You are then able to deposit or withdraw money as the case may be. You are not allowed to deposit more money that you have in cash, nor to withdraw more money than you have on deposit!

7. OPTIONS DISPLAY

There are nine different options which you can select, when invited to, by pressing X on the keyboard; they are:

Key	Option
N	Start a new game
R	Recover an old game from tape
S	Save the present game on tape
P	Display the commodity prices and travel times
T	Travel printout
M	Map of the known star systems in the galaxy
B	Bank statement (shows who is winning)
X	Display options again
!	End the game, and calculate who is the winner

8. BANK STATEMENT

The bank statement shows for each captain in the game the financial status, aggregated across all his or her ships. The display shows cash on board ship and in the bank (in thousands of pounds), the value of the cargo at current market rates, and the resulting total assets.

This display is also used for each annual report (if the game lasts more than one year) and for the end of game report to show who has won.

9. NEW STAR REPORT

From to time, if you started with less than 15 star systems, a new one will be discovered, and this display will flash the message to you giving its name and then showing its position in space with the 'map of the galaxy' display.

10. ETA

When making your choice of the next system to visit, after finishing trading, and before being told of the ETA at the new system, you may find that you are delayed

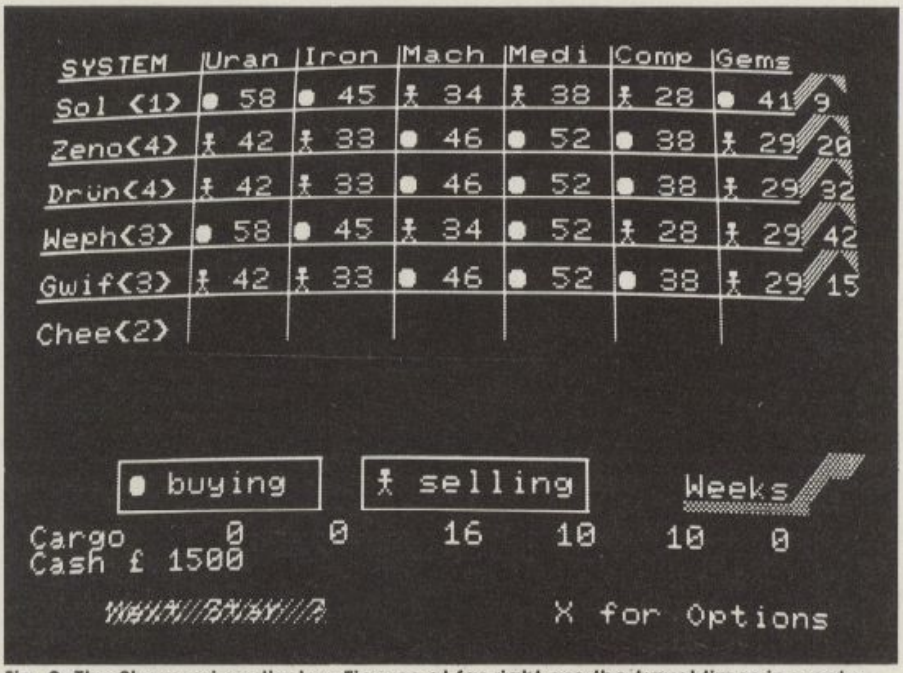


Fig. 2. The Sharp price display. Figures at far right are the travel times in weeks.

because the ship does not pass inspection, the crewmen demand a vacation (that Sinclair again), or there is about to be a local holiday.

11. URGENT MESSAGE

Again, at unpredictable intervals, the screen will clear to reveal a message about an urgent need for some particular commodity at one of the star systems. If you have a supply of that commodity then you need to get there before the other captains to make a financial killing. If you do not have it in your ships, then get to a system that has that commodity for sale *fast!*

ROUTINE APPROACH

This list of screen formats used in Planetfall is, in fact, also a list of the main routines used in the program. It is always helpful to draw a flowchart of a program in order to enable others to understand how it works. Certainly, the Sharp listing accompanying this article is not at all easy to follow. Indeed, it is a 'good' example of the pitfalls that result from not following a structured approach to programming. There are myriad GOTO statements which cause the interpreter to jump about all over the program as it is executed. If you hunt for it you will even find a GOSUB statement which transfers control to a GOTO statement. The program works but it is very difficult both to maintain and to change. It is also none too easy to translate as it stands.

For those of you who might be considering translating Planetfall for a different computer, the flowchart in Fig. 3 is your best starting point. The present translation for the BBC microcomputer has, for reasons of expediency, largely been a literal translation of the Sharp version, without much of an attempt to rewrite it in a more structured fashion. BBC BASIC is in the forefront of the various dialects of BASIC, in providing the appropriate elements to allow well-structured programs to be written, so there is plenty of scope for others to try their hand at improved translations. However, it should be pointed out that, unstructured as it is, the present BBC translation does work and just fits into the available RAM on a Model B!

To show you what a structured version of the program would look like in outline, the flowchart has been converted into BBC BASIC in Program 1.

One or two liberties have been taken with BBC BASIC for the sake of brevity, as in lines 240 and 250 where (condition) would be some test involving program variables, and (statement) would be an expression from which the next ship to land would be calculated.

BASIC STRUCTURE

Even the most hardened spaghetti-style programmer will have to admit that lines 100 to 340 make it quite easy to see how the program works. In actually writing the program in a structured fashion, you would first enter lines 100 to 340 plus all of the procedure definitions (the DEF PROC and ENDPROC statements). However,

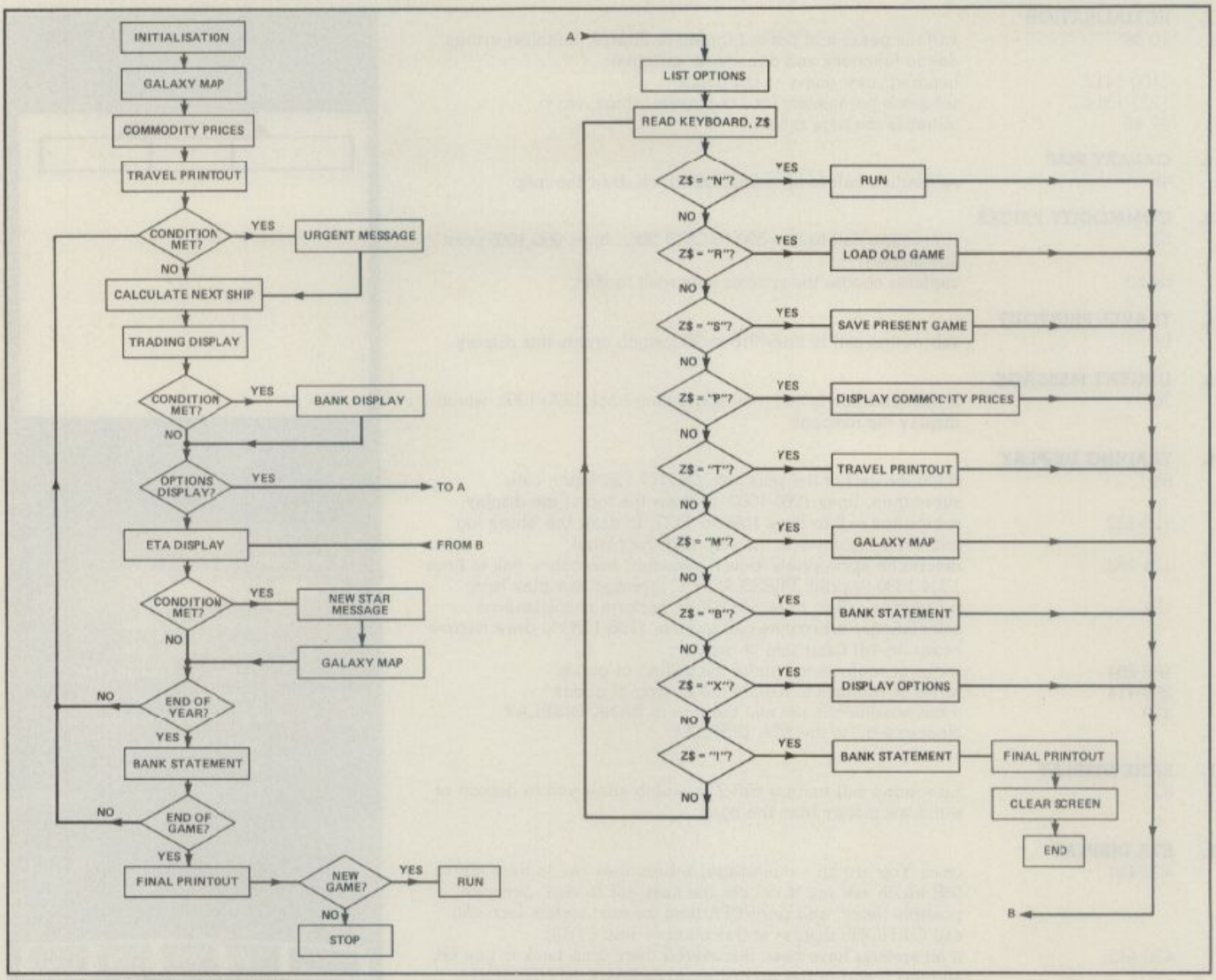


Fig. 3. Flowchart for Planetfall.

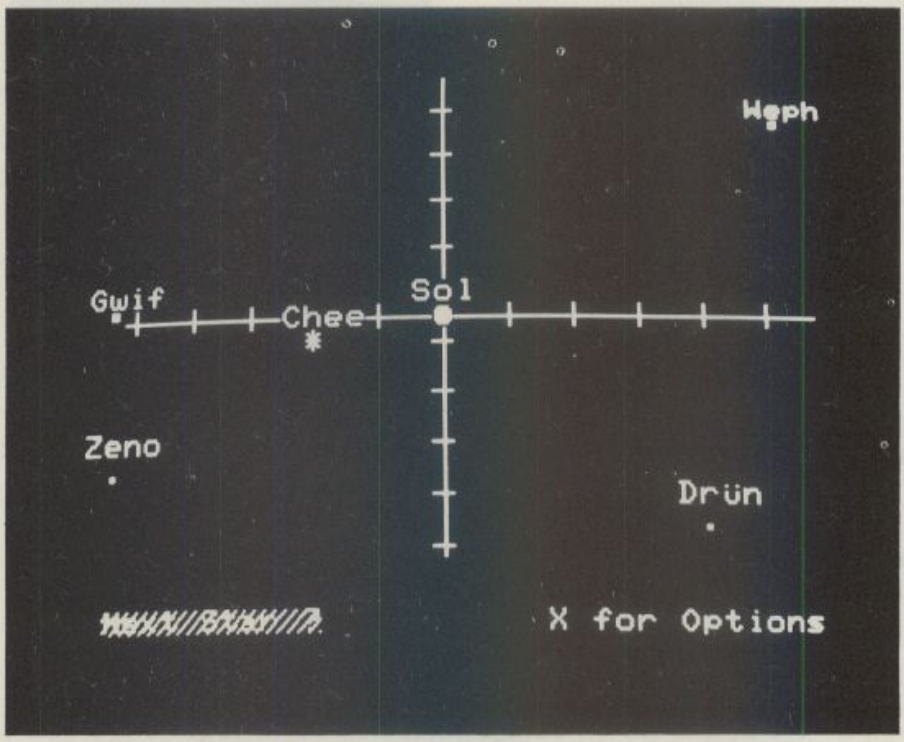


Fig. 4. The Sharp version of the galactic map.

the only line inside each procedure would be a PRINT statement which printed out the name of the procedure. Simple statements would be substituted for (condition) and (statement). Running this framework program would then test out the logical structure. Once this was shown to work satisfactorily, the coding for each procedure would be worked out in detail, one by one. At each stage only one new procedure would be in the process of development and this would greatly simplify program writing and testing.

To help you understand the Sharp listing more easily, whether or not you intend to convert it to your own machine, the program lines which relate to each main flowchart step are overleaf.

Well, there it is — PLANETFALL. We hope that your appetite has been whetted. If you own a Sharp MZ-80K or a BBC Model B (or 32K Model A) then send for the tape straight away and start playing. If you own another machine then get translating! ▶

1. INITIALISATION

10-38	various peeks and pokes (unique to Sharp); initialise strings; define functions and dimension variables;
1400-1412	heading; new game or old game?
1227-1314	set game parameters (no. of players, ships, etc.);
42-46	initialise the time to zero.

2. GALAXY MAP

48	subroutine call to lines 882-912 which draw the map.

3. COMMODITY PRICES

52	subroutine call to line 590 (GOTO 986); lines 986-1056 print this display;
54-62	captains choose the systems they wish to visit.

4. TRAVEL PRINTOUT

64	subroutine call to lines 916 to 960 which create this display.

5. URGENT MESSAGE

70	if the condition is met, call subroutine lines 1370-1392, which display the message.

6. TRADING DISPLAY

84	if not the end of the year then GOTO 126 which calls subroutine, lines 1060-1082, to draw the top of the display;
128-132	subroutine call to lines 1086 to 1132, to draw the 'ship's log' and write the name of the ship and the planet;
134-182	determine appropriate 'delay' message; subroutine call to lines 1324-1330 to print 'PRESS A KEY' message and play tune;
184	subroutine call to lines 648-676 to perform miscellaneous calculations; subroutine call to lines 1136-1150 to draw narrow boxes on left hand side of display;
186-284	series of routines to handle the selling of goods;
290-414	series of routines to handle the buying of goods;
418	if the condition is not met then go to BANK DISPLAY, otherwise go to the ETA DISPLAY.

7. BANK DISPLAY

420	subroutine call to lines 678-716, which allow you to deposit or withdraw money from the bank.

8. ETA DISPLAY

422-424	print 'You are on . . .' message; subroutines call to lines 490 to 588 which ask you to choose the next star to visit, generate possible delay, and print ETA time for next system (you can call OPTIONS display at this point — line 1170);
426-442	if all systems have been discovered then jump back to line 68, and test if end of the year (if so go to BANK STATEMENT), otherwise TRADING DISPLAY for next ship;
444-452	if condition not met then jump back to line 68, as above, otherwise new star discovered, print message and then call GALAXY MAP and jump to line 68.

9. OPTIONS DISPLAY

1170-1214	print out possible options and branch depending on the choice made;
1216-1226	start a new game.

10. BANK STATEMENT

596-646	these statements list the captains and their various assets, with the current leader highlighted.

11. END OF GAME

98	calls the BANK STATEMENT display;
100-124	print out the name of the winner, and ask whether you want another game, if so then RUN, otherwise jump to line 1368;
1368-1369	various POKEs unique to Sharp before ENDing the program.

Fig. 5. From top to bottom: the Beeb travel printout, the Beeb option list and the Sharp bank statement.

Program 1. Outline of Planetfall in BBC BASIC.

```
100 REM - Outline of Planetfall
110 REM - in BBC BASIC
120 REM
130 REM - Startup routines
140 REM
150 PROCinitialise
160 PROCgalaxy_map
170 PROCcommodity_prices
180 PROCtravel_printout
190 REM
200 REM - start of main program loop
210 REM
220 REPEAT
230   REPEAT
240     IF (condition) THEN PROCurgent_message
250     nextship=(statement)
260     PROCtrading_display(nextship)
270     IF (condition) THEN PROCbank_display
280     IF (X pressed on keyboard) THEN PROCoptions_dis
play
290     PROCeta_display
300     IF (condition) THEN PROCnew_star:PROCgalaxy_map
```

```
 310     UNTIL ("end of year?" = TRUE)
 320   PROCbank_statement
 330   UNTIL ("end of game?" = TRUE)
 340 PROCfinal_printout
 350 IF ("start new game?" = TRUE) THEN RUN ELSE END
 360 REM
 370 REM - end of main program loop
 380 REM
 390 REM - procedure definitions
 400 REM
1000 DEF PROCinitialise
1010 .
1020 .
1030 .
1500 ENDPROC
2000 DEF PROCgalaxy_map
2010 .
2020 .
2030 .
2500 ENDPROC
3000 DEF PROCoptions_display
3010 PROClist_options
3020 REM
3030 REM - read keyboard
3040 REM
3050 Z$=GET$
3060 REM
3070 REM - new game
3080 REM
3090 IF Z$="N" THEN RUN
3100 REM
3110 REM - recover old game
3120 REM
3130 IF Z$="R" THEN action$="LOAD":PROCload_save:ENDPROC
3140 REM
3150 REM - save present game
3160 REM
3170 IF Z$="S" THEN action$="SAVE":PROCload_save:ENDPROC
3180 REM
3190 REM - prices of commodities
3200 REM
3210 IF Z$="P" THEN PROCcommodity_prices:ENDPROC
3220 REM
3230 REM - travel_printout
3240 REM
3250 IF Z$="T" THEN PROCtravel_printout:ENDPROC
3260 REM
3270 REM - map of star systems
3280 REM
3290 IF Z$="M" THEN PROCgalaxy_map:ENDPROC
3300 REM
3310 REM - bank statement
3320 REM
3330 IF Z$="B" THEN PROCbank_statement:ENDPROC
3340 REM
3350 REM - option selection
3360 REM
3370 IF Z$="X" THEN PROCoptions_display:ENDPROC
3380 REM
3390 REM - end game
3400 REM
3410 IF Z$="!" THEN PROCbank statement:PROCfinal_printou
t:CLS:END
3420 REM
3430 REM - other key pressed, so
3440 REM - read keyboard again
3450 REM
3460 GOTO 3050
3470 ENDPROC
4000 DEF PROCcommodity_prices
4010 .
4020 .
4030 .
4500 ENDPROC
5000 .
5010 .
5020 .
5030 etc
```

Listing 1. Planetfall for the Sharp MZ-80K.

```
10 UX=PEEK(7221): UY=PEEK(7222)
12 LIMIT 53024
14 GOSUB 1436
16 POKE 7221,35: POKE 7222,207
18 TEMPO 5: DIM Q(6): IN=53068
20 DIM S(12,15),T(12,12),T$(12,2),B(3,12),D$(4),P$(15),CO$(6)
22 FOR XX=1 TO 6: READ Z(XX): NEXT
24 BL$="                                   ": GOSUB 1342
26 DIM M(6,3),C(6,3),P(6),G(6),N$(12)
28 C$="JANFEBMARAPRMAYJJNJULAUGSEPOCTNOVDEC"
30 S$="Sol VerlGwifZenoJätzFlynNephNöökYttrDrünIpneCheeLingOvisJuss"
32 DEF FNZ(X)=(FNY(X)*.5-IFNT(X)*X)/(2*ABS(S(I1,S1)))/K1
34 DEF FNY(X)=-(X=ABS(S(I1,S1)))
36 DEF FNT(X)=-(X<ABS(S(I1,S1)))
38 GOTO 1400
40 DATA 5000,3900,4000,4500,3300,3500
42 TI$="000000": IF R=1 THEN 46
44 H3=1: H4=1: GOTO 48
46 GOSUB 648: GOSUB 754: GOSUB 916: GOTO 68
48 S1=1: T1=1: L1=1: GOSUB 882: PRINT [22,10] "PRESS A KEY TO START"
50 GET A$: I1=RND(1): IF A$="" THEN 50
52 FL=1: PQ=1: GOSUB 590
54 GQ=1
56 FOR I1=1 TO T9/P9
58 FOR P1=1 TO P9: S7=(P1-1)*6+1: PRINT [22,0] BL$
59 PRINT [22,0] T$(T1,1);" in ";T$(T1,0): GOSUB 490
60 FOR GJ=20 TO 23: PRINT [GJ,0] BL$: MUSIC "C0": NEXT: GOSUB 1052
61 IF SW=9 THEN PRINT [23,2] "Press 'A' for the rest of the prices"
62 L1=L1+6: T1=T1+1: NEXT P1,I1 : PQ=0
64 IF GQ=1 THEN GOSUB 916: GQ=0
66 GET A$: IF A$="" THEN 66
68 D=T(9,1): Y=T(10,1): T1=1: FOR I=2 TO T9: IF T(10,I)<Y THEN 80
70 IF (RND(1)).93)*(SA$="") THEN GOSUB 1370
72 K0=K0+1: IF K0)45 THEN SA$=""
74 IF T(10,I)>Y THEN 82
76 IF T(9,I)>D THEN 82
78 IF (T(9,I)=D)*(RND(1)).5) THEN 82
80 D=T(9,I): Y=T(10,I): T1=I
82 NEXT I
84 IF Y1=Y THEN 126
86 D1=1: Y1=Y: T2=T1: GOSUB 584
88 GET A$: IF A$="" THEN 88
96 T1=T2: IF Y1<Y9 THEN 126
98 GOSUB 596: XX=65
100 PRINT [18,13] "▛▀▀▀▀▀▀▀▀▀▜ "
102 PRINT [19,13] "▌ END OF GAME ▐ "
104 PRINT [20,13] "▙▄▄▄▄▄▄▄▄▄▟ "
106 PRINT [22,12-INT((LEN(N$(WI))/2)] "### ";N$(WI);" has won ###"
108 GET A$: PRINT [19,14] "::::::::::::": XX=XX+1+(XX>72)*8: MUSIC CHR$(XX)
110 IF A$="" THEN 102
112 PRINT "■"
114 PRINT [5,5] "Perhaps ";N$(WI);" won't be so lucky"
116 PRINT "on the next game!!"
118 PRINT [8,3] "Do you want to set up another game?"
120 GET A$: IF A$="" THEN 120
122 IF A$="Y" THEN RUN
124 GOTO 1368
126 D1=D: M=INT((D1-1)/30): L=3*M+1: GOSUB 1060
128 M=INT((D1-1)/30)
130 H3=L: H4=D1-30*M: L=(T1-1)*6+1
132 S1=T(8,T1): M=S(8,S1): GOSUB 1086
134 FOR XX=1 TO 3: P$(XX)="": NEXT
136 ON T(12,T1)+1 GOTO 172,164,156,138
```

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138 TT=RND(1): IF TT>.5 THEN P$(1)="♦ 3 week delay ♦"
139 IF TT>.5 THEN P$(2)="   at Customs": P$(3)="": GOTO 174
140 T(11,T1)=INT(T(11,T1)/2)
142 FOR XX=1 TO 5: T(XX,T1)=INT(T(XX,T1)*(1-.4*RND(1))): NEXT
144 T(6,T1)=INT(T(6,T1)*RND(1))
146 T(7,T1)=T(1,T1)+T(2,T1)+T(3,T1)+T(4,T1)
148 P$(1)="♦ 3 weeks late ♦"
150 P$(2)=" Pirate attack  "
152 P$(3)="   mid voyage   "
154 GOTO 174
156 P$(1)="♦ 2 weeks late ♦"
158 P$(2)="  Navigational "
160 P$(3)="     error     "
162 GOTO 174
164 P$(1)="♦ 1 week late ♦"
166 P$(2)="   Computer    "
168 P$(3)="    error      "
170 GOTO 174
172 P$(2)="   On Schedule  ": P$(1)="": P$(3)=""
174 FOR XX=1 TO 3: PRINT [9+XX,23] P$(XX): NEXT: WZ=0: GOSUB 1324
176 GET A$: IF A$="" THEN 176
178 FOR ZZ=1 TO 3: PRINT [15,21+5*ZZ] STR$(T(ZZ,T1)): NEXT
180 FOR ZZ=4 TO 6: PRINT [18,21+5*(ZZ-3)] STR$(T(ZZ,T1)): NEXT
182 IF QQ=1 THEN RETURN
184 GOSUB 648: GOSUB 1136
186 Z1$="Requirement:": Z2$="Number for sale:   ": Z3$=" offers:"
188 Z4$="Asking price: ": J1=1: AL$="1234567890"
190 PRINT [10,23] "     \\\\      "
192 PRINT [11,23] "   SELL CARGO   "
194 PRINT [12,23] "     ////      "
196 MUSIC "C7_C4C7"
198 FOR I1=1 TO 6
200 PRINT [1,0] "|";LEFT$(T1$,2);" ";MID$(T1$,3,2);" ";RIGHT$(T1$,2);" |";
202 GOSUB 1154
204 FOR Q5=9 TO 19 STEP 2: PRINT [Q5,1] "                    ": NEXT
206 IF (S(I1,S1)>=0)+(T(I1,T1)<.5)+(P(I1)<100) THEN 280
208 MUSIC "F4G3F4"
210 PRINT [9,1] "Item:";CO$(J1): PRINT [11,1] Z1$;" ";-INT(S(I1,S1))
212 PRINT [13,1] Z2$;
214 XF=17: YF=13: NC=2: GOSUB 728
216 PRINT [19,1] "
218 IF X=0 THEN 280
220 IF X<=T(I1,T1) THEN 226
222 PRINT [19,3] "Only";T(I1,T1);" in hold"
224 GOTO 212
226 IF X<=-INT(S(I1,S1)) THEN 230
228 PRINT [19,1] "NO DUMPING": GOTO 280
230 FOR K1=1 TO K*
232 IF K1<3 THEN PRINT [15,1] "::::::::::::::::": MUSIC "GB": GOTO 240
234 MUSIC "_A3"
236 PRINT [19,1] "Final offer: ";
238 GOTO 246
240 PRINT [17,14] "     "
242 PRINT [15,1] MID$(S$,M,4);Z3$;
244 Y2=(L1+1)*10/3
246 PRINT 100*INT(.009*P(I1)*X+.5)
248 PRINT [17,1] Z4$: YF=17: XF=14: X1=X
250 NC=6: GOSUB 728: Y=X: X=X1
252 IF (Y>P(I1)*X/10)*(Y<P(I1)*X*10) THEN 258
254 PRINT [19,1] "Try again   "
256 GOTO 242
258 IF Y<=P(I1)*X THEN 270
260 IF Y>(1+ABS(FNZ(X)))*P(I1)*X THEN 266
262 P(I1)=.8*P(I1)+.2*Y/X
264 NEXT K1
266 PRINT [19,1] "No thanks"
268 GOTO 280
270 PRINT [19,1] "We'll buy!"
272 T(11,T1)=T(11,T1)-X
274 T(7,T1)=T(7,T1)+X*(I1<5)
276 T(11,T1)=T(11,T1)+Y
278 S(I1,S1)=S(I1,S1)+X
280 J1=J1+1
282 AZ$="  ": GOSUB 1168: AZ$=STR$(T(I1,T1)): GOSUB 1168
284 NEXT I1
290 Z1$=" available": Z2$="Number wanted:": Z3$=" asks": Z4$="Your offer"
292 J1=1
294 PRINT [10,23] "      ////      "
296 PRINT [11,23] "    BUY GOODS    "
298 PRINT [12,23] "      \\\\      "
300 MUSIC "GC7C4C4"
302 FOR I1=1 TO 6
304 PRINT [1,0] "|";LEFT$(T1$,2);" ";MID$(T1$,3,2);" ";RIGHT$(T1$,2);" |";
306 GOSUB 1154
308 FOR Q5=9 TO 19 STEP 2: PRINT [Q5,1] "                    ": NEXT
310 IF (P(I1)<100)+(B(I1)<=0)+(S(I1,S1)<1) THEN 410
312 IF (I1<=4)*(T(7,T1)>=W) THEN 410
314 MUSIC "CF4GB3F4"
316 PRINT [9,1] "Item:";CO$(J1)
318 PRINT [11,1] STR$(INT(S(I1,S1)));Z1$;" @";100*INT(.011*P(I1)+.5)
320 PRINT [13,1] Z2$;
322 XF=16: YF=13
324 NC=2: GOSUB 728: PRINT [19,1] LEFT$(BL$,18)
326 IF X=0 THEN 410
328 IF (I1>4)+(X+T(7,T1)<=W) THEN 334
330 PRINT [19,1] "Max load =";W-T(7,T1)
332 GOTO 320
334 IF X<=INT(S(I1,S1)+.2) THEN 340
336 PRINT [19,1] "Only";INT(S(I1,S1));" available"
338 GOTO 320
340 FOR K1=1 TO K9
342 IF K1<3 THEN PRINT [15,1] "::::::::::::::::": MUSIC "GB": GOTO 350
344 MUSIC "_A3"
346 PRINT [19,1] "Final offer";
348 GOTO 354
350 PRINT [17,14] "     "
352 PRINT [15,1] MID$(S$,M,4);Z3$;
354 PP=ABS(P(I1))
356 PRINT 100*INT(.011*PP*X+.5)
358 PRINT [17,1] Z4$: YF=17: XF=14: X1=X
360 NC=6: GOSUB 728: Y=X: X=X1
362 IF (Y>PP*I/10)*(Y<(PP*X*10) THEN 366
364 PRINT [19,1] "Try again      "
366 IF Y>=PP*X THEN 380
368 IF Y<(1-ABS(FNZ(X)))*PP*I THEN 374
370 P(I1)=.8*P(I1)+.2*Y/X
372 NEXT K1
374 PRINT [19,1] "Too low - NO SALE"
376 MUSIC "_B7 _F5_E6_B7_C7"
378 GOTO 410
380 IF Y<=T(I1,T1) THEN 400
382 T(12,T1)=0
384 PRINT [19,1] "Only";T(11,T1);" in cash"
386 GOSUB 718
388 IF (S(7,S1)<10)+(T(11,T1)+B(1,B1)<Y) THEN FOR TT=1 TO 400: NEXT: GOTO 374
390 FOR XZ=1 TO 400: NEXT
392 PRINT [19,1] Y-T(11,T1);" from Bank      "
394 B(1,B1)=B(1,B1)-Y+T(11,T1): T(11,T1)=Y
396 FOR XZ=1 TO 500: NEXT
398 IF Y>T(11,T1) THEN 374
400 PRINT [19,1] "♦♦♦ SOLD ♦♦♦      "
402 M$="C1EC2": FOR XZ=1 TO 3: M$=M$+M$: NEXT: MUSIC M$: T(11,T1)=T(11,T1)+I
404 T(7,T1)=T(7,T1)-X*(I1<5)
406 S(I1,S1)=S(I1,S1)-X
408 T(11,T1)=T(11,T1)-Y
410 J1=J1+1
412 AZ$="  ": GOSUB 1168: AZ$=STR$(T(11,T1)): GOSUB 1168
414 NEXT I1
416 GOSUB 718
418 IF (S(7,S1)<10)+(T(11,T1)+B(1,B1)=0) THEN 422
420 GOSUB 673
422 PRINT [21,0] "You are on ";MID$(S$,M,4)
423 S(7,S1)=S(7,S1)+.02+RND(1)/25
424 GOSUB 490
426 J=0
428 FOR I=1 TO 6: IF S(I,S1)>=0 THEN 434
430 IF S(I,S1)<B(I) THEN 442
432 J=J+1
434 NEXT I
436 IF J>1 THEN 442
438 S(7,S1)=S(7,S1)+69
440 G0=S(7,S1)
442 IF S9=15 THEN 68
444 J=0
446 FOR I=1 TO S9: J=J+S(7,I): NEXT
448 PRINT [2,0] "Developmental status of galaxy = ";INT(J/S9*100/7);"%"
450 FOR XZ=1 TO 2000: NEXT
452 IF J/S9<7 THEN 68
454 S1=S9+1: S9=S9+1: GOSUB738: GOSUB462: S(9,S1)=D1: S(10,S1)=Y1: FOR J=1TO6
456 S(J,S1)=0: NEXTJ: GOSUB 736
458 PRINT "[redacted] New class (4) star called ";MID$(S$,S(8,S1),4)
460 FOR XZ=1 TO 2000: NEXT: GOSUB 754: GOTO 68
462 X=(RND(1)-.5)*100: Y=50*RND(1)
464 IF (ABS(X)<25)*(Y<25) THEN 462
466 F=1: GOSUB 472
468 IF F=0 THEN 462
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470 S(7,S1)=0: RETURN
472 ON H GOTO 480,478,476,474
474 I=X: X=-Y: Y=I: GOTO 480
476 Y=-Y: GOTO 480
478 I=X: X=Y: Y=I
480 FOR J=1 TO S1-1
482 IF SQR((X-S(11,J))↑2+(Y-S(12,J))↑2)=D9 THEN 488
484 F=0
486 RETURN
488 NEXT J: S(11,S1)=INT(X): S(12,S1)=INT(Y): H=1-(H(=3)*H: RETURN
490 PRINT [24,0] BL$;
491 IF PD=1 THEN 494
492 PRINT [24,25] "X for Options";
494 PRINT [24,2] "              ";: GET A$
495 PRINT [24,2] "Next Star ?";: IF A$="" THEN 494
496 IF (SW=9)*(A$="A") THEN GOSUB 986: GOTO 490
497 IF PQ=1 THEN 500
498 IF A$="X" THEN GOSUB 1170: GOTO 490
500 FOR I=1 TO S9: J=S(8,I)
502 IF LEFT$(A$,1)=MID$(S$,J,1) THEN 518
504 NEXT I
506 GOTO 512
508 GOSUB 590: GOTO 516
510 S2=S1: GOSUB 754: GOTO 516
512 PRINT [24,16] "                         ";: FOR TT=1 TO 400: NEXT TT
514 PRINT [24,16] "No such system";: FOR TT=1 TO 400: NEXT TT
516 GOTO 490
518 T(8,T1)=1
520 IF I<>S1 THEN 526
522 PRINT [24,16] "              ";: FOR TT=1 TO 100: NEXT TT
523 PRINT [24,16] "You're there !";
524 GOTO 516
526 D2=SQR((S(11,S1)-S(11,I))↑2+(S(12,S1)-S(12,I))↑2)/R9
528 D2=INT(D2): WZ=0: QM=0
530 S(7,S1)=S(7,S1)+.02+RND(1)/25
532 IF GQ=1 THEN 552
534 PRINT "■": IF RND(1)>Q/2 THEN 552
536 ON I GOTO 546,542,538
538 PRINT "Ship does not pass inspection"
540 GOTO 548
542 PRINT "Crewmen demand a vacation"
544 GOTO 548
546 PRINT "Local holiday soon ";
548 PRINT "...";I;" week delay"
550 D2=D2+7*I
552 T(9,T1)=T(9,T1)+D2
554 IF T(9,T1)<=360 THEN 560
556 T(9,T1)=T(9,T1)-360
558 T(10,T1)=T(10,T1)+1
560 M=INT((T(9,T1)-1)/30)
562 L=3*M+1
564 IF GQ=1 THEN 570
566 PRINT "The ETA at ";MI$(S$,J,4);" is ";MID$(C$,L,3);" ";
568 PRINT T(9,T1)-30*M;",";T(10,T1)
570 I=(INT(RND(1)*7 +1)*(-(RND(1)>Q/2)))
572 IF I>3 THEN 570
574 T(9,T1)=T(9,T1)+I*7
576 IF T(9,T1)<=360 THEN 582
578 T(9,T1)=T(9,T1)-360
580 T(10,T1)=T(10,T1)+1
582 T(12,T1)=I: RETURN
584 GOSUB 736
586 AR=1: PRINT"■";"Annual Report ";Y1-2070: GOTO 598
588 RETURN
590 GOTO 986
596 PRINT "■";
598 PRINT "■──────┬──────┬──────┬──────┬──────■";
600 PRINT "■ Captain ■ Ship ■ Bank ■Cargo ■ Total ■";
602 PRINT "■         ■ '000s■ '000s■value ■ assets■";
604 PRINT "■──────┴──────┴──────┴──────┴──────■";
606 MAX=0: FOR B1=1 TO P9: GOSUB 724: NEXT
608 IF P9<5 THEN PZ=4: L0=5: GOTO 614
610 IF P9<6 THEN PZ=3: L0=5: GOTO 614
612 PZ=2: L0=5
614 FOR P1=1 TO P9
616 M1=0: M2=0
618 FOR I1=0 TO T9/P9-1
620 M1=M1+T(11,P9*I1+P1)
622 FOR K=1 TO 6
624 M2=M2+T(K,P9*I1+P1)*Q(K)
626 NEXT K,I1
628 S7=(P1-1)*6+1
630 M3=M2+M1+B(1,P1)
632 IF M3>MAX THEN MAX=M3: WINNER=P1
634 PRINT [L0,0] N$(P1)
636 PRINT [L0,11] INT(M1/1000): PRINT [L0,18] INT(B(1,P1)/1000)
638 PRINT [L0,24] INT(M2/1000): PRINT [L0,31] INT( M3)
640 L0=L0+P2
642 NEXT P1
644 PRINT [6+(W1-1)*P2,0] LEFT$("■■■■■■■■■■■■■■■■",LEN(N$(W1)))
645 IF AR=1 THEN PRINT [22,12] "PRESS A KEY": AR=0
646 RETURN
648 R1=1-(S(7,S1)>=5)-(S(7,S1)>=10)
650 D2=12*(Y1-S(10,S1))+(D1-S(9,S1))/30
652 FOR I=1 TO 6
654 G(I)=(1+S(7,S1)/15)*(M(I,R1)*S(7,S1)+C(I,R1))
656 IF ABS(G(I))>.01 THEN 660
658 P(I)=0: GOTO 672
660 Q1=ABS(G(I)*12): Q2=ABS(S(I,S1)+D2*G(I)): IF Q1>Q2 THEN Q1=Q2: GOTO 664
662 Q3=Q1
664 S(I,S1)=SGN(G(I))*Q3
666 P(I)=Q(I)*(1-SGN(S(I,S1))*ABS(S(I,S1)/(G(I)*X9)))
668 P(I)=100*INT(P(I)/100+.5)
670 NEXT I: IF (SA$="")+(S1<>VAL(LEFT$(SA$,1))) THEN 676
672 P(VAL(MID$(SA$,2,1)))=VAL(RIGHT$(SA$,2))*100
674 S(VAL(MID$(SA$,2,1)),S1)=-ABS(S(VAL(MID$(SA$,2,1)),S1))
676 S(9,S1)=D1: S(10,S1)=Y1: RETURN
678 PRINT "■Do you wish to visit the local bank ?"
680 GET A$: IF A$="" THEN 680
682 IF A$="Y" THEN 688
684 IF A$="N" THEN RETURN
686 GOTO 680
688 GOSUB 718: GOSUB 724
690 PRINT "■■You have £";INT(B(1,B1));" in the bank"
692 PRINT [5,5] "And £";T(11,T1);" on the ship"
694 IF B(1,B1)=0 THEN 708
696 PRINT[7,2]"How much do you wish to withdraw?": PRINT[8,15]"£      ■■■■■■";
697 USR(IN),AL$,10,A$: Z=VAL(A$): IF Z<=B(1,B1) THEN 700
698 PRINT [9,18] "TOO MUCH": GOTO 696
700 IF Z<=0 THEN 708
702 B(1,B1)=B(1,B1)-Z
704 T(11,T1)=T(11,T1)+Z
706 RETURN
708 PRINT[10,2]"How much do you wish to deposit?":PRINT[11,15]"£      ■■■■■■";
709 USR(IN),AL$,10,A$: Z=VAL(A$)
710 IF Z>T(11,T1) THEN PRINT [12,3] "You only have £";T(11,T1): GOTO 708
712 T(11,T1)=T(11,T1)-Z
714 B(1,B1)=B(1,B1)+Z
716 RETURN
718 B1=T1: FOR I=1 TO S9/P9: IF B1<=P9 THEN 722
720 B1=B1-P9: NEXT
722 RETURN
724 B(1,B1)=B(1,B1)*(1+.05*(Y1-B(3,B1)+(D1-B(2,B1))/360))
726 B(2,B1)=D1: B(3,B1)=Y1: RETURN
728 PRINT [YF,XF-1] "■";
730 USR(IN),AL$,NC,A$
732 X=VAL(A$)
734 RETURN
736 MUSIC "C3_C5C4": RETURN
738 IF S1>1 THEN 742
740 I=1: GOTO 750
742 I=4*INT(14*RND(1))+5
744 FOR J=2 TO S1-1
746 IF I=S(8,J) THEN 742
748 NEXT J
750 S(8,S1)=I: RETURN
754 GOTO 882
758 IK=0: FOR IJ=SW TO SX: IK=IK+1
760 IF S3=IJ THEN 770
762 D2=SQR((S(11,S3)-S(11,IJ))↑2+(S(12,S3)-S(12,IJ))↑2)/R9
764 NW=INT(D2/7)
766 PRINT [2*IK-1,37] "■"
768 PRINT [2*IK,37] "F";STR$(NW)
770 NEXT IJ: RETURN
772 PRINT "■■■■■■   CONFIRM !!! (Y/N)"
774 GET A$: IF A$="" THEN 774
776 IF A$="Y" THEN 780
778 RETURN
780 IF RE=9 THEN ROPEN
782 IF RE=5 THEN WOPEN DA$
784 FOR I=0 TO 12: FOR J=0 TO 15
786 IF RE=9 THEN INPUT#1,T S(I,J)
788 IF RE=5 THEN PRINT#1,T S(I,J)
790 NEXT J,I
792 FOR I=0 TO 12: FOR J=0 TO 12
794 IF RE=9 THEN INPUT#1,T T(I,J)
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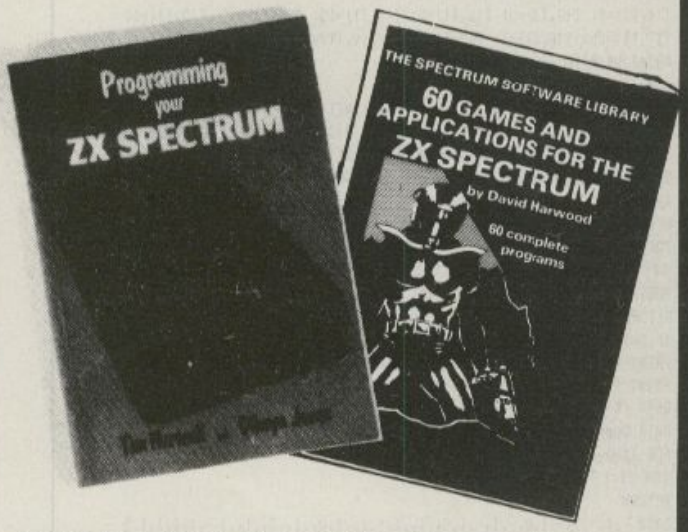
796 IF RE=5 THEN PRINT/T T(I,J)
798 NEXT J,I
800 FOR I=0 TO 3: FOR J=0 TO 12
802 IF RE=9 THEN INPUT/T B(I,J)
804 IF RE=5 THEN PRINT/T B(I,J)
806 NEXT J,I
808 FOR I=0 TO 6: FOR J=0 TO 3
810 IF RE=9 THEN INPUT/T M(I,J)
812 IF RE=5 THEN PRINT/T M(I,J)
814 NEXT J,I
816 FOR I=0 TO 6: FOR J=0 TO 3
818 IF RE=9 THEN INPUT/T C(I,J)
820 IF RE=5 THEN PRINT/T C(I,J)
822 NEXT J,I
824 FOR I=0 TO 12
826 IF RE=9 THEN INPUT/T N$(I)
828 IF RE=5 THEN PRINT/T N$(I)
830 NEXT I
832 FOR I=0 TO 12
834 IF RE=9 THEN INPUT/T T$(I,0):T$(I,1)=N$(I)
836 IF RE=5 THEN PRINT/T T$(I,0)
838 NEXT I
840 FOR I=0 TO 6
842 IF RE=9 THEN INPUT/T P(I)
844 IF RE=5 THEN PRINT/T P(I)
846 NEXT I
848 FOR I=0 TO 6
850 IF RE=9 THEN INPUT/T Q(I)
852 IF RE=5 THEN PRINT/T Q(I)
854 NEXT I
856 FOR I=0 TO 6
858 IF RE=9 THEN INPUT/T G(I)
860 IF RE=5 THEN PRINT/T G(I)
862 NEXT I
864 IF RE=9 THEN INPUT/T W,D9,K9,X9,D1,X1,P9,T9,S9,Y9,H,Y1
866 IF RE=5 THEN PRINT/T W,D9,K9,X9,D1,X1,P9,T9,S9,Y9,H,Y1
868 IF RE=9 THEN INPUT/T R9,G9,Q,S1,T1,R,H3,H4,DA$
870 IF RE=5 THEN PRINT/T R9,G9,Q,S1,T1,1,H3,H4,DA$
872 PRINT "COMPLETE"
874 CLOSE
876 RETURN
882 S3=S1
884 PRINT "■"
886 FOR L0=1 TO 19 STEP 2: PRINT [L0,20] "|": PRINT [L0+1,20] "+": NEXT
888 PRINT [11,4] "+-+-+-+-+-+-0-+-+-+-+-+-+-"
890 FOR S1=1 TO S9
892 PRINT [INT(10+ S(12,S1)/6),INT(S(11,S1)/3)+19] MID$(S$,S(8,S1),4);
894 PRINT "■■■■";
896 ON INT(S(7,S1)/5+1) GOTO 898,900,902,904
897 GOTO 904
898 PRINT ".": GOTO 906
900 PRINT "•": GOTO 906
902 PRINT "▮": GOTO 906
904 PRINT "■": GOTO 906
906 NEXT
908 S1=S3
910 FOR XX=1 TO 3000: NEXT
912 RETURN
916 L0=4: P2=2: IF T9>8 THEN P2=1
918 PRINT "■"
920 PRINT [0,14] "◢ ";DA$;" ◣"
922 PRINT "┌──────┬──────┬──────┬──────┐"
924 PRINT "│ SHIP │ TO │ ETA │"
926 PRINT "└──────┴──────┴──────┴──────┘"
928 GOSUB 964: FOR XZ=1 TO T9: FOR S7=1 TO T9
930 IF S7=T1 THEN 954
932 IF T(0,XZ)<>T(S7,0) THEN 954
934 T(S7,0)=0
936 S3=T(8,S7): S4=S(8,S3): L=(S7-1)%6+1
938 M7=INT((T(9,S7)-1)/30)
940 L7=3*M7+1
942 L8=T(9,S7)-30*M7
944 PRINT [L0+1,1] LEFT$(T$(S7,0),15)
946 PRINT [L0+1,18] MID$(S$,S4,4)
948 PRINT [L0+1,27] L8
950 PRINT [L0+1,31] MID$(C$,L7,3);" ";RIGHT$(STR$(T(10,S7)),2)
952 L0=L0+P2: GOTO 956
954 NEXT S7
956 NEXT XZ
958 PRINT [24,15] "PRESS A KEY";
960 RETURN
964 FOR X2=1 TO T9
966 T(0,X2)=(T(10,X2)-2070)*360+T(9,X2)
968 T(X2,0)=T(0,X2)
970 NEXT XZ
972 FOR XZ=T9 TO 2 STEP -1
974 FOR XJ=1 TO XZ-1
976 IF T(0,XJ)<=T(0,XJ+1) THEN 980
978 XX=T(0,XJ): T(0,XJ)=T(0,XJ+1): T(0,XJ+1)=XX
980 NEXT XJ,XZ
982 RETURN
986 S3=S1: SW=1: SX=8
988 IF S9<8 THEN SX=S9
990 IF S9<9 THEN SZ=S9*2-1
992 IF S9>8 THEN SZ=15
994 PRINT "■SYSTEM |Uran |Iron |Mach |Medi |Comp |Gems"
996 IF SW=9 THEN SZ=2*S9-17
998 L1$="       |    |    |    |    |    |    "
1000 L$="-------+----+----+----+----+----+----"
1002 FOR L0=1 TO SZ STEP 2: PRINT [L0,0] L$: PRINT [L0+1,0] L1$: NEXT
1004 FOR S1=SW TO SX: IF WZ=0 THEN P$(S1)=""
1006 IF SW=1 THEN SP=S1
1008 IF SW=9 THEN SP=S1-8
1010 SC=INT(S(7,S1)/5): IF SC>3 THEN SC=3
1011 PRINT [SP*2,0] MID$(S$,S(8,S1),4);D$(SC);
1012 IF S3=S1 THEN 1034
1014 IF WZ=1 THEN 1032
1016 GOSUB 648
1018 FOR I=1 TO 6
1020 W$=STR$(P(I)/100)
1022 IF (S(I,S1)=0)+(P(I)<1000) THEN W$="    "
1024 IF S(I,S1)>0 THEN W$="▮"+" "+W$
1026 IF S(I,S1)<0 THEN W$="▮ "+W$
1028 P$(S1)=P$(S1)+" |"+ W$
1030 NEXT I
1032 PRINT P$(S1)
1034 NEXT S1: PRINT [17,4] "└──────┘ └──────┘ ◢■■"
1036 PRINT [18,4] "|▮ buying | |";"▮ selling|    Weeks◢■"
1038 PRINT [19,4] "└──────┘ └──────┘    ■■■■■ " : GOSUB 758
1040 GOSUB 1052
1041 IF SW=9 THEN PRINT [23,2] "Press 'A' for the rest of the prices"
1042 IF (S9>8)*(S1=9) THEN WZ=0M: GOTO 1046
1044 S1=S3: FL=0: 0M=1: WZ=1: RETURN
1046 PRINT [23,2] "Press 'A' for the rest of the prices"
1048 GET A$: IF A$="" THEN 1048
1049 TT=ASC(A$): IF TT<>65 THEN 1048
1050 SW=9: SX=S9: GOTO 994
1052 PRINT [20,0] "Cargo"
1054 FOR L0=1 TO 6: PRINT [20,L0*5+5] STR$(T(L0,T1)): NEXT
1055 PRINT [21,0] "Cash £";T(11,T1): PRINT [22,0] T$(T1,1);" in ";T$(T1,0)
1056 WZ=1: RETURN
1060 L$="|     |     |     |"
1062 L1$="|_____|_____|_____|"
1064 PRINT "■";L$: PRINT [2,0] L1$
1066 PRINT [1,0] "|";LEFT$(TI$,2);" ";MID$(TI$,3,2);" ";RIGHT$(TI$,2);" |";
1068 DA$=STR$(D1-30*M)+" "+MID$(C$,L,3)+" "+STR$(Y1)
1070 PRINT DA$: PRINT [1,22] "|"
1072 J0=T1
1074 IF J0>9 THEN J0=J0-9: GOTO 1074
1076 N1$=N$(J0)
1078 PRINT [1,31-INT(LEN(N1$)/2)] N1$: PRINT [1,39] "|"
1080 A$=N1$: GOSUB 1352
1082 RETURN
1086 L$="┌──────────────────────────┐"
1088 L1$="└──────────────────────────┘"
1090 PRINT [4,5] L$: PRINT [6,5] L1$
1092 PRINT [5,5] "| ";T$(T1,0): PRINT [5,17+INT(LEN(T$(T1,0))/2)] "on "
1094 PRINT [5,30] MID$(S$,M,4);" |"
1096 0M=0
1098 L$="┌──────────────┐"
1100 L1$="■■└ SHIP'S LOG ◢■■"
1102 L2$="■■■└──────────┘■■■"
1104 PRINT [7,22] L$: PRINT [8,22] L1$: PRINT [9,22] L2$
1106 FOR YY=10 TO 22: PRINT [YY,22] "|": PRINT [YY,39] "|": NEXT
1108 L$="├──┬──┬──┬──┤"
1110 L1$="├──┼──┼──┼──┤"
1112 L2$="├──┼──┼──┼──┤"
1114 L3$="└──┴──┴──┴──┘"
1116 PRINT [13,22] L$: PRINT [16,22] L2$: PRINT [19,22] L1$: PRINT [22,22] L3$
1118 PRINT [14,23] "C|Uran|Iron|Mach"
1120 PRINT [15,23] "A|  <|  <|  <"
1122 PRINT [16,23] "R"
1124 PRINT [17,23] "G|Medi|Comp|Gems"
1126 PRINT [18,23] "D|  <|  <|  <"
1128 PRINT [20,24] "Cash:      "
1130 PRINT [21,24] "Bank:      "
```

```
1132 RETURN
1136 L$="┌──────────────────┐"
1138 L1$="├──────────────────┤"
1140 L2$="└──────────────────┘"
1142 PRINT[8,0] L$: FOR ZZ=10 TO 18 STEP 2: PRINT[ZZ,0] L1$: PRINT[ZZ+1,0] "|"
1144 PRINT [ZZ+1,20] "|": NEXT
1146 PRINT [20,0] L2$
1148 PRINT [9,0] "|                  |"
1150 RETURN
1154 PRINT [20,30] "        "
1156 PRINT [21,30] "        "
1158 GOSUB 718
1160 GOSUB 724
1162 PRINT [20,30] T(11,T1)
1164 PRINT [21,30] INT(B(1,B1))
1166 RETURN
1168 PRINT [15-(I1>3)*3,21+5*(I1+(I1>3)*3)] A2$: RETURN
1170 MUSIC "T"CO$C2"
1172 PRINT "■                OPTIONS"
1174 GOSUB 1332
1176 PRINT [2,17] "━━━━━━━"
1178 PRINT [6,10] "N. New Game    "
1180 PRINT [8,10] "R. Recover old game"
1182 PRINT [10,10] "S. Save present game"
1184 PRINT [12,10] "P. Prices of commodities"
1186 PRINT [14,10] "T. Travel printout"
1188 PRINT [16,10] "M. Map of Star Systems"
1190 PRINT [18,10] "B. Banr statement"
1192 PRINT [20,10] "X. Option selection."
1194 PRINT [22,10] "!. End Game and Reset BASIC"
1196 GET A$: IF A$="" THEN 1196
1198 IF A$="P" THEN 986
1200 IF A$="M" THEN 882
1202 IF A$="S" THEN RE=5: R=1: GOTO 772
1204 IF A$="T" THEN 916
1206 IF A$="N" THEN 1218
1208 IF A$="B" THEN 596
1210 IF A$="R" THEN GO=0: RE=9: R=1: GOTO 772
1212 IF A$="!" THEN 1368
1214 GOTO 1196
1218 PRINT "■": PRINT [10,3] "Do you really want to start a new game?"
1220 GET A$: IF A$="" THEN 1220
1222 IF A$="Y" THEN 1226
1224 GOTO 1170
1226 PRINT: PRINT "    OK!! OK!! OK!!"
1227 RESTORE: FOR XX=1 TO 16: READ A$: NEXT
1228 R9=2/7: D9=15: S9=8: X3=2: Q=.1: GO=1
1230 FOR XX=0 TO 12: FOR YY=0 TO 12: T(XX,YY)=0: NEXT YY,XX
1232 FOR XX=0 TO 3: FOR YY=0 TO 12: B(XX,YY)=0: NEXT YY,XX
1234 FOR XX=0 TO 12: FOR YY=0 TO 15: S(XX,YY)=0: NEXT YY,XX
1236 K9=3: W=30: X9=36: G9=1.25: R=0: B1=1: Y1=2070: DA$=" 1 JAN 2070"
1238 FOR XX=1 TO 6: FOR YY=1 TO 3: READ M(XX,YY): NEXT YY,XX
1240 FOR XX=1 TO 6: FOR YY=1 TO 3: READ C(XX,YY): NEXT YY,XX
1242 PRINT "■"
1243 PRINT [6,0] "How many players?    ■■■";: AL$="1234567890"
1244 USR(IN),AL$,2,A$
1246 P9=VAL(A$)
1248 IF (P9>1)*(P9<13) THEN 1252
1250 PRINT: PRINT "Between 2 and 12 can play": GOTO 1243
1252 PRINT [10,0] "How many ships per player?    ■■■";
1254 USR(IN),AL$,1,A$
1256 X=VAL(A$): T9=P9*X: X3=X: IF X<1 THEN 1252
1258 PRINT
1260 IFT9>12THENPRINT"I can't look after more than a total    of 12": GOTO1252
1262 PRINT [13,0] "How many star systems?    ■■■";
1264 USR(IN),AL$,2,A$: PRINT
1266 S9=VAL(A$): IF(S9<1)+(S9>15)THEN PRINT"Between 1 and 15 please": GOTO1262
1268 PRINT
1270 PRINT [16,0] "Enter length of game in years ";
1272 USR(IN),AL$,2,A$: PRINT
1274 PRINT "■■It takes a few moments":PRINT"to build the Universe....."
1276 Y9=VAL(A$)+Y1
1278 S(7,1)=15: H=1: S1=2: GOSUB 462
1280 S1=3: GOSUB 462: S1=4: GOSUB 1316
1282 FOR S1=5 TO S9: ON S1-3*INT((S1-1)/3) GOSUB 462,1316,1318
1284 NEXT S1: FOR S1=1 TO S9: FOR J=1 TO 6: S(J,S1)=0: NEXT J: IFS1>1 THEN1288
1286 I=1: GOTO 1292
1288 I=4*INT(14*RND(1))+5: FOR J=2 TO S1-1: IF I=S(B,J) THEN 1288
1290 NEXT J
1292 S(B,S1)=I: S(9,S1)=27): S(10,S1)=Y1-1: NEXT S1
1294 AL$="": FOR I=32 TO 255: AL$=AL$+CHR$(I): NEXT
1295 PRINT "■": PRINT [6,0] "Captains - enter your names"
1296 FOR I=1 TO P9: PRINT: PRINT " Captain";I;".... ";
1297 USR(IN),AL$,12,A$
1298 N$(I)=A$: NEXT I
1300 T1=1
1302 PRINT "■■■Captains name your ships-:"
1304 FOR I=1 TO T9/P9: PRINT: FOR P1=1 TO P9
1306 T(1,T1)=0: T(2,T1)=0: T(6,T1)=0: T(3,T1)=15: T(4,T1)=10: T(5,T1)=10
1308 T(7,T1)=25: T(8,T1)=1: T(9,T1)=D1: T(10,T1)=Y1: T(11,T1)=5000: T(12,T1)=0
1310 PRINT N$(P1);" name ship #";I;": ";
1311 USR(IN),AL$,12,A$: PRINT
1312 T$(T1,0)=A$: T$(T1,1)=N$(P1): T1=T1+1: NEXT P1,I
1314 FOR B1=1 TO P9: B(1,B1)=0: B(2,B1)=D1: B(3,B1)=Y1: NEXT B1: GOTO 42
1316 E=100: GOSUB 1320: S(7,S1)=5+RND(1)*5: RETURN
1318 E=50: GOSUB 1320: S(7,S1)=10+RND(1)*5: RETURN
1320 X=(RND(1)-.5)*E: Y=RND(1)*E/2: F=1: GOSUB 472: IF F=0 THEN 1320
1322 RETURN
1324 POKE4514,INT(T1/2+2): FORIU=0TO255STEP5: POKE4513,IU:USR(68):NEXT:USR(71)
1326 A$="PRESS A KEY": FOR XX=1 TO 11: A1$=MID$(A$,XX,1): PRINT [9+XX,0] A1$
1328 MUSIC "T"GO":PRINT [10,XX-1] A1$: NEXT
1330 RETURN
1332 IF DA$="" THEN RETURN
1334 PRINT [3,3] DA$: FOR X1=3 TO 2+LEN(DA$): PRINT [2,X1] "-"
1336 PRINT [4,X1] "-": NEXT: RETURN
1338 DATA (4),(3),(2),(1),Uranium,Iron Ore,Machinery,Medic Supplies
1340 DATA Computers,Diamond Gems
1342 FOR XX=0 TO 3: READ D$(XX): NEXT
1344 FOR XX=1 TO 6: READ CO$(XX): NEXT
1346 RETURN
1348 DATA -.1,-.2,-.1,0,-.1,-.1,0,.1,.1,-.1,.1,0,.1,.2,.1,.1,-.1,0,1,1.5
1350 DATA .5,.75,.75,.75,-.75,-.75,-.75,-.75,-.5,-1.5,.5,-1,-1.5,-.5,.5,1.5,-.5
1352 IF LEN(A$)<4 THEW A$=A$+A$
1354 TEMPO 7: FOR XX=1 TO LEN(A$): XC=ASC(MID$(A$,XX,1))
1356 IF XC>71 THEN M$="_": XC=XC-7
1358 IF XC>71 THEN M$="■": XC=XC-7
1360 IF XC>71 THEN M$="#": XC=XC-7
1362 IF XC>71 THEN M$="R2": XC=XC-7
1364 MUSIC M$+CHR$(XC): M$=""
1366 NEXT: TEMPO 5: RETURN
1368 POKE 7221,UX: POKE 7222,UY
1369 USR(46081): END
1370 K0=0: PRINT "■": PRINT [8,0] " ";
1372 XX=INT(RND(1)*S9)+1: A$=MID$(S$,S(8,XX),4): SA$=STR$(XX)
1373 IF XX>9 THEN 1372
1374 ON INT(RND(1)*5+1) GOTO 1376,1378,1380,1382,1384
1376 SA$=SA$+"175": PRINT "  NUCLEAR POWER PLANT DISASTER ON ";A$
1377 J0=1: GOTO 1386
1378 SA$=SA$+"660": PRINT "        RAGING INFLATION ON ";A$
1379 J0=6: GOTO 1386
1380 SA$=SA$+"275": PRINT "      NEW GALACTIC RAILWAY ON ";A$
1381 J0=2: GOTO 1386
1382 SA$=SA$+"575": PRINT "      DEEP THOUGHT PROJECT ON ";A$
1383 J0=5: GOTO 1386
1384 SA$=SA$+"488": PRINT "            PLAGUE ON ";A$: J0=4
1386 PRINT: PRINT "    Urgent need for ";CO$(J0)
1388 PRINT [24,15] "PRESS A KEY";
1390 GET A$: IF A$="" THEN 1390
1392 RETURN
1394 PRINT [24,15] "PRESS A KEY";
1400 PRINT "■": MUSIC "C"CC": PRINT [4,13] "┌──────────┐"
1402 PRINT [5,13] "│ Planetfall │"
1404 PRINT [6,13] "└──────────┘"
1405 PRINT [11,8] "Press 'N' for New Game"
1406 PRINT [12,2] "or 'R' to recover old game from tape"
1407 GET A$: I=RND(1): IF A$="" THEN 1407
1408 IF A$="N" THEN PRINT "■": PRINT [1,15] "NEW GAME": MUSIC "A": GOTO 1227
1410 IF A$="R" THEN R=1: GO=0: RE=9: PRINT "■": MUSIC "A"
1411 IF A$="R" THEN PRINT[10,0]"Ensure you have the tape in!■":GOSUB780:GOTO42
1412 GOTO 1407
1414 DATA 0,0,0,205,139,22,91,69,28,205,169,25,123,254,25,210,152,19,50,114
1416 DATA 17,205,154,22,44,205,169,25,123,254,40,210,152,19,50,113,17,205,154
1418 DATA 22,93,195,69,28,17,160,0,25,34,12,17,205,151,22,44,205,175,34,205,15
1420 DATA 24,205,1,24,213,197,205,154,22,44,205,169,25,205,154,22,44,34,1,72
1422 DATA 225,34,10,17,225,67,74,237,91,12,17,213,205,179,9,205,206,11,254,102
1424 DATA 40,60,254,96,40,34,197,237,75,10,17,229,237,177,225,193,32,230,18,19
1426 DATA 12,205,18,0,16,222,205,179,9,205,206,11,254,102,40,26,254,96,32,242
1428 DATA 13,12,40,204,62,20,205,18,0,205,12,0,62,20,205,18,0,13,4,27,24,186
1430 DATA 175,71,197,42,1,72,205,19,38,205,54,36,205,41,24,34,1,72,205,123,25
1432 DATA 193,225,205,223,24,205,118,25,205,106,27,157,19,201,0,0,0,0,205,9,68
1434 DATA 40,68,0,0,29
1436 FOR I=1 TO 52: READ A$: NEXT I
1438 FOR I=53024 TO 53232
1440 READ A: POKE I,A
1460 NEXT I
1480 RESTORE: RETURN
```

SPECTRUM



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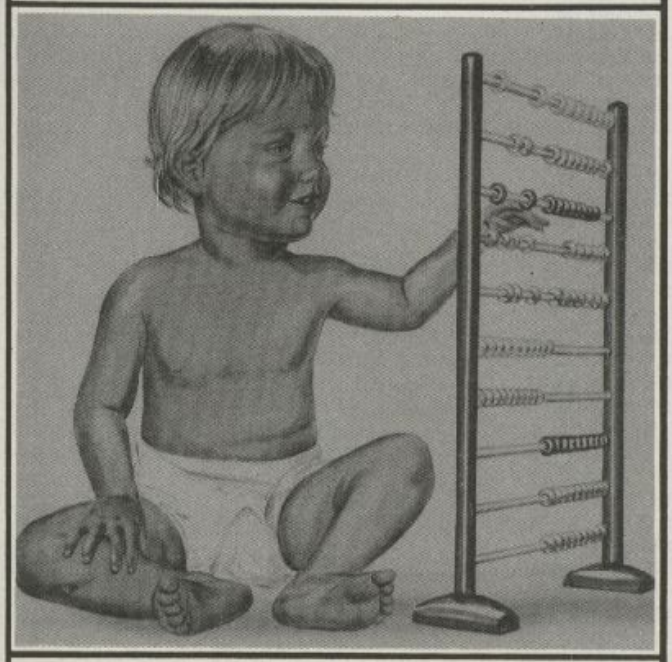

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PRINTOUT

Dear Sir,

It is trite to write of the vast diminution in the cost of computing power over the last 20 years. Though peripherals have also got cheaper, they are dependent on expensive traditional engineering disciplines and have lagged behind so much that the cost of important bolt-on goodies can dwarf the price of a potent micro. Yet they are necessary; and the lack of them will cramp if not cripple the wider deployment of micros. Word processor users need bags of nonvolatile memory plus a good printer, musicians likewise, and maybe a special printer at that. Artists really need high quality hard copy — in full colour.

Could you gaze into your crystal ball and hazard some educational guesses at the future of such desirable widgets, especially in low-cost home systems? Will they need new technology? For example, a colour printer could use coloured pens, or coloured typewriter ribbons (as in some multi-coloured chart recorders), but might use something more or less completely new, such as electrophotographic (ie photocopier-like) devices. And when, if ever, will disc drive prices subside to a level within reasonable reach for a not-too-serious home micro?

On a separate topic, Mr Peckett referred to his previous articles on FORTH in his Going FORTH Again and so did Mr Bishop in his Jupiter Ace review. Please could you find space in the magazine to give the exact address, ordering costs and cost of back issues plus the cost of photocopies of articles in copies which you may have sold out of.

Yours faithfully,
R. J. Bull
Bath

(*Colour printers are here already; Tandy market a lovely little four pen printer plotter called the CGP 151 at about £150 and Integrex do a colour matrix printer that uses a multicolour ribbon and overstriking to achieve its effects. The cost of disc drives is falling slowly but I doubt that they will ever get to under £100 in the form that we know now. New designs like the Sony 3'' disc and Sinclair's Microdrives may come to be accepted as replacements over the next few years and these should prove to be considerably cheaper.

Our back issues are generally advertised in the magazine but if there is no reference to this service you can write to Computing Today Backnumbers, 513 London Road, Thornton Heath, Surrey CR4 6AR. Those issues which are available cost £1.50 each. Photocopies of any article from any issue also cost £1.50 each and can be obtained from our Charing Cross Road address, but please indicate clearly which issues and which articles you want. Ed.*)

Dear Sir,

Owners of UK101s fitted with CEGMON monitors probably know that the OUTPUT vector in PAGE 2 is still at $021A. If they wish to implement the lower case routine (M Williams,* **Computing Today,** *April 1983, p92) they can merely change the last two DATA values to 155 and 255 so that the output reaches its original destination ($FF9B with CEGMON).

However, if the top of PAGE 2 is not being used, the routine can be located there so that the low byte of the start of the routine is the same as the low byte of the output vector address. This has two advantages: first, only one POKE instruction is required either to activate or to deactivate the routine; second, when the routine is deactivated, there is no additional delay in the output as it goes directly to its original destination instead of indirectly via the end of the routine. Some may consider it has another advantage in that it leaves the bottom of PAGE 2 free for other programs.

The program suitably amended for a UK101 with CEGMON monitor is:

```
10  FOR J=667 TO 688:READ A
20  POKE J,A:NEXT:POKE 539,2
30  DATA 201,65,144,7,201,91,176
40  DATA 3,24,105,32,76,155,255
```

It is deactivated by POKE 539,255 and reactivated by POKE 539,2.

UK101 owners with either the old or new monitors can share these advantages. In each case the routine must be relocated higher in PAGE 2. For the old monitor the routine must be moved to 617 (decimal) and for the new monitor it must be started at 724 (decimal). The program should be as above but amended to use these locations and the last two DATA values given in the original article. In both cases the routine is reativated by POKE 539,2. For the old monitor the routine is deactivated by POKE 539,255 but the new monitor requires POKE 539,251. WEMON owners will have to work out their own salvation.

Yours faithfully
N. G. Savill,
Ascot

Dear Sir,

Considerable interest has been evoked of late by the fact that the ZX Spectrum accepts the statement:

```
PRINT#1;"This is the bottom line"
```

which prints on the line usually reserved for error messages and input.

In fact, five non-microdrive statements accept stream numbers (denoted by the hash) — PRINT, LIST, LPRINT, LLIST and INPUT.

The streams referred to in these statements are not the same as in the microdrive statements, but are as follows.

 # 0
 # 1 The bottom half of the screen

 # 2 The top half of the screen
 # 3 The printer

Some statements to experiment with:

```
LIST#3
LLIST#2,10
PRINT#3;"This will be on the printer"
LPRINT#2;"Top of the screen"
LIST#1
INPUT#0;"No difference";A$
INPUT#1;"No charge";LINE A$
```

Yours faithfully
Alex Green,
Uxbridge

Dear Sir,

In answer to C. Y. Fung's letter in the May edition of your magazine.

To overcome one of the Tangerine BASIC's little quirks, all you do is type POKE3,0 after the GET command. This zeros the display index.

Yours faithfully,
T. G. Royle
Waterlooville

Dear Sir,

The Oric-1, 48K. First, the good news. The Oric-1, for its price, compactness and power, is

probably the most cost-effective microcomputer on the market (despite Sinclair having reduced the 48K Spectrum to only £130.00 recently). The keyboard is positive, the sounds are deafening, and the graphics all that the home owner could desire. The display is clear and bright, and I find no hint of fatigue, even though I have spent many hours programming the machine, since its purchase from the Sevenoaks branch of the Spectrum chain of computer stores on 19th April this year. The business programs I have written so far run well.

Now, unfortunately, the bad news. There is no way that this could be considered a beginner's computer. The 164-page manual supplied with the machine (serial number 18165) did not have the errata sheet included. However, this was requested by Spectrum and arrived by post with commendable speed soon after purchase. However, the errata as listed in the photoccpied sheet had already been adjusted in the manual, and I can only assume that the sheet referred to the first edition (32-page previous manual?). There are still many errors, omissions and non-existent explanations (eg SOUND or MUSIC commands appear to need to be preceded by PLAY 7,0,0,0 to be effective, as the PLAY command would appear, on turn-on, to default to PLAY 1,1,1,1. Thus, channels 2 and 3 cannot be used within the SOUND or MUSIC statements, only channel 1 being switched on. The demo tape shows this, but it cannot be spotted immediately).

Those coming from the ZX81 or ZX Spectrum would, on reading Chapter 11 of the manual, assume that saving the program also saves any variables which have been input through the running of the program. Not so! Some variables do, indeed, appear to be saved, as typing PRINT (variable name) after loading will print the value of the named variable (string or numeric). You try typing GOTO (line number) in order to start the program, though!! An error statement (undefined statement in line X) will be produced, and a LIST command throws up a large line number (typically 53313) with a single character following. Typing TRON: GOTO (line number) shows that, whatever the line number stated, the instruction first jumps to an even larger line number (in excess of 65,000), then back to the named line. The program will not run, come what may, unless you type RUN, when all variables are lost.

Ringing Oric about this produces the telephone number of Tansoft Ltd., Ely (0353-2271) and the telephonist there will give you a name of Paul Kaufman (pronounced Cough-man) as the man to talk to regarding programming problems. After four attempts to speak to him (engaged on phone, tied up in meeting, taking no further calls, unavailable), I was told to send a stamped addressed envelope to him, when a listing would be posted showing how to save variables to tape: I live in hope!

Other, minor bugs that I have found are:

PLOT, X, Y, will only plot a string. If you PLOT a number, or even a numeric variable name, the computer assumes this to be an ASCII code, and will print the appropriate CHR$. eg PLOT 10,10,100 will print a 'd' at position 10,10. (ie CHR$(100)).

IF...THEN...ELSE only works if ELSE is immediately followed by PRINT.

A simple REM statement after RETURN, if the latter is at the end of a multi-statement line, gives the error report RETURN WITHOUT GOSUB. This, even though you give a GOSUB (line number) command to reach the subroutine.

The lack of instructions regarding the use of control characters and screen attributes have been discussed by reviewers elsewhere, and I will merely state here that the computer would appear to take many numerical variables and convert them to control characters and/or attributes without the user being aware that this is happening, until such time as the screen display corrupts itself.

A program such as

```
10  INPUT X
20  PLOT 10,10,"You have entered"
30  PLOT 10,20,X
```

will convert X to CHR$(X) and print it at position 10,20.

Why does the changing of line 30 to PLOT 10,20, STR$(X) print X in green at position 10,20?

Finally, a word about my tape recorder. I bought it for use on my original ZX81, subsequently used it for a Dragon 32, and now CSAVE and CLOAD programs from the Oric. At no time have I had a problem with either saving or loading with any of these machines. The recorder is the Boots CR225 fitted with DIN socket and jack sockets (even a Remote socket for motor control), and the tapes I use are W. H. Smith's C12.

I hope this helps someone else out there in their attempts to get the best from the admittedly temperamental machine.

Yours faithfully
E. H. Wilson
Technical Manager,
RIW PROTECTIVE
PRODUCTS CO. LTD.

(*The IF-THEN-ELSE problem has been cured on the most recent Orics . . . Ed. *)

Dear Sir,

I'm sorry to hear that there have been some problems with Ultima that appeared in Personal Software in Spring 1983. I have done my best to winkle out the problem but since I am at the moment computerless I cannot be certain that my solution will work. Anyway, please try the following:

```
250  IF X1-X2<>0 AND Y1-Y2<>0 AND
     (ABS(X1-X2)<>ABS(Y1-Y2) OR ABS(BIT)=1)
     THEN PROCILLEGAL:GOTO 160

360  LEAPT(LEAPCOUNTER)=X+?*Y

390  IF LEAPCOUNTER<>0 THEN FOR LOOP=0 TO
     LEAPCOUNTER-1:PROCOUT:LEAPT(LOOP) MOD 9,
     LEAPT(LOOP) DIV 9):BOARD(LEAPT(LOOP)
     MOD 9,LEAPT(LOOP) DIV 9)=0:NEXT LOOP
```

Sometimes I wonder why I use such long variable names! Line 250 will make sure that the Rollers can't move diagonally.

Yours faithfully
S. Draper
Cambridge

Dear Sir,

A couple of amendments/ suggestions regarding recent articles.

First, in the article on Elegant Programming (April 1983), p82, the author says that his regressive factorial program will not work as first written. If one enters:

```
1010  N=N+1:F=N*F
```

the program will run properly.

Secondly, in the March 1983 issue on p58 it is stated that the answer to the ultimate question will take 7,000,000,000,000 years to compute. This is a gross error in order of magnitude: Deep Thought took, in fact, 7,500,000 years to compute the answer 42!

Yours faithfully
B. P. J. White
Principal Lecturer
South West London College

(*The 7,000,000,000,000 years referred to was an estimate of the time taken by the Video Genie — assuming it's 1,000,000 times slower than Deep Thought! Ed. *) ▶

Dear Sir,

Already the HX-20 Users' Group has received exposure through Editors publishing information about the existence of the group. Response has been overwhelming, yet I feel there could be more, especially from magazines who have not participated.

I wonder if I may request your cooperation in advising through your magazine users of the HX-20 about the group and asking them to submit information on the following topics; 1) Their occupation; 2) Their use of the HX-20; 3) What they would like to see from the group.

I thank you most sincerely in advance for your cooperation.

Yours faithfully
Terence L. Ronson
25 Sawyers Lawn, Drayton Bridge Road, Ealing, London W13

Dear Sir,

With reference to the letter published in the June issue of Computing Today, we note that Mr Colin Chase has mixed views with his Nascom 3 computer in implementing CP/M. We write this letter as we have a few answers to his problems.

Firstly we agree the NASDOS operating system is a first class, simple-to-use, disc operating system for the Nascom. We note that he is currently considering an 80 column video card so as to take full advantage of CP/M. Among the cards he has considered is the MAP 80 VFC. The whole principle behind the design of the MAP VFC has been to provide the Nascom owner with a cheap professional way of implementing CP/M on his Nascom. It not only provides full compatibility with the ADM3A terminal and the Gemini IVC but also allows the user to revert to NASSYS (Nascom's standard operating system) without incorporating any complicated switching. Unlike MONITOR.COM the VFC actually switches in NASSYS with the video RAM in its normal location and all the Nascom existing software will run with it.

Modulated outputs for 80 column video cards to drive a television generally result in bad screen displays. Some of our customers have driven the 80 column display through a modulator on a television with acceptable results. It is, however, not recommended and we would suggest that a 24 MHz bandwidth monitor is obtained.

Mr. Chase also asks the question regarding Superbrain's QD system. Some Gemini systems allow use of a Superbrain program called COPYSB.COM written by David Parkinson, but this will not work with the Lucas Nascom disc system.

CP/M has the reputation of being a bad operating system. Without exception all implementations of CP/M on the NASBUS/80BUS systems have particularly good software incorporating good screen editors, etc. Once the user has started with CP/M there is an enormous amount of software available, which in turn makes CP/M the best thing since sliced bread.

We trust this answers all Colin Chase's queries.

Yours faithfully
M. G. Rothery
Director, MRP 80 Systems Ltd.

Dear Sir,

Re: FROGLET Program. Thank you for your very prompt (and in computer magazine circles) very atypically efficient reply to my queries about the above program, which now works perfectly on my 1.0 system.

I have been able to SAVE and RUN on disc without any trouble. I inserted an extra line at 2265 PAGE = & 1200.

I now play it right through from disc without acquiring the no room message. In my experience, therefore, there is no need for crunching programs as suggested in your leaflet.

Yours faithfully,
Dr J. J. Hamblin
Westcliff-on-sea

Dear Sir,

With regard to the letter from Nicholas Fitten in the June edition of **Computing Today**, *I have experienced no problems when saving/loading programs from the Casio FX-702P via the FA2 interface unit using a Sony TCM-757 cassette recorder. I have also used this machine with my BBC Model B with equal success and would particularly commend its sturdy construction and fine finish.*

Unfortunately this recorder is no longer in production but may still be available from some shops if one is prepared to hunt around, or alternatively on the second-hand market.

Yours faithfully,
Ronald A. Rankine
Sutton

Dear Sir,

In your December 1982 edition you published a game for the ZX80, on page 33, called ZX Connect. Will it also run on the ZX81 or does it require modification? I have not come across this game for the ZX81 and I am very interested.

I also wish to say something about microccmputer keyboards. The QWERTY layout is definitely out as far as I'm concerned. It was designed in the last century for fast typists who were jamming up the mechanical keys.

With most micros you don't have to release the last key before you press the next, but most hobbyists are not typists and I suggest would welcome a more ergonomic arrangement of the keys. Am I too late? Are computer manufacturers so committed to QWERTY that they can't now get together and design a new standard layout? May I ask all computer manufacturers through your letters page to change the world — or the micro world at least!

Yours faithfuly,
P. Stilliard
Twickenham

(*You will have to make some modifications to the program to get it RUNning on a ZX81 but these are minor and the ZX81 manual provides all the information that you are likely to need. If you think that the QWERTY typewriter layout is strange, try to remember that it was invented to physically slow typists down (the old mechanical typewriters jammed easily) and that the inventor's last joke on the world was that the longest word you can generate on any row of the keyboard is TYPEWRITER! Seriously, though, many typists find computer keyboards confusing as they have more keys and these are in unconventional places. In an attempt to standardise we now have the ISO keyboad which is being offered as a standard fitting to many new computers and typewriters. That, I can promise you from recent experience in changing from an Apple II to an Apple IIe, is just as confusing as moving from a typewriter to a ZX81. Ed.*)

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The program follows the style of that arcade favourite, Frogger and you must negotiate your green coloured friend across first a road populated with fast moving cars and lorries and then over the river by means of turtles and logs. Frogs may be able to swim but if your turtle decides to sink you'll be swept away by the current. Once across with three out of your four frogs you'll be able to score bonus points by catching the flies that appear over the river but, take care that you don't run out of time!

All in all it's a great, fast moving game that any number of people can play and, just to add to the spirit of the thing the program stores the top ten players' names so you can measure your performance. How much are we charging for this minor masterpiece? Just **£5.99** all inclusive!

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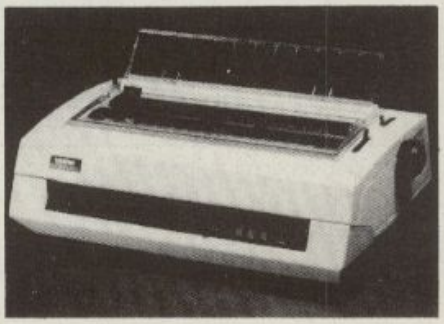

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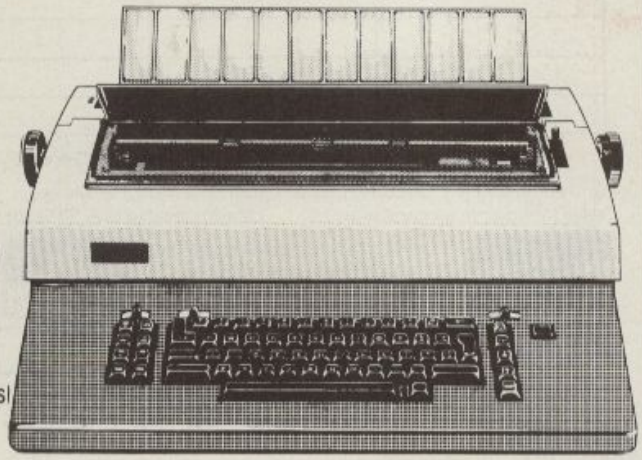

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FH1-32D	S/S D/Dens. 32 Hard Sect	34.90	33.90	32.90
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FH2-32D	D/S D/Dens. 32 Hard Sect	39.90	38.90	37.90

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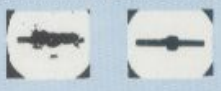
We're fed up with being asked whether our disk drive head cleaning kit actually works. So here's the proof:-

BEFORE.  AFTER

Can you really risk that breakdown?

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CK8 for 8" disk drives	14.90

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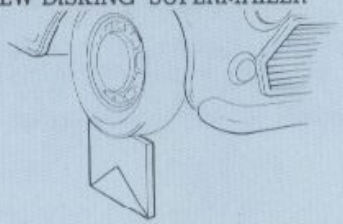

* COPYRIGHT DESIGN - Unlike the rest, this ingenious mailer has a flute crossing action when folded, resulting in a virtually unbendable mailer.

* CAVERNOUS CAPACITY - will take, one, two, three or even four diskettes WITH envelopes.

* FULL INSTRUCTIONS - Each DISKING 'SUPERMAILER' is printed with full instructions and comes complete with addressing/sealing label.

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1 PACK	2 PACKS	3+ PACKS
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2 - DISKWRITER
3 - SDL GIFT VOUCHER

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The whole area of your disk, its labelling and its envelope are fully visible for INSTANT selection ANYTIME.

AVAILABLE IN TWO VERSIONS

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They come complete with keys and dividers

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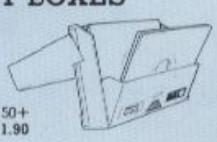

PRICES EXC VAT	1-49	50+
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The new SEE 10 is probably the best 5¼" library box around.
(FREE with every ten disks ordered)

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Approximate Weights for guidance only -	
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