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Volume Two Number

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

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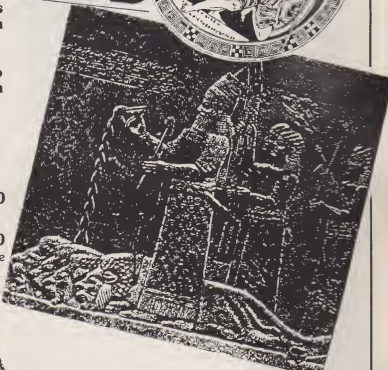
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Create Your Own Adventure World

Melvyn Wright

Last month I concentrated my attention on the desirable qualities of a good adventure master program. This month I will look at the second aspect of any adventure game, namely the story itself. The requirements here are much more difficult to define but they are just as important as the actual adventure program. You must place the player in an interesting environment, give him an objective to fulfil and provide a set of logical and inter-related puzzles for him to solve. You should also provide a reason for the player being in the situation that you have placed him, but this is not often done, and it doesn't seem to bother most people. They are not really interested in the past, all they want to know is how to escape in the future!

OBJECTIVES

Broadly speaking, the objective of most adventure games falls into one or more of the following categories. The player has to a) collect various items of treasure, possibly storing them somewhere along the way; b) score a minimum number of points, usually achieved by solving all the puzzles; c) get to a certain location or find a certain object; d) kill a certain creature, or perform some heroic act, like rescuing a damsel in distress.

Many games incorporate more than one of these ideas. If the player may have to get to a certain location in order to perform the heroic act, collecting and storing treasures along the way!

The setting for an adventure game is one of the first things that an adventure writer must decide upon when writing a new game. Many types of settings have been used but there is little doubt that the most popular type of environment, and the one favoured by the majority of adventurers, consists of a world which is as far removed from the present world as possible. Adventuring is a form of escapism and the player enjoys being the king of his own world in which he can forget the day-to-day troubles of reality.

This explains why the majority of adventures at present

In the second of two articles, Melvyn Wright of EPIC Software explains how to ensure that your own adventure games are both exciting and playable.

available take place either in a magical fantasy land, or in space. The average person would not normally have any expectations of visiting these kinds of environments during his lifetime, so the fascination is obvious. However, this does not mean that an adventure based upon the real world is a bad idea. When people get bored with their fantasy lands they may well want to escape back to reality!

PUZZLING AND PLAUSIBLE

One of the most important aspects of any adventure game is the layout and type of the puzzles that have to be solved by the player in order to successfully complete the game. I would go as far as to say that it is these puzzles (and more importantly, their solutions) which will decide whether the game is to be a success or not. It does not matter how brilliant the program is, nor how fascinating the scenario, the player is likely to quickly become bored and frustrated if he is constantly confronted with tortuous problems which seem to have no logical solution.

On the other hand, an adventure game is like a jigsaw puzzle, inasmuch as once you have solved it, it becomes worthless. If someone spends £10 on a game which he then solves in a matter of days, he is very likely to feel cheated, and rightly so. Therefore, you must strike a balance when you are devising the puzzles for your adventure, and I shall devote the rest of the article to this very important aspect.

It is very difficult to judge exactly how hard your puzzles actually are when you are devising them, as you already know the answers! After a great deal of experience in this matter, I will warn you that the player will find them far harder than you had intended when you devised them. Even experienced adventurers will get stuck at places where you didn't intend there to be any puzzles at all!

The golden rule is to make all the solutions logical. They can be as hard or easy as you think fit, but the solutions must be logical and plausible.

For instance, in a certain well-known adventure there is a portcullis which has to be raised to pass through. There is no indication given as to how this feat may be performed and the program does not respond to the usual efforts that would be required to carry out such a task, even if the player possesses objects that would appear to be useful. Consequently, most people give up in despair at this point.

The solution is in fact to rub the ruby, which is one of the items of treasure you have previously encountered. This solution is totally illogical and the only way of solving the problem would be by accident, or by cheating (as I did!). At no time is there any connection suggested between the ruby and the portcullis, nor are there any clues that would lead the player to think that the ruby had to be rubbed at some stage of the game.

Whilst it is not unacceptable to arrange for the ruby to have magical powers to lift the portcullis, such a thing is so far

removed from reality that the total absence of clues is completely inexcusable. It would have been a simple matter to have said "the ruby vibrates slightly" when approaching the portcullis, or to arrange for the ruby to have a portcullis engraved upon it. If the writer wanted this to remain a particularly nasty problem then he could have had a red portcullis. This would have suggested an association between the two objects but would still have required a great deal of thought to solve the problem.

GIVE US A CLUE

The previous example also demonstrates that it is not the puzzles, nor their solution which determine the difficulty of the game, it is the clues contained within the text of the messages that decide whether the game will be easy or hard. Even the most illogical puzzle becomes easy if its solution is virtually given away within the text of the game.

When writing your adventure, try to put yourself in the player's shoes and imagine what actions he is likely to attempt as he comes to each problem. If the solution does not suggest itself naturally, he must be given a prod in the right direction. Moreover, if a problem has to be solved in two stages, give him some encouragement when he has solved the first stage, otherwise he may give up altogether.

For instance, suppose you have a treasure chest that has to be opened by first unlocking it, then prising the lid free. The first attempt to open it should be met with the response "the chest is locked". When the player unlocks it and tries again the program should give a different message, ie: "the lid appears to be jammed". This combination of messages will steer the player gradually towards the full solution to the problem. Had he been confronted with the message: "you cannot do that" or "the chest will not open" then it is very unlikely that he would have realised that the puzzle needed a two-part solution, and would probably have given up after the first stage, not realising that he

had in fact solved half of it.

This takes us on to the subject of error messages. If a player attempts to do something which is clearly impossible, or downright silly, then he should expect to be told, simply: "You cannot do that." There is no need to use up valuable memory in trapping these errors and storing messages like: "you cannot take the door" or "you cannot eat the lamp!" However, he should not be told: "you cannot do that" if he attempts to do something and is prevented from doing so because he has overlooked something.

In Epic games, if the player enters any command that the program recognises (even if it cannot yet be carried out), the player is given a special message depending upon the reason why the command cannot yet be executed. For example, he may be in the wrong place, or in the right place but at the wrong time.

It is often a good idea to include a blanket error message for each of the more common verbs in the game, for example: "you cannot eat that" or "you cannot kill anything here", but beware, this can cause confusion. If the player mis-spells the noun and types: "EAT BISIT" he will be told "you cannot eat that" and may not spot his error, as the program appears to understand him. If he had been told "you cannot do that" the lack of recognition by the program would probably have caused him to re-examine this command. So avoid trying to be too clever with your error messages, keep them as general as possible and make sure that they sound right whatever the player types in.

Although it is part of the game to work out the vocabulary of the program, you should never enforce a strict input from the player for the solution of any of your puzzles (except passwords). You must always try to work out what the player is likely to type in a given situation then cater for it in your program. It is a poor game if the player has to constantly keep rephrasing his commands to get the program to understand him, especially if he is typing the obvious. He will even-

tually give up and assume that he has the wrong solution. For example, if he has a boat the player should be able to cross a river by typing: "CROSS RIVER", "BOARD BOAT", "ROW BOAT", etc. Don't provide "EMBARK" as the only accepted command.

LOGICAL MAPPING

I have stressed the importance of logic when drawing up your puzzles and this applies equally to the map of your adventure layout. If the player ventures north from a certain location, going south should return him to his original location, unless it is a one-way route. He should not end up at a third location simply by typing two opposite directions. Furthermore, if it is a one-way route it should be made clear why it is not possible to return, eg "you have jumped off the cliff" or "the door slams behind you".

Making illogical directions unusable is impossible for the adventurer to make a map of his journey and whilst you may think

this is good fun, experience has shown that the majority of players are infuriated by this type of maze. It is quite possible to construct a complicated maze without having to resort to illogical paths which are not retracable. The use of these reduces the game to a test of trial and error which can only be solved by accident. This is not what adventuring is all about. The provision of this type of maze could be justified if a novel method of solving it is devised, as is the case in some of the Acornsoft adventures.

Another illogical trick used by some adventure writers is to kill off the player at random. The designer will arrange for there to be a monster prowling one section of the game and if you are in that section when the wrong random number comes up — end of game. Thus the section is reduced to a test of patience while you constantly save your position at every move, and reload it each time you get killed. However, this trick is permissible if there is a valid way of tending off the monster, as long as a logical association is established between the monster and the required

weapon beforehand. However, it is acceptable to kill the player suddenly if you clearly explain the reasons for him being killed. In this case he can avoid it next time.

Although the subject of mapping has already been discussed, there are a few additional details which can be incorporated to make the game more playable.

Make it easy for the player to move about and explore his environment, particularly at the start of the game. Do not use 45 degree compass points, stick to north, south, east, west, and occasionally up and down. These make exploration much easier, and are more convenient to type in. Finally, do not kill the player simply for moving about in the dark, unless there is a good reason which is explained in the text.

You must decide for yourself exactly how easy or difficult your adventure game is going to be. However, by implementing the techniques that I have outlined in this article, you will ensure that your game remains interesting and playable, whatever the difficulty.



IEEE Experiment

David Abbott

WHAT IS THE IEEE-488 INTERFACE BUS?

Also known as the General Purpose Interface Bus (GPIB), the Hewlett-Packard Interface Bus (HP-IB), and the International Electrotechnical Commission (IEC) 625 bus, the Institute of Electrical and Electronic Engineers (IEEE) standard number 488 defines a 'standard digital interface for programmable instrumentation'. Originally written in 1975 and revised in 1978, the standard deals with systems that use byte-serial, bit-parallel means to transfer digital data among a group of instruments and system components.

Put simply this means that data is transmitted over the interface a byte at a time (byte-serial), over eight separate data lines (bit parallel). The flow of data is controlled by three command lines which are used to indicate the successful passage of data from one instrument to another. This is known as a three-wire handshake. In all there are 24 lines connecting instruments on the bus, comprising eight data lines, eight ground lines and eight command lines, three of which are the handshake lines, the other five handling general interface management.

There are two types of data transmitted on the bus: data used to manage the interface itself, and data used by the devices connected by the bus. In the IEEE-488 standard these are known as interface messages and device dependent messages respectively. Devices connected by the bus have one or more of the capabilities of listening, talking and controlling. Under the control of interface messages a listener can receive device dependent messages from another device on the bus, and a talker can send device dependent messages to another device on the bus. A controller sends the interface messages that command the specific actions in the other devices. An example of a listener is a power supply which receives information on a voltage setting



Exhaustive testing for Acorn's IEEE.

and acts upon it. An example of a talker is a digital thermometer which, when commanded, transmits its current temperature reading. A digital multimeter has both the ability to listen and to talk, and a computer usually has all three abilities of listening, talking and controlling.

THE ACORN IEEE-488 INTERFACE

The Acorn interface was designed for Acorn by a company called Intelligent Interfaces Ltd, who also manufacture the unit. The interface supplied for review was, unlike a lot of review hardware, a production unit, working to the full specification, and containing complete documentation. It arriv-

ed in an expanded polystyrene box with one side thoughtfully marked 'TOP'. Inside, in addition to the interface, was an EPROM containing the IEEE filing system, a ribbon cable for connecting the interface to an instrument and the user guide, also produced by Intelligent Interfaces. Also supplied with the review hardware, though perhaps not standard issue, was an application note written by Intelligent Interfaces on the use of functions and procedures in programming the interface in Basic.

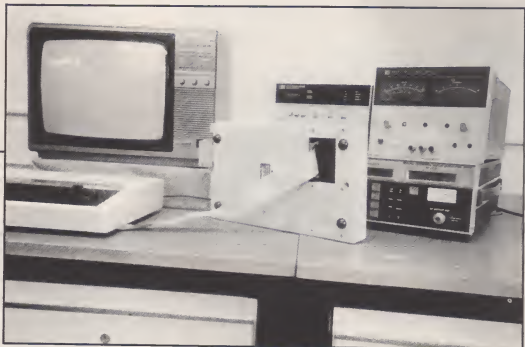
The electronics of the interface are housed in the standard Acorn box (teletext adaptor, second processor etc), and connect to the 1MHz bus by a 34 way ribbon cable. Being only 50cm long the cable dictates that the interface is placed next to the microcomputer. The ribbon cable

is permanently attached to the interface, but has a 34 way header to allow connection of further 1MHz bus peripherals at the same time as the interface. The interface does not derive its power supply from the computer but has its own mains connection. In the same style as the computer, the interface comes with an integral mains lead with moulded three-pin plug and on-off switch on the rear panel.

On opening the interface one is struck by how little there is inside. The electronics, nine integrated circuits and a handful of passive components, are on a single printed circuit board, and the largest single component is the mains transformer. The construction is excellent. The three main integrated circuits are socketed, and the board does not contain any modifications. By using shrouded connectors on all the a.c. leads, it is impossible to touch the mains supply anywhere.

The user guide also reflects similar attention to detail. A spirally bound A5 volume of 64 pages and appendices, it is clearly laid out and properly printed. It contains introductory information to get the user going, then goes into a deeper study of the interface operation. A complete list of the IEEE commands is given, with programming examples and a clear description of the command and its effect. The guide includes a short description on using the filing system in assembler, and gives the structure of the OSWORD block for each command. There are appendices covering the minimum abbreviations for each command, error messages, and the fitting of the filing system EPROM. The guide finishes with a single page index.

Despite recommending at the beginning of the user guide that the IEEEFS EPROM be fitted by a dealer, appendix 5 gives very detailed instructions on how to fit the EPROM yourself. As with the hardware, the EPROM supplied contained the current production filing system, version 0.02. Given Acorn's penchant for multiple issues of filing systems (eg Econet), it was gratifying to find from a phone call to



Intelligent Interfaces that this was the definitive version despite the 'temporary' sound of the version number (no OS 0.10 here). On installing the EPROM and typing *HELP IEEE one is greeted by the rather curt 'IEEE Filing system 0.02', 'Please refer to the User Guide', not the usual list of available commands. As the IEEE commands are not issued directly, prefixed by an asterisk as in the DFS, perhaps this omission is not surprising.

USING THE ACORN INTERFACE

Having installed the EPROM and connected the interface to the 1MHz bus everything was ready to go. Starting at the simplest end I chose to control a single listen-only device, a power supply, which was connected to the interface with the supplied cable.

Communication between the computer and the interface is through two channels. A command channel is used for transmitting bus commands and for receiving information on the interface status, and a data channel used for transmitting and receiving data to and from other devices on the bus. This rather unusual approach is a consequence of the communication being through a filing system rather than a more conventional I/O driver.

The first steps therefore are to select the filing system and to open the command and data channels:

```
10 *IEEE
20 cmd% = OPENIN("COMMAND")
30 data% = OPENIN("DATA")
```

The integer variables used in lines 20 and 30 can be chosen to suit your needs, but having been assigned, all transfer of information is referenced by these variables.

The bus address of the power supply is assigned in a similar manner:

```
40 power% = OPENIN("5")
```

where '5' is the numeric address set up on dual-in-line switch on the rear of the power supply. All devices on the bus have a numeric address which is used to uniquely identify them. The computer must also be assigned an address. Any number between 0 and 30 is acceptable, though custom has the system controller assigned to address '0'.

```
50 PRINT #cmd%, "BBC
DEVICE NO", 0
```

This instruction is sent to the interface through the command channel referenced by the integer variable 'cmd%' assigned in line 20. The phrase "BBC DEVICE NO" is one of the 28 commands that may be issued to the interface. It can be typed in full or abbreviated to 'B'. All commands have abbreviated forms with the most used commands abbreviated to a single letter. The saving in memory space comes with a lack of readability, a problem experienced in normal basic operation when using long variable names.

Having assigned addresses the interface is initialised with the CLEAR command, and instruments prepared for remote operation with the REMOTE ENABLE command:

```
60 PRINT #cmd%, "CLEAR"
70 PRINT #cmd%, "REMOTE ENABLE"
```

Everything is nearly ready now for the power supply to be given an instruction. This will be a string of ASCII characters. In order for the device to know

when the string has finished it recognises particular characters as marking the end of the string. These characters may change from one instrument to another and should be set up if they differ from the default character of 'line feed'. The power supply used recognised 'carriage return/line feed', so:

```
80 PRINT #cmd%, "END OF
STRING", CHR$(13) +
CHR$(10)
```

This finishes the preparation. It seems awkward, but only needs to be done once, so can be relegated to a procedure:

```
10 *IEEE
20 PROCinitialise
```

This gives readability to the main program flow, and defines a procedure that could be used in subsequent programs.

The power supply used had two ranges, 0-10V, and 0-50V, with 1000 discrete programmable steps in each range. The required voltage had to be translated to a particular step in the 0-999 range and prefixed with '1' for the lower range, and '2' for the higher range, giving an effective four digit number between 1000 and 2999. This number is then transmitted to the power supply as a string.

A combination of function and procedure was used to get round the problem of a procedure not returning a value:

```
30 REPEAT
40 voltage = FNget_volts
50 PROCvolts(voltage)
60 UNTIL FALSE
```

The function to obtain the required voltage could be a simple INPUT statement, or could include limit value checking, to ensure that the requested voltage lay between 0 and 50 volts. The procedure to set the voltage has to scale the voltage within the required range, convert it to a string, and transmit it to the interface:

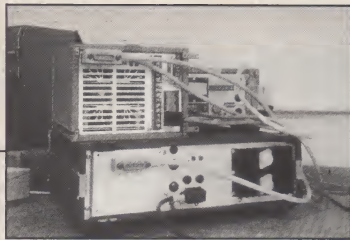
```
100 DEFPROCvolts
(voltage)
110 IF voltage > 9.990
THEN volts$ = STR$(
2000 + INT
(voltage / 0.05 + 05))
ELSE volts$ = STR$(
1000 + INT(voltage /
0.01 + 0.5))
120 PRINT #cmd%,
"LISTEN", power%,
"EXECUTE"
130 PRINT #data%, volts$
140 PRINT #cmd%,
"UNLISTEN"
150 ENDPROC
```

When these lines are executed the power supply that has been assigned to 'power%' sets itself to the voltage 'voltage'. This may seem very long winded, and is compared with other dedicated controllers, but by using the function and procedure statements available on the BBC computer, a concise and readable main program can still be maintained.

GETTIN IN DEEPER

Having mastered the control of a simple listen-only device, the

CONTINUED OVER



next step was to link in a talker so that information could be received by the computer. The obvious complement to the power supply was a volt-meter connected up to measure the voltage set upon the power supply.

As the interface has already been set up the only preparatory statement necessary is to assign the address of the meter in PROC initialise:

```
80 dvm% = OPENIN ("7")
```

The taking of a measurement is a two stage process. Firstly the meter has to be set to measure the correct function, volts in this case, with a given resolution. More complex meters might require more information such as which input on a multi-input instrument, whether a number of readings are to be taken and averaged, is any processing of the reading necessary before outputting the data etc. Information on the codes required are obtained from a particular instruments handbook.

For the meter in question the setting up was accomplished by:

```
200 PRINT #cmd%, "EXECUTE"
210 PRINT #data%, "J3D3T1N1Y1Q1R0"
220 PRINT #cmd%, "TRIGGER", dvm%, "EXECUTE"
230 PRINT #cmd%, "UNLISTEN"
```

This sequence only needs to be executed once unless any of the parameters in line 210 need to be changed, so it can normally be included in the initialisation procedure.

As actually reading the meter needs the return of the measured value, this is handled by a function call:

```
90 answer = FNmeter
.
300 DEFFNmeter
310 PRINT #cmd%, "TALK", dvm%,
320 INPUT #data%,
330 PRINT #cmd%, "UN-TALK"
340 = VAL (voltage$)
```

The way the transfer works should be fairly obvious from this function. A particular instrument, here denoted by 'dvm%', is commanded to talk, ie transmit its data. This is inputted on the data channel into the variable 'voltage\$'. The command 'UN-TALK' puts the bus back into a quiescent state, and the value transmitted is turned from a string to a numeric value using the function 'VAL' and returned to the calling program.

MORE ADVANCED USES

The simple examples of the previous section where a talk-only device, the power supply, was set to a given voltage, and a talker/listener, the voltmeter, was set to a known state and made to transmit a measured value, may seem trivial, but in essence such sequences are all that is necessary in perhaps 80% of applications. Transmission of simple strings between instruments and the controller is all that is necessary to measure the frequency response of an amplifier, to measure the frequency spectrum of an oscillator, or measure the performance of a complex electronic system.

So far we have only seen 10 of the possible 28 commands in use. The remaining 18 fall into three groups:

- 1 — Block data transfer
- 2 — Instrument status
- 3 — Bus status control

The block data transfer instructions 'READ BINARY', 'WRITE BINARY', and 'TRANSFER' are for moving specified numbers of bytes both between a controller and an instrument and between two instruments — one acting as the talker, the other as the listener. In this way data dumps may be performed by copying the contents of an instrument memory straight to a plotter.

The second group, instrument status, covers the use of serial and parallel polls and bus status. The status request command 'STATUS' returns an integer's worth, ie four bytes, of information on the bus status. Individual bits indicate the current status of a number of bus functions. To check for specific states the requisite bit has to be masked out. For instance if an instrument needs attention from the controller, it generates a service request (SRQ). The presence of an SRQ is indicated by bit 5 in the status word being set. This could be handled by:

```
490 DEFPROCstatus
500 PRINT #cmd%, "STATUS"
510 INPUT #cmd%, state%
520 state% = state% AND &20
530 IF state% = 0 ENDPROC
```

If SRQ is not set the status procedure terminates, otherwise the SRQ must be handled. How to handle the SRQ brings in the serial and parallel poll instructions. If there is only one instrument on the bus then it can be generating the SRQ and it can be accessed directly using a serial poll. This instructs the instrument to return status information to the controller, from which the controller can work out why the SRQ was generated and take appropriate action.

If there is more than one instrument on the bus, then which one has generated the SRQ is not known. Two courses of action are then open to the controller. Either it can serial poll each in-

strument in turn until the one generating the SRQ is located, or get the instrument to 'own-up' by using a parallel poll. In a parallel poll each instrument is allocated a particular bit in a status byte. When a parallel poll is issued the instrument generating the SRQ sets its bit in the status byte, thus the controller can immediately distinguish which of eight instruments (there are only eight bits in a byte), is requesting attention. This particular instrument may then be serial polled for more specific information. This sequence is illustrated in the following code:

```
540 PRINT #cmd%, "PARALLEL POLL REQUEST"
550 INPUT #cmd%, poll%
560 IF poll% AND 4 PRO-Cserial_poll_dvm
570 IF poll% AND 6 PRO-Cserial_poll_psu
580 IF poll% AND 6 PRO-Cserial_poll_psu
580 ENDPROC
590 DEFPROC serial_poll_dvm
600 PRINT #cmd%, "SERIAL POLL", dvm%, 1
610 INPUT #cmd%, status$
620 status = ASC (status$)
630 IF status AND &40 = 0 ENDPROC
640 status = status AND 7
650 IF status = 4 PRINT "Out of range value"
660 IF status = 5 PRINT "Unrecognised character"
670 ENDPROC
```

The digital voltmeter used was set to respond to a parallel poll on bit 3 (line 560). When presented with a serial poll command it returns one byte of status information (line 600), bit 6 of which is set if it generated the SRQ (line 630). This check is merely a 'belt-and-braces' way of double checking the origin of the SRQ. If it did generate the SRQ, bits 0, 1, and 2 are set to indicate one of two error conditions, these are examined on lines 640-660 and appropriate messages printed out.

Associated commands not

used in this example are "PARALLEL POLL ENABLE" and "PARALLEL POLL DISABLE" which enable/disable the parallel poll on a specific addressed instrument, and "PARALLEL POLL UNCONFIGURE" which stops all instruments taking part in a parallel poll.

In large systems having more than eight polling instruments, there may be two instruments responding on one bit of a parallel poll. In this case it might be necessary for the controller to serial poll each to find the instrument requesting service.

The third and final group of commands are those associated with general bus status control. There are four pairs of commands handling similar functions, and a single un-paired command:

GO TO LOCAL — return addressed device to local
REMOTE DISABLE — return all devices to local

SELECTED DEVICE CLEAR — clears specified device
DEVICE CLEAR — clears all devices on the bus

TAKE CONTROL — pass control to another controller
REQUEST CONTROL — request control from system controller

TIME ON — enable timeout
TIME OFF — disable timeout

LOCAL LOCKOUT — locks panel controls on a specified device

These are all self-explanatory and are used in a variety of ways. For instance 'GO TO LOCAL' would enable an adjustment to an instrument to be made, setting a power supply voltage, whilst other instruments were still under bus control. 'REMOTE DISABLE' on the other hand might be the last statement in a program, that returns all instruments to local control before halting.

Not all instruments respond to all commands. A careful examination of the operating manual will reveal which do not respond to polling, or do not permit block transfer of data. The set of 28 commands, though, allows as much control as each instrument permits, giving the programmer the opportunity to extract as much from the instrument as possible.

IN CONCLUSION

On the hardware side the interface was virtually faultless. Its construction is sound with several nice touches, such as the covering of all points at mains voltage inside the interface. With so few components the reliability should be good, but if anything does go wrong then maintenance should be straightforward due to the ease of access.

My only quibble on the hardware side is with the cable connecting the interface to the instruments. The usual configuration is for a screened cable with a stackable connector at each end. The cable supplied by Acorn is a ribbon cable with a non-stackable connector at each end. This forces the controller to be at the end of a chain, or a single branch in a star-connected system which is a limitation not experienced with other controllers. In addition the non-stackable connector does not have the screw-fit attachment found on conventional bus connectors, leaving the possibility of it becoming disconnected behind a bank of equipment.

When it comes to the software, different people expect different things. The command set in EPROM enables you to perform quite complex bus control operations, but in a rather laborious fashion. The need to operate at the 'TALK/UNTALK' level is balanced by the ability to confine these sorts of operation to functions and procedures, in which case the main program flow takes on the look of a higher level controller.

Documentation, though not abundant, is sufficient, and what there is is well written and well presented. It is though aimed more at the experienced user than at the beginner. A novice in programming instruments on the bus will need more information than the user guide provides, particularly as the low level approach to control means that the

programmer is not protected by a sophisticated I/O driver.

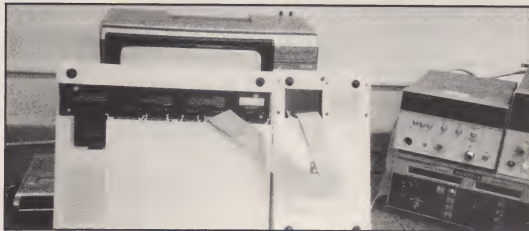
I experienced no problems with the interface. I ordered an EPROM, connected up the 1 MHz bus and away it went. However another interface, purchased by a colleague, failed to work until a pull-up resistor was connected to pin 1 of the EPROM. Talking both to Intelligent Interfaces and to Acorn failed to throw any real light on the cause, as it seemed to be an isolated incident that no-one else had reported.

Whilst not exactly a problem, I did come across an 'effect' which was a little disconcerting. In common with all filing system ROMS, the IEEEFS moves PAGE upwards in memory to claim space for a work area. If this space is re-claimed for program use it can still be affected by the IEEEFS. Pressing ESCAPE or BREAK/OLD causes certain memory locations to be overwritten, resulting in a corrupted program. This could be embarrassing if one was trying to run an analysis program on data collected over the interface, where all memory space was valuable.

This effect is due to the necessity to leave the bus in a known state if a control program was interrupted using the ESCAPE or BREAK keys. As the claiming of work space, and the overwriting of these memory locations takes place even if the interface is not connected (cf the teletext adaptor), then the only way out is to remove the EPROM. Not a practical proposition on a day-to-day basis though.

On balance I found the interface to be easy to use. As an experienced user of the bus, the low level programming required was not a problem, though a first time user would require more general information on the bus operation than had been supplied.

For use in industry or in education, the Acorn interface provides a cost effective alternative to the currently acceptable range of controllers. Question marks fall over reliability, maintenance and support but the answers will only be found with time.



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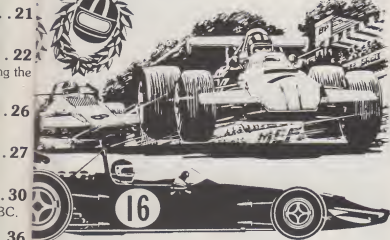
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Phloopy

Jonathan Evans

If you are fed up with loading files from cassette the chances are either that you are frustrated by its slowness and suspect reliability or that you require serious file handling which is impractical on the tape system (or both).

If you are hesitating to buy a disc drive it may be the price that is putting you off, or the sheer confusion. Do you need standard size or mini-discs, 40 track or 80 track? Do you need a dual disc drive, or perhaps a double sided single drive? And what is going to happen now that the single density chip controller used by the standard Acorn DFS has gone out of production? The observant may have noticed that Acorn's Electron disc upgrade, new ABC computer and Level 2 Econet all involve a new double density chip. Makes you wonder doesn't it?

If price is the problem and you don't already have a disc drive interface fitted to your machine, you might consider a fast tape system as an alternative solution. There are two systems on the market that I am aware of. One is the Ikon Ultradrive (upgraded Hobbit) which I reviewed in the October issue of A & B Computing. The other is the Phloopy, distributed by Phi Mag Systems (Trenoggie Industrial Estate, Falmouth, Cornwall TR11 4RY). There is a considerable price difference, with the Ultradrive retailing at a totally inclusive price of £79.95 and the Phloopy at £147.75 (notwithstanding the misleading £99 at the top of their advertisements, which does not include VAT, interface, carriage etc).

The Phloopy's claim for superiority over the Ultradrive is faster file access due to a much faster data transfer rate, on-board microprocessor and 16K (rather than 8K) filing system ROM which avoids the need for a utility tape. However, as we shall see later, the practical file access time on the Phloopy is incredibly variable, according to how it is used. Its main claim over disc is price, though at around £150 it is not much cheaper than the cheapest 100K systems (with interface) that are now being advertised. The only other advantage I

Is fast tape the answer for your filing system requirements?

can think of is that the tape cartridges are far more robust and easy to handle than floppy discs — a useful point if young children are involved in the use of the computer.

HARDWARE

Anyone who has opened a computer magazine in the last few months will have seen a full colour Phloopy ad explaining its "byte wide" head, ie eight track recording, which has enabled them to achieve the astonishing data transfer rate of 10K per second, which is comparable to disc.

Unlike the Ultradrive (which is reel to reel), the Phloopy uses a continuous tape loop, but one which they assure me is superior in design to the much criticised Sinclair microdrive. Apparently the latter uses a Centre Tap spindle, whereas the Phloopy uses a Bin Loop, for the benefit of any readers who might appreciate the distinction.

The tape actually has extra tracks which carry redundant information to allow automatic error detection and correction by the built in microprocessor. It uses random rather than serial access, which means that a complete map of the tape is read each time a filing system command is issued, and a file can be saved and retrieved in separate chunks distributed throughout the tape. For this reason, the tape never needs to be compacted, since all the free space from the front of the tape is automatically filled.

A nice feature of the Phloopy is the on-board microprocessor which performs some operations, such as formatting a tape, while returning control of the BBC computer to the user. Although the system needs to return the recording head to the splice following each filing operation, this is again handled by the microprocessor without

occupying the computer's time once the save or load has been completed.

The Phloopy connects to the disc port and requires the fitting of an interface. I didn't have to do this myself since I was loaned a suitably equipped micro for the review, so I can only pass on a summary of the very clear and detailed instructions in the manual (the documentation is generally very good).

Two 14 pin connectors are inserted in the IC79 and IC80 sockets and a much larger controller board into the IC78 socket — the text suggests that lining up the pins might be a bit tricky here. There is, of course, a filing system ROM to be fitted into one of the sideways ROM sockets, and a bit that will frighten some readers — a need to cut the wires leading to resistors R22 and R23. The final step is to connect the ribbon cable to the disc port and the power supply cable to the socket provided on the BBC machine. Although the instructions are clear, with diagrams, some people will inevitably lack the confidence to do it themselves (or be worried about warranty), in which case a dealer's fee must be added to the cost of the system.

OPERATION

The Phloopy loads and saves files in a completely automatic fashion and responds to all the usual filing system commands (*CAT, *SPOOL etc) in addition to permitting use of the BASIC commands for random access such as PTR# and EXT#. A full list of Phloopy's additional commands (all in ROM) is given in Table 1. The manual gives a detailed description of all filing system commands, both general to the micro and specific to the Phloopy. A disc user (Acorn DFS) looking at Table 1 will spot the addition of the useful

*VERIFY and note, in particular, the absence of *COMPACT and *BACKUP. The former, as I have explained, is not needed but the latter would have been useful especially because *COPY can only handle one file at a time with no wildcards etc.

We now consider the critical question of the speed of the system which, at the price asked, one would expect to improve considerably on the Ultradrive and approach that of a disc. First impressions are that this is indeed so, until one investigates a little more carefully.

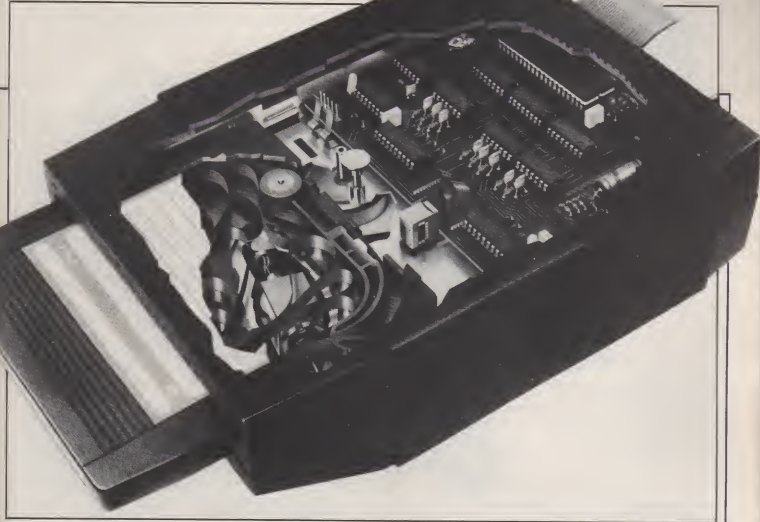
A standard 100K Phloopy cartridge takes 13 seconds to go around the loop, so this is the maximum time that it can take to load a single program. By comparison the Ultradrive can take up to 45 seconds when formatted with two catalogues on each side of the (120K+) tape, and it can take up to 45 seconds to change catalogues if you start at the wrong one. Hence, the Phloopy shows a big advantage over the Ultradrive but some inferiority to disc unless the program loaded is the first file recorded on the tape.

The big speed advantage of the Phloopy over the Ultradrive may, however, be lost or reversed if a program loads in several parts. This is because the Phloopy can only pick up one file on one spin of the loop, and cannot chain a series of programs recorded in correct sequence at one pass. This does, at least, have the advantage that one does not need to worry about the order in which programs are saved. However, we can begin to see why there is much more involved in file access time than data transfer rate.

We now come to the major weakness of the Phloopy, which is the way in which it handles data files. All filing systems load and save data files slower on the BBC micro than LOAD, SAVE, *LOAD or *SAVE operations, because the filing system is switched off between blocks of 256 bytes. The effect on the Phloopy is, however, much more dramatic than with other systems.

With a single data file open, as when using Wordwise, it

Phloopy with on-board processor.



manages to pick up (or lay down) about 1.5K and then must do a complete loop before it can do any more. To test the effects of this I loaded the identical smallish (6.3K) Wordwise file on several different filing systems. A Teac 80 track disc drive took a surprisingly long 14 seconds, while domestic cassette loaded the file in 140 seconds.

The Phloopy took 70 seconds and lost comfortably to the Ultradrive which loaded in 50 seconds (all figures approximate).

Phi Mag have responded to the Wordwise problem in two ways. One is that they have produced shorter loops for development work. The same file loaded in 32 seconds and 20 seconds on a 50K and 25K loop respectively. The snag is that these short tapes come very expensive for the amount of data they hold. The standard 100K cartridges are fairly pricey in my opinion — £18.11 for 5 or £4.25 bought

singly. Both 25K and 50K tapes will sell at £16.95 for 5 or £4.03 individually. The company also tells me that they are developing their own wordprocessor for the Phloopy which they plan to supply free of charge on cartridge when the whole system is bought. I have, of course, no idea how good this program will be, but I understand that it will overcome the slow save/load problem. At my suggestion, the company are now testing View for its suitability of use with the Phloopy.

Wordwise is not the only user of data files of course, which may be used for saves in games programs and also in users' own BASIC programs for data logging etc. This is where I have to give the really bad news. The Phloopy, like disc and Ultradrive, claims to be able to handle up to five open files at once. Unfortunately, once a second data file is open, the system can only handle one 256 byte buffer per pin

of the loop on any open data file.

In one test I loaded a small 3K data file from a BASIC program first with one file open and then with a second opened. The Ultradrive took 28 seconds in either case. The Phloopy (100K tape) took 32 seconds with one file open, but an horrendous 2 minutes 41 seconds with two files open. I am forced to the conclusion that for all practical purposes the Phloopy is a non-starter as a multiple file handler.

SOFTWARE

Once you upgrade your filing system you will run into problems with commercial software. Some programs are available on disc, but many, especially games, are not. Despite the claims of the advertisements it appears that no commercial software houses have as yet committed themselves to supplying software on Phloopy cartridges. Transferring tape programs to disc runs in-

to two problems, program protection (if present) and use of memory, since the disc system sets page up from &E00 to &1900.

Similar problems arise with the Phloopy since it normally sets PAGE to &1600. The problem is a little easier than with disc since a program can be loaded direct to &E00 if it does not then attempt to load or save another file, and to &F00 allowing chaining of other programs etc. However, any program which loads below &E00 will need to be "downloaded", ie loaded in higher in memory and then shifted down in software before running.

Phi Mag have provided supplementary documentation to their customers on how to download machine code, as well as BASIC programs. They have also provided a command in their ROM, *TRANSFER, which

CONTINUED OVER



transfers single files from cassette to Phloopy automatically. Whilst this will transfer a locked file, if protection is found on the original it is also placed on the Phloopy copy. Whilst the company presumably did this to avoid accusations of aiding piracy, it was actually a mistake, in my view.

They seem to have entirely overlooked the fact that most machine code games load below &E00 and thus cannot run on Phloopy without downloading. Since a protected Phloopy file can only be *RUN, their (presumably) frustrated customers have no means of *LOADing the copied file in order to download it. There is also a bug in the *TRANSFER routine, which sometimes puts protection on to harmless BASIC programs which then refuse to CHAIN. Such programs can of course be transferred by *TAPE, LOAD, *PHLOOPY, SAVE etc, but the utility provided is more convenient and should work as documented.

CONCLUSIONS

How good a buy is the Phloopy? The sensible comparisons seem to be with the Ultradrive, which is much cheaper, and a disc drive which is significantly more expensive (at least one of a quality

worth buying). Firstly, Phi Mag are to be congratulated on achieving a superb data transfer rate equalling or bettering disc, and on the use of an on-board microprocessor which has many advantages. They have convinced me, in principle, that fast tape systems could provide some genuine competition in performance with floppy disc systems.

Unfortunately, their current software design does not seem to me to permit the hardware to realise its potential. When programs chain in sections or when one data file is open (as in Wordwise) the system's performance is way below that of discs and, if anything, inferior to the Ultradrive, unless one is prepared to work with the very short and expensive tape loops. Worse still, in multiple file handling operations in which the disc system excels and the Ultradrive is workable, the Phloopy is effectively useless.

How many people need multiple-file handling, the manufacturers will retort. Well, it is needed in serious database manipulation, for example, to keep index files to speed up the computation of access into large masterfiles. True, commercial software written to use such facilities is aimed at disc users, but what of programmers who wish to do such operations themselves? I would imagine that secondary school usage in both

teaching computer science and laboratory applications will require this facility, so the Phloopy must concede this potentially lucrative market entirely to discs. The Phloopy might appeal to primary schools because of its relatively fast program access time and robust cartridges. Whilst much educational software makes use of the datafiles, these are generally single file operations because the software is written to work with ordinary cassettes.

What of home owners? If they are primarily Wordwise

users or programmers wishing to do extensive data file handling, they would have to recommend that they upgrade to discs if they can afford it, or to the Ultradrive if they cannot. If their prime interest is in writing programs which do not make much use of data files then the Phloopy will provide very good performance. Whether the system is a good buy for games players is debatable: (a) it's a lot of money to pay for the privilege of loading your games more quickly, (b) there is no guarantee as yet that commercial games will be sold on Phloopy cartridges, (c) a fair proportion of cassette based programs will prove difficult to transfer.

One thing is for sure, no one should buy the Phloopy without knowing what kind of use they want to make out of the micro and checking carefully whether the system will be suitable. I think this is unfortunate since one of the big advantages of the BBC micro is its flexibility. That owners might initially buy one for games or educational software, but later get into wordprocessing or serious database management. If they have bought a relatively expensive filing system they are entitled to expect it to cope with the range of filing activities provided by the machine without drastic loss of efficiency.

Table 1

* Commands in Phloopy ROM

* COPY	Copies a single file to another tape either on the same drive or a different drive
* DELETE	Deletes specified file
* DRIVE	Selects drive
* FORMAT	Formats a blank tape
* HELP PHLOOPY	Lists commands
* INFO	Provides parameters of specified file (load address, length etc)
* LOCK	Locks files to prevent accidental overwriting or deletion (equivalent to *ACCESS on disc system)
* PHLOOPY	Selects Phloopy filing system
* RENAME	Renames specified file
* TITLE	Gives a title to a tape (optional)
* TRANSFER	Transfers a file from domestic cassette recorder
* UNLOCK	Reverses *LOCK
* VERIFY	Verifies saved file with contents of memory

Bookshelf

Disk Systems for the BBC Micro

by Ian Sinclair. Published by Granada. Price £6.95.

This book on utilising disc drives alongside the BBC has been around for a few months but is now particularly relevant as more and more Beeb owners turn to discs as a storage medium. Ian Sinclair is steeped in detailed knowledge of how disc systems work with most micros that support them and is an ideal candidate to produce an introduction for the BBC.

Sinclair's knowledge of other micros (Tandy, Apple) enables him to go as far as advising on transfer of text (ASCII) files from one computer system to another (the Beeb's) — a complex process. At the other end of the extreme, great care is taken to explain in simple terms how the software handles disc storage and how the user can handle the software.

A great many disc drives are being purchased independently of the DFS, and documentation in most cases is poor. There are also two viable alternative filing systems by AMCOM and Watford Electronics. The author continually cites examples from these systems, usually in more detail than for the Acorn version. A case in point is the chapter on using disc utilities. AMCOM's package allows for direct disc surgery, with sector editing and the like, and is an ideal example. Much of the advice applies to using Disc Doctor or Disc Recovery.

An introductory chapter about discs and drives leads into a look at filing system commands. There are lots of examples to try out as you go along and hints on the thorny problem of tape to disc transfer. "Digging Deeper" investigates some of the more subtle uses of wildcards, COPY, BACKUP, RENAME and so on. It also explains some of the problems you might encounter, like "can't extend" messages — when a new, longer version of a file is SAVED with the same name, but the disc has no reserved extra space.

The book covers machine code programs, saving chunks of memory. *BUILDING 'BOOT



files, text files (a whole chapter mainly concerned with Wordwise) and filing techniques. The chapter on the latter is clear, comprehensive and full of examples; the best contribution to a very useful guide for disc users new and old.

Interfacing the BBC Microcomputer by Colin Opie. Published McGraw Hill. Price £8.95.

The dazzling silver cover of this book disguises a highly technical but clearly presented look at interfacing the BBC. The book makes full use of line drawings, illustrating both general architec-

ture and complex circuit and program flow.

There are helpful tables (especially memory maps) in the text and the appendices. These appendices also contain the circuits and board layouts for the hardware projects introduced during the last section. Where relevant, chapters are concluded with a useful bibliography.

First off, there is an introduction to the basic micro system and a look at how the various elements communicate. It looks at 6502 operation, serial/parallel communication, Boolean logic, interrupts, A/D conversion types, TTL devices and buffers. Pretty comprehensive as you can

imagine. Anyone coming to interfacing anew need not worry since the author takes care to explain the basics before going on.

Time for FRED, JIM and SHEILA, those important I/O related pages of BBC memory. Colin Opie rightly emphasises the need to use O.S. calls rather than directly changing memory. The second processors are with us and changing software can be hard work.

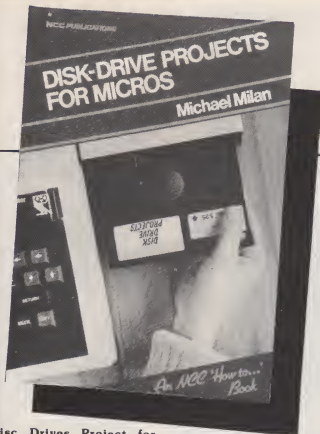
We get excellent and lucid accounts of the user and parallel printer ports, with circuit diagrams and pin functions. Same treatment for the analogue to digital port. For this part of the book you will need a general understanding of components in circuit diagrams. The RS423 and 1Mhz bus are now investigated. The usefulness of the 1Mhz bus for control applications becomes clear and its design is explained in detail.

The hardware now over, Part 2 starts on programming it. There is clear tabular information relating addresses in memory to registers in the hardware. Each I/O port is treated individually and read/write routines listed in BASIC and Assembler forms. There is also line by line explanation in some cases.

The reading of this section results in a comprehensive study of programming the devices which link the Beeb to the outside world, analogue or digital, serial or parallel.

For Part 3, the publishers have got together with Watford Electronics to supply a motherboard and application boards so that theory can be put into practice. Real results do wonders for the concentration. The ready availability of hardware also makes the book a useful guide for self study or for work in the classroom.

If you are thinking in terms of using your BBC for control applications or you would just like to understand more about what is going on when you plug in your interfacing box, or even when Acorn come up with their home control system, then you can't really do better than getting hold of this book on the subject.



Disc Drives Project for Micros by Michael Milan. Published by National Computing Centre. Price £5.95.

Don't be put off by the title. No mention of a BBC? Nothing about the Plus 3? Whatever it says on the jacket, the picture is a dead giveaway. The whole book is based upon handling disc based information with a BBC Micro and Acorn DFS. If I owned another computer and bought this book on the understanding that there might be some worth in it for me, I might be very disappointed. As a BBC owner with disc drives, I can feel delighted.

The book covers everything you need to know about actually putting your disc system to work, it does not go into all the hardware and software details but helps you get your system up and running and only then pursues some more advanced features that discs provide.

There are general points about the sort of hardware available, and pointers on what you might need. The software side starts simply and extends up to the heights of software subtlety, random access filing.

This book would in fact make ideal documentation for any one of the current multitude of disc drives available for the BBC and Electron Plus 3.

This is one of a series of NCC publications which thankfully makes a point of not

jumping in at the deep end, leaving the reader, and proud owner of new disc drives, drowning in *commands, hex locations, sectors and cryptic abbreviations.

Each new element of disc use, from simple saving and loading, to complex file handling, is approached as from new. Throughout the book examples of what you will see on the screen are provided in the form of screen dumps. There are also a number of example listings which can be attempted by the reader as he/she works through the various commands now at his/her disposal. Having the power of disc drives available means that the user is tempted to do many things which seemed tedious when working with tape, like saving and loading screens.

High resolution screens take up quite a bit of memory and loading them in block by block from tape is boring. With discs it takes just a few seconds and is easy to execute. The book takes us into the areas of *SAVE, *EXEC and *SPOOL. Discs are more fun. Next up are serial files, another area where the speed of drives makes all the difference. This section and the next, on Direct Access Files, are full of examples and conclude with complete listings of useful filing programs.

The final project is a graphics drawing suite, which uses discs to store the current screen image.

Two quick appendices take in error messages and "other computers". Don't doubt it, this is a BBC book and a very good introduction to disc handling on all levels.

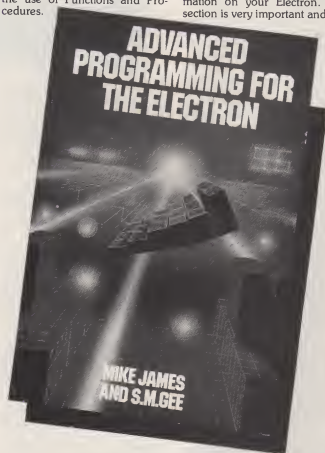
Advanced Programming for the Electron, by Mike James and S.M.Gee. Published by Granada. Price £6.95.

This book sets out to tackle the problems of writing larger BASIC and Assembler programs on the Electron. The authors' approach is designed to produce organised programs, carefully planned and designed before coding. They look for reliability through the use of the natural structures of BASIC, like REPEAT...UNTIL and FOR...NEXT, and through the use of Functions and Procedures.

The authors go into "step-wise refinement", testing and perfecting the individual components of the program. They discuss the use of parameters and local variables as well as the physical appearance of listings, formatting and use of REMs.

On the Assembler side, there are discussions on the natural structures of assembly language, details of how the Electron assembler can be used and a few paragraphs on Macros and some of the problems associated with implementing them.

As the book gets more involved, and the O level Maths get a bit strained, we move onto data types, arrays, look-up tables, handling a stack structure; everything you need to know about storing and accessing information on your Electron. This section is very important and well

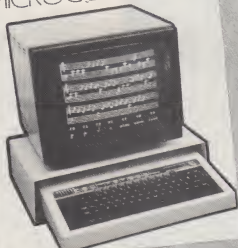


The key to this organisation is the modular structuring and building of programs — a theme which crops up throughout the

explained, with lots of examples and step by step runs through.

CONTINUED OVER

USING SOUND AND SPEECH on the BBC MICROCOMPUTER



These techniques are used by every program worth its salt, from databases to arcade thrillers. A section follows on both BASIC and Assembler control of sequential filing.

An interesting contribution appears in the form of "Making Programs Work" — pretty important! It looks at the testing of programs, the location and eradication of bugs, common errors and program presentation.

Chapters eight, nine and eleven are based upon full-scale programs. Spelling Checker, Execution Tracer and Disassembler. Each is built in stages, including design. All have major elements of Assembler (spelling checks are useless if they are slow) but use BASIC to hold them together and present them in an organised and understandable fashion.

Unfortunately the Spelling Checker, though it works, is, by the authors' own admission, not a completely finished version. Still, if you take all the rest of the information in, you may well be in a position to do something about it! The Execution Tracer takes up the theme of debugging and could be a useful program for the new programmer.

On either side of the Disassembler project are chapters on the MOS and on fundamental background in Bits, Binary and Boolean. The Machine Operating System and the part it plays in the everyday functioning of the Electron is explained. Work on OS calls and interrupt handling lead to the construction of a background clock.

The final chapter looks at binary hex and logic in relation to the way Acorn BBC BASIC and Assembler handle numbers.

The Disassembler itself does not have enough facilities to be really useful (but is open to improvement), but introduces some more complex programming techniques and the final result is good enough for "Leaving through" Electron software.

This book is for the programming enthusiast. Although the techniques discussed, and practiced throughout, would enable the writing of efficient programs

of all types, the approach is entirely from the point of view of writing code. It will be beyond anyone who is not already an interested and fairly experienced programmer. For the ambitious Electron programmer, who wants to acquire the skills of a professional, this book is an excellent start.

Using Sound and Speech on the BBC Microcomputer by Martin Phillips. Published by MacMillan. Price £6.95.

Perhaps it is the complexity of the SOUND and ENVELOPE statements in BBC BASIC or perhaps the romantic idea of sitting back for an evening's musical entertainment with your BBC, but sound/music books seem to spring up at regular intervals.

This one by Martin Phillips covers much of the usual ground, expanding upon the official explanations of SOUND and ENVELOPE, looking at the physics of sound and the programming of music. It also supplies the first (in book form) independent look at the Acorn speech synthesis add-on.

The explanations of sound are an interesting path into the BBC Micro's own production of

pitch, amplitude and timbre. The author has written some nice programs to graphically demonstrate the production of wave forms, including a representation of air displacement. This sort of technical information is interlaced with three and four line program examples as well as larger listings. As explained in the introduction, considerable care has been taken to provide well-documented and readable listings. The technical appreciation continues with a fascinating investigation into the whereabouts and functioning of the sound buffers and an highly accurate table of measured frequencies for note production, highlighting the inadequacies of the sound chip.

There is a brief appendix on the mixer and amplifier circuits and reproduction of the circuit drawings for sound and speech.

A chapter on assembly language control of speech is disappointing although it hints at the possibilities. Ian Birnbaum's assembly language book in the same Macmillan series will prove more fruitful reading for those venturing into this area, alongside the user guide. The use of macros for generating both speech and sound (something I

find a natural use with tables of encoded notes or parts of speech) is not covered. The author touches on the use of event handling in conjunction with speech, resulting in a "talking typewriter" program.

Music making on the BBC is difficult and the chapter in this book does not really investigate the theory or practise of programming music. Music and musical notation are introduced for the layman and much of the programming goes into producing graphical representation of (out-comed?) notation. There is a full scale program to play tunes and display the appropriate notes on a stave at the same time, a useful educational exercise.

The chapter on speech synthesis uses much the same approach as with sound. We get an introduction to the hardware, the methods of reproducing human speech, an analysis of speech itself and how the problems of storing it in computer memory have (to an extent) been overcome. There is a detailed look at how to use the words and parts of speech provided by the Acorn system, culminating in an example of how to implement a full speech application into your own programs. Speech is amazingly popular with children especially, and does much to enhance educational programs. Games scores and high-score tables can similarly benefit. Reading this chapter will probably persuade a good many people that speech synthesis is a fair investment if you are willing to do some programming.

Informative on some points and original on others, this book would make an ideal first book about using sound and speech on the BBC. If you have already gone into sound, or already own the speech synthesis system, then much of the information here is already available to you. Nonetheless, this book for music makers, unless to gain a more technical understanding of the internal operations of the sound chip and operating system software. If you have always fancied delving into sound or speech then Martin Phillips' book will prove a precise and informative partner.

Getting the Most from your BBC Micro by Clive Williamson. Published by Penguin. Price: £5.95.

Clive Williamson has done a fair job producing yet another follow up to the BBC User Guide. New BBCs are continually being purchased and new owners are still apparently being bewildered by Acorn's own manual.

If the user were to actually "take on" the User Guide then this sort of book wouldn't have much of a market. Most of the information here is paralleled in the guide. Yes, there are more examples and the flow of the book is more logical than the guide, but there is not enough difference to make it in any way an addition to the information or its availability.

There is a gap in the standard documentation which accompanies the BBC — filled nicely in the Electron package by Yazdani's Start Programming — but this new attempt to fill it is a lot less interesting especially on sound and graphics than its already established rivals form Prentice-Hall, Granada and Addison-Wesley.

Adventure Games for the Electron by A.J. Bradbury. Published by Granada. Price: £6.95.

This very impressive book is a bit more technical than its sci-fi cover suggests but this should not deter the Electron (and, I see no reason why not, unless Granada are going to come up with a BBC version, the BBC) adventurer from going straight out and buying it. If you bought Peter Kilworth's Penguin/Acorn guide then don't worry. There is some overlap in subject matter, naturally, but with both you will be as clued up on the subject as most.

There's the obligatory history lesson, Stanford Research versus Massachusetts Institute of Technology, Colossal Caves versus Dungeon. The latter's Infocorn language is compared with Melbourne House's English, found in the Hobbit. Language recognition is all part of the believability of Adventures.

Later in the book, chapter eight goes into the tokenising and

crunching techniques needed to squeeze "language" into a micro Adventure. This chapter presents some very interesting ideas and demonstrates them with a set of programs for encoding and decoding text/descriptions — similar methods, we are told, to those used by Level 9.

For those new to programming, there is a line by line analysis of each largish program. The method used is one of assigning character groups to ASCII codes above 127. A string analysis program lists the most common letter groupings and this information is used by the encoder.

Strings are stored above HIMEM in byte arrays and accessed with a pointer table. Electrons with only Mode 6 and not a lot of memory to play with, will especially benefit from this sort of crunching.

However, Adventure Games is not just about the coding. The author deals with the creative side, the necessary elements to maintain interest, the plot, problems and clues. He also looks at planning, internal consistency and comprehensibility. Creating characters, keeping track of movement, not just of

the player but other creatures, saving games, analysing player input; all these aspects and more are discussed with programming examples. Finally there is a chapter on limited use of sound and graphics.

It's fairly obvious that the author did not develop all his ideas on an Electron, or even a BBC. As an ardent adventurer, steeped in the American game, he reveals himself as an Apple owner. No matter. Even if he does use subroutines rather than procedures. Electron adventurers would not want to miss out on a wonderfully enthusiastic, breezily written and technically comprehensive manual on Adventure writing.

Drawing your own BBC programs by Jonathan Grieg. Published by Century Communications. Price £6.95.

Despite the rather strange title this is a good, interesting book on the subject of BBC and Electron graphics facilities. The 160 pages of main text split up into six main sections, each covering a major point of the machine's capabilities or of the mathematics involved in

using the graphics to get the effect that you need.

The first section "High resolution graphics" explains how the various PLOT and DRAW options work and how data can be scaled, translated and rotated to change its effect on screen. This section involved some mathematics and despite my being decidedly rusty on these matters it soon started to make sense and fall into place.

The next section is about "Block graphics" which are usually referred to as character graphics in the case of the BBC and Electron. Once again there was a good introduction on the subject of character definition and movement around the screen. Each part of the discussion is punctuated with short procedures or program lines ready for you to try the effect and experiment as you go along.

Then comes the section on colour and animation which starts appropriately enough with an explanation on how colour screens work. There follows an explanation of the various colour options available and their effects on the screen, including the use of truth tables for logical operations. This chapter closes with a discussion of the various types of animation that can be achieved by colour manipulation, a common technique on the BBC machine.

The following sections deal with the uses of graphics in other programs such as graphs and charts and covers the various methods of circle drawing that you might like to try. The section on three dimensional graphics was rather too mathematical for my liking but there were plenty of examples to try and a number of well defined formulae to use when writing your own programs.

The book closes with a chapter on the block graphics of Mode 7, therefore only of interest to BBC owners. This section was well written and contained a great deal of interesting information well presented with little programs to try.

All told this book provides a good introduction to the mathematics and programming

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of graphics on these machines and whilst it isn't at a high enough level for those to whom the mathematics is relatively easy, I can see a number of young people and indeed their parents getting a good grounding in the subject from this text. Well worth the £6.95 for a good, steady easy-to-read book.

BBC Software Projects by Rudolf Smit. Published by Melbourne House. Price: £6.95.

It strikes me, after reading this book, that you shouldn't assume that because a company has a good reputation for producing software of distinction that they can also produce books about programming. This is a poor book by any standard, for all the reasons that I give below, but to have such a book published under this company's name is a double tragedy.

This is a teaching text with the avowed aim of giving you a good grounding in programming and in project management. It takes, what I am presuming is, a rather unique approach to its teaching. It proposes a project and then gives a full description of the program required but doesn't actually provide the program. That is where you come in and the book is therefore comprised of six projects all in a half finished state. This is a good idea and if done well would be an efficient and involving way of learning to program. Unfortunately here it is not well done and the book is riddled with contradictions and mistakes, enough to leave me feeling that it was rushed onto the presses without anywhere near enough checking and attention to detail.

There is a program that makes no sense at all because part of it is missing, there are wrong line numbers mentioned in the text and there are even mistakes in variable names. All of these could be simple typing errors but it doesn't stop there, there are errors of fact included too. The book states, quite firmly, that you cannot have DEF FN code, ie used defined functions,

that aren't in the first procedure called. This is nonsense, if they are initialised in this way they work faster, but to say that they cannot be anywhere else is fanciful. Add to this the fact that the book is about good structured programming yet there is not one mention of input validation and you have real problems.

The projects in the book claim to be interesting but, to be honest, they are boring and I think that most readers will find them this way too. The first three

projects are simply variations on a theme, data storage, and simply change the method from project to project. The level of the text is low as you might expect but there are a number of restrictions placed on the programs that you have to write. A good example of this is the way that variable names are specified, in order that the rest of the program can use the same names. This too would be fine, if the author actually practised what he preached — he suggests the use of long and

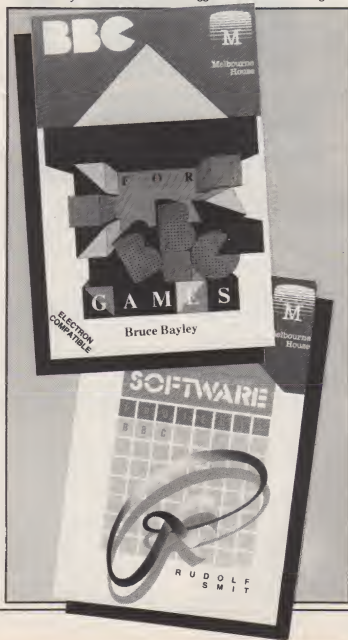
meaningful variable names yet regularly uses single letter names himself. That isn't the end of the list but I've run out of space. This book is based on a good idea, in teaching terms, but it has been so badly thought out as to be rendered useless.

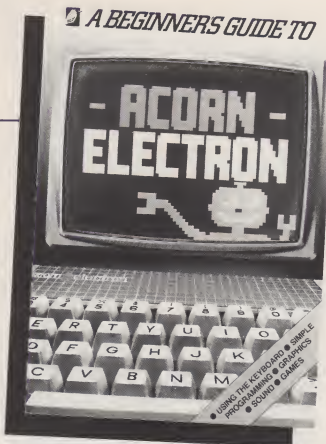
Building Blocks for BBC Games by Bruce Bayley. Published by Melbourne House. Price: £8.95.

This book, "for all BBC enthusiasts" according to the blurb, suggests that one way to make games writing easier is to have a set of pre-programmed modules to do the common jobs within a program. Then it goes on to show how the modules can be used to provide "exciting and original games". Far from being exciting and original, games like River Frog, Luna Landa, Simon and Brick Out are more likely to elicit a groan than a smile in this day and age.

The first section of the book on programming and how to manage a game writing project is fairly good and accurate. The diagrams are clear and the use of good programming structure is emphasised. I do wish though that authors wouldn't confuse "Top — Down design" with "Structured Programming", there is a difference. The last part of this chapter contains a procedure called "chexsum" which is a method of checking programs as they are input and seeing where any typing mistakes might be. This is a great idea for machines that have a poor error reporting system, which cannot be said of the BBC or Electron machines. With these machines the procedure is almost redundant as the reports tell you a great deal more than a checksum ever could. It helps the writer however, each program is followed by the full "chexsum" list and by my quick calculation that takes up over 20 pages of the book!

The next section contains three utility programs, a character definer, a sound definer and a background builder. The first two are both reasonable but are far less well organised and capable





than a number of such programs that you have read in magazines. The character definer will give you the VDU 23 lines for the characters but will not allow any colour changing within a character. The sound aid allows you to redefine envelopes but only the pitch envelope section. This is probably because the amplitude envelope is fixed on the Electron but means that it is less flexible than most others I have seen. The background aid is a very strange invention for developing DATA lines to be used to draw backgrounds in games.

The actual program modules themselves are a surprising collection to say the least. They comprise modules to move a character around the screen, clear a message off the screen, build up a deck of cards, pick a card from the deck and build backgrounds from DATA lines. Apart from a machine code version of the move module that is it, five modules. No mention of high score tables, multicoloured sprites, title screens, instruction routines etc. The routines seem to work alright but they leave a great deal to be done by the programmer. In a matter of minutes I could produce a list of modules of far more value than these.

Even the author doesn't extensively use them. Of the seventeen finished games in the book, five don't use any of the "building blocks" and only a couple use three of them at once. By far the most valuable is the movement procedure, which is called different names in some parts of the text! This is rather too little a core on which to base a book and as such I could only recommend it to those who are interested in having a collection of simple listings to type into their machine. Don't think that you will learn a great deal from doing so however, there is a very minimum of program documentation. Save your money.

A Beginner's Guide to the Acorn Electron by Richard and David Graves. Published by Kingfisher Books. Price: £2.50.

This simple and practical guide

provides a useful introduction to learning to use the Electron. It was written by a teacher with the help of his 11-year-old son because they found many of the standard books on introducing programming were far too complicated. It gives step-by-step instruction on writing simple programs, using number and string variables and producing sound, colour and simple graphics.

The book is written in a light style and its colourful pages are filled with humorous illustrations. While it will be helpful for beginners of any age it is clearly aimed at young people. The reader is taken through the chapters in stages from initial familiarisation with the machine to a final summary of programming words, and a series of problems and solutions runs through the book. Each chapter ends with "A reminder" to summarise what has been taught.

Although the book gives clear explanations of what it is teaching, the text is as brief as possible and filled with practical examples to keep children interested. As early as the second chapter, three very short but complete programs are given to show what the computer can do with colour and sound. The theory is detailed in later chapters

but hopefully readers will be encouraged to continue through the book if they know what they have to look forward to. Longer programs in the later chapters include a guessing game demonstrating both number and string variables, a birdsong program using procedures and a "ghosthunt" program which contains examples of everything taught in the book.

At just £2.50 this book would make an ideal gift for any young person who is beginning to realise that there is more to computers than just playing games. If they can understand and appreciate all that is explained, they will be well on the way to writing their own simple programs.

The Better Guide To The Acorn Electron by Geoff Bains. Published by Zomba Books. Price: £3.95.

This book, described as the "alternative user's manual", explains how to use the Electron without assuming any previous knowledge but only an interest in the subject. It is written in a light, straightforward and conversational style and takes the reader through the most popular aspects of programming, with plenty of encouragement to experiment

further.

The guide covers every topic in detail, starting with a simple explanation of how a microcomputer works and continuing through using the keyboard; words and numbers including real, integer and string variables and arrays; using the screen for display; modes and colours; sound facilities, music and noise; graphics; data-day programs, animated graphics and finally converting BBC programs to run on the Electron. The book is concluded with two appendices explaining how to load, save and catalogue programs and how to compact programs to save memory and speed up running time.

Each chapter starts with an illustration but after that the pages are crammed with text, broken up only by programs and occasional diagrams and tables. The book's design will not appeal to young people but those who want to read as much as possible will appreciate the value for money it offers. Any beginner with enough concentration and interest in the book could go through it page by page and feel they had learned a great deal at the end.

It is not a very easy book to pick up and put down, mainly due to the poor presentation. There is no contents page or index and no summary of what each chapter explains. Even the chapter headings do not shed much light on their subject and there are no sub-headings to break them up. It becomes very annoying when you can vaguely remember reading something useful and want to check it again but have no idea where to find it, and chapters titled "Graphic Details" and "More Graphic Details" don't really help. This is a pity because the text is enjoyable to read and makes the subject matter interesting and appealing.

The book will be useful to anyone who has bought an Electron and wants to learn how to use it fully, but finds the User Guide rather dry. While it could be improved simply with better presentation, it is well written and

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provides very clear and helpful instruction on the various aspects of simple programming.

Basic on the BBC Micro
Further Basic on the BBC Micro
Assembler on the BBC Micro, a Beginner's Guide
 by Richard d'Silva. Published by M.U.S.E. Price £1 each, £7.50 for a set of ten, or bulk rates for 30+.

Micro Users in Secondary Education is a well-respected body, leading as it has the development of micros in schools. These pamphlets are produced as a very inexpensive source of teaching material for a group of children beginning to learn on the BBC Micro. The idea, obviously, is that each student should have an individual copy of the booklet, and in that way it turns out to be a very cost-effective scheme.

Mr d'Silva is a teacher, and obviously these booklets reflect the way in which his teaching has ironed out all the wrinkles that most teachers find in their working. My one source of a little concern is that some of the Model A, but there again, I suppose there must be a few of those still around. Each TASK appears to be about right for a lesson, albeit a slightly short one, and appears to be quite self contained. This is followed by a section of further ideas which the student should try. As with all activities of this nature, it is during the experimental stage that real learning takes place. Short instructions are given, but these should generally be sufficient. There will presumably be a teacher around anyway to deal with problems. Again more information on the commands can be found from the User Guide.

I like the level of advancement between subsequent lessons in the first booklet. This continues into the second Basic book, but I think many students might find the TASKS in the Assembler booklet a little demanding. All in all, this is a

novel idea, and many less confident teachers might well benefit from Mr d'Silva's buoyant style. Even those teachers with their own strengths might find his ideas a welcome alternative, being clear yet concise. Above all, I am sure the student would find the process enjoyable and would benefit from having the text constantly available.

Business Applications on the BBC Micro by Susan Curran and Margaret Norman. Published by Granada. Price: £7.95.

I cannot recommend this book to anyone who is seriously thinking of using their BBC for business and I think it would bore the rest of the Beeb user community staff.

It is almost entirely a descriptive work. It describes the general functions of wordprocessing, keeping accounts and so on. This is partly culled from a similar book for the Commodore 64. It also describes various pieces of commercially available software for the BBC plus DFS and the

BBC plus Torch Z80 disc pack. There is software from Gemini, MicroAid, BBC Publications, Acornsoft and Software for All as well as many of the CP/M favourites.

Unfortunately there is no comparison of products unless you wish to do the job yourself. Nor — and the author confirms this for us — can we rely on the packages having been fully tested. Much information has merely been culled from the manuals and we know how reliable they are!

The book has tried to keep up to date but recent interesting releases such as the Acorn Z80 software, DataGem, Sage, and Systematic, are not included.

Nor can such a book take time off to explain about business practice or give advice on installing a computer system. As it stands it is more a compendium of commercial software, and to be fair, not just an uncritical one.

There is no doubt that a substantial amount of information is packed into the book but I think a few telephone calls to the com-

panies concerned would result in a substantial bundle of sales literature and spec sheets (up to date) and would save you the £7.95.

Using the BBC Micro in Education by Don Thorpe. Published by Interface Publications. Price: £5.25.

I have never read a book quite like this before! I started to read, expecting to find the usual mish-mash of educational programs, or sadly what is often passed off as educational, with listings of these ready to type in. Instead, I found myself as a teacher being drawn into this book, which attempts to show how a course of study might be set up using a BBC micro, or two. The course is explained in detail, but this is only one of four sections within this book.

The first section is rather sadly called "First steps in a new land", a title which hardly helps to lessen the aura of mystery surrounding micros in schools. I found that this section would be extremely interesting reading matter for a non-computing colleague, but I was also shown a couple of ways to looking at things anew myself! Who says old dogs can't learn new tricks!

Running a first course in BBC Basic is indeed a challenge. I have attempted to teach some elements to young children, and am currently teaching computer programming at night school, where my class includes a gentleman of 75. This course is aimed fair and square at school, but the general points of consideration are very similar. Some seem quite important to consider, such as the establishing of rules, and the importance of "games", but other questions such as "Should a charge be made for damage?" seem to be beyond any general answer in a book. The explanation of Keywords begins in promising fashion, but I was unable to follow the train of thought which the author followed. Most of the information in this part would perhaps be better gleaned from the excellent User Guide, which is not too difficult for Secondary school pupils.



FILING SYSTEMS AND DATABASES FOR THE BBC MICRO



The third section is entitled "Designing an Educational Program". Here, I feel, the author has assumed that his audience are perfectly conversant with BBC Basic, because little explanation is given as to the use of certain instructions, and yet the same audience is assumed to be incapable of designing a title screen! I found this a rather odd approach. However, Mr. Thorpe redeems himself with a rather nice selection of special effects demonstrations. These provide enough information for the keen teacher to adapt to his own personal purposes.

The final section describes the system employed by the author to set into motion the writing of a program required by a non-computing colleague. I confess I have always steered well clear of this kind of activity, as I generally seem to be working a ten or eleven hour day anyway, what with lesson preparation and marking etc. Should the reader be foolish enough to bite off even more, then this section might perhaps finally put him off! I found this final section out-of-place, and would have been happier if it had been left out.

Overall, this is not a great book, but there is enough of interest and contention to enliven many a staff meeting!

Filing Systems and Databases for the BBC Micro by A.P. Stephenson and D.J. Stephenson. Published by Granada. Price: £7.95.

This time last year the sole database contender for the BBC was Pison's Vufile. It's still a best seller but now just one, and a limited one, such program amongst a sea of software.

While the BetaBases, StarDataBases, DataGems, Indexes (Indices?), Record Keepers, Club Managers etc etc, were being hatched, the Stephenson partnership spotted the trend. They produced a book of great interest to those who use the various aspects of the BBC filing system, in programming or in using one of the many databases, spreadsheets or even save facilities in an

Adventure, or the loading of data from tape or disc into a main program.

The book looks at the physical methods of storage on cassette and disc and the design of filing systems around the requirements of the potential user. Each chapter has the familiar and welcome summary of points and self-test section.

Anyone coming new to this area will find a clear description of both the concepts and specific programming methods employed. We start with a simple RAM based sequential file (the RAM based Vu-file remains the best bet for tape users) and build on it, introducing more complex functions, opening and closing files, reserving space, taking orders from a menu, selecting, amending and searching records. All these tasks are coded within PROCedures and FN's and the listings not difficult to follow. A full implementation of a RAM based system is listed and the programming and operation explained.

As a footnote to this program the authors introduce the idea of reserving space on disc for more than one file. This is taken

up again later, after a lengthy chapter on searching and sorting. It's actually nearly all about sorting. Different sorts are demonstrated in BASIC and machine code, with timings for various combinations of data, indicating their relative efficiency.

Back to file types with serial, sequential and indexed sequential files. Full examples of a serial and indexed system are listed and the definitions gone into in great detail. At this stage I would have appreciated some shorter examples to type in, to clarify the rules of operation I was reading about, rather than have to tackle another long program. I decided to work out some of my own, but this might put off the beginner.

The final example is of a direct access filing system with fixed length records. The limitations of this system lead to the introduction of hash-coding techniques and tombstone markers. I will leave the authors to explain them.

For me this book greatly improved my understanding of the techniques being employed in the filing system software I use with the BBC. It may also encourage me to have a go myself

sometime, to add my personal version to the many already available. The problem with any system is a certain lack of flexibility and personalisation may be the answer. This book will supply the know how, you must supply the task and the time.

Educational Programs for the Electron by Ian Murray. Published by Century Communications Ltd. Price: £6.95.

Ian Murray is a secondary school teacher, and was at a London school when these programs were originally written for the BBC micro. They were tested out in the classroom, and proved to be very successful, according to the author. However, I would imagine that Mr. Murray himself must be writing rather better programs than these nowadays. They give the feel of early, "pioneering" work with a new micro, as the BBC was then, but they now appear to be a little old-hat.

It's not that they are bad programs, some have a fairly good style, but for educational purposes they are not written with much clarity. Also, I would question the educational content of some, although they might therefore appeal to a wider audience!

Quite a few are long, but those with slow fingers will be able to obtain a cassette for a further £6.00. Certainly the long Stockmarket program is well worth typing in, but it does run to about nineteen pages! You have to be dedicated to give your fingertips that kind of bashing.

None of the programs appear to be scaled down for the Electron, but I've not seen the full BBC versions. I would imagine that the BBC listings would make a little more use of sound, for instance, than the new listings in this book.

Overall, I am torn between a great admiration for some of these programs, clearly written and free of errors, and a feeling of surprise as to why others are included in this same volume. I feel that Century might have done better to prune down the number of programs, and to throw in the cassette for free.

Machine Code Made Easy

It is all very well me giving you lists of commands and address modes, but nothing beats an example. This month we look at a simple SOUND routine which I wrote to save space in a long BASIC program and thus prevent the dreaded 'No Room' message.

The routine itself is not very elegant but can easily be modified for your own use. It does however demonstrate many principles which we have looked at in previous articles. It is loaded and set up by a heading program, which subsequently chains the main program, and this assembles the routine and sets up a data store.

Both the routine and the data reside in the area below the normal BASIC program storage space. Thus they don't count in 'room' calculations.

THE THEORY OF THE ROUTINE

As the routine is written, data for tunes is stored as a sequence of pitch and duration values, in this case the data starts at &D80. The routine itself utilises two of the machine code calls provided by Acorn — namely OSBYTE and OSWORD. The OSWORD call requires an eight-byte sequence known as a parameter block for which I have used zero-page space reserved for user routines — &71 to &7A.

Right, so how do we go about writing such a routine? The flowchart in Figure 1 illustrates the sequence which I wanted, and in the following explanation I have indicated which boxes relate to the discussion.

Well the principle is that a number of tunes can be stored, note by note, in sequence. To play them we need to know how far through the data they start and how many notes are to be played. Thus this information must be provided by the BASIC program calling the routine — the INPUT to the routine — box 1.

The parameter block required by the OSWORD call is to provide the same information as a SOUND command — i.e. Channel, Volume, Pitch, Duration. Each of the four is provided

Name that tune! In keeping with the rest of the mag, Machine Code goes musical.

by two bytes, one of which is, for our purpose, fixed. So then we must set up this block in a suitable place, providing the four fixed parameters at the beginning and then feeding the variable values required for each note in turn.

The sequence of information required for the block is shown in Figure 2 and is supplied by box 2 for the fixed values and box 3 as each note is passed in the loop for playing the tune. We have now entered the tune playing loop!

Having collected the information required for a note in the parameter block we now check to see if the sound buffer is full. This is achieved by using one of the OSBYTE calls, namely that with the accumulator containing &80 OSWORD. The OSWORD call we test again, repeating this process until there is free space in it — thus we loop around box 4 in the flowchart until a space occurs.

Once the buffer has room we send a note to channel 1 using the OSWORD parameter block and call, then the volume, pitch and channel are changed to give a second note. This is two octaves higher than the first to give a harmony effect as the two will play all but simultaneously — machine code being so fast! This note is in effect sent to the buffer for channel 2 by calling OSWORD again and the delay between the two is in the order of 20 microseconds, hardly an audible delay.

Having sent the note to both channels we are not ready to get the second note from the data store! Thus the offset counter is incremented to the next set of data and the count of notes to be played is decremented. If the count is not zero there are still notes to be played, so we test the count and go back for another

note if required. Otherwise the routine ends and returns control to the main program.

THE ROUTINE — BASIC/ASSEMBLER PROGRAM

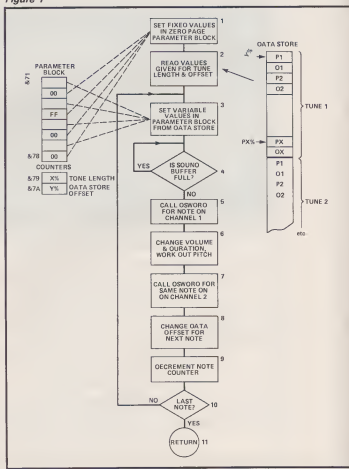
The program that I have given here is part of a program that

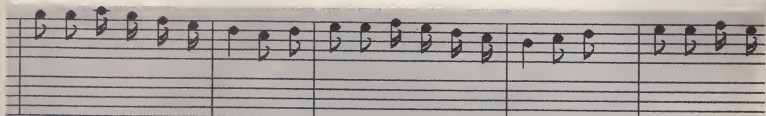
would display game titles, set up character definitions etc before chaining the main program. It first creates the 'data store' by reading DATA and then putting in into locations &D80 onward. This is followed by the ASSEMBLER part, commencing at line 100 and this we will examine in more detail in a moment.

First, however, note two things in this program. In line 110 we load P% with the value &D00 — on entering the ASSEMBLER we must tell it where to assemble the code and the value of P% on entry gives the start address (we will examine this more fully next month). Forgetting to set P% means that your code could end up almost anywhere!

Secondly note the comments that I have added in the

Figure 1





ASSEMBLER lines. These are preceded by a '/' after the commands to be assembled. Thus it can be seen that the '/' is directly equivalent to the word REM in a normal BASIC part of the program. These comments need not be typed in and are there solely for your instruction as to how the commands operate.

Look through the program now and examine how it works. After the listing we discuss each part of the code more fully.

THE ROUTINE — HOW IT WORKS

We can now examine the various commands and how they work. This is probably best done line by line.

LINE 120 — the 6502 has no individual command which will clear either the accumulator or any memory location. Thus to zero any location we have to load it with the number zero, hence

LDA #0 where # indicates that we are using the 'immediate' addressing mode to put zero in the accumulator. Now we can zero the fixed parameter block locations of the next three commands by copying the accumulator zero into each in turn — STA&72 etc.

The assembler would allow us to use STA&0072 but this is absolute addressing not zero-page addressing, it is unnecessary, uses another byte and is slower — always use zero-page mode if possible. We then load the accumulator with 255 (LDA #255) and use it to copy 255 into location &74 — in the parameter block.

LINE 130 — whenever we wish to call the routine we must give it the number of notes to play and where to start picking up the data. In calling a BASIC program it is possible to pass parameters into the machine code routine by using A%, X% or Y%. When a call is made the accumulator, X register and Y register contain the least significant byte of the last respective values given to the above resident variables.

In this case the calling program would be: X%=20; Y%=0; CALL %D00 (see line 240), thus in line 130 we pick up the values of X% (X register) and Y% (Y register) and store them in our counter stores at &79 and &7A respectively.

A second tune could be stored immediately after the first — all that is required to play it would be a new value of X% and Y% when the routine is called.

LINE 140 — The channel and volume are selected to 1 and -15 respectively and then passes to their correct places in the parameter block and we are now in the beginning of the loop (box 3). Note how we achieve a negative number by the use of &F1 (&FF = -1, &FE = -2 etc). However, after the four bytes that achieve this we now come to the collection of the data from the store. This is a frequently encountered function, namely the selection of one or more bytes from a 'look up' table.

It is achieved in nearly all microprocessors by one or more forms of 'Indexed Addressing'.

With the 6502 the address given at the beginning of the command is the start address, the last part — in this case the contents of the Y register — is the offset of the required address from the start. Thus the &D80 is always the start address and Y is loaded with the offset which Y was given at entry to the routine.

At the end of the loop the location &7A is incremented by two. So on the next turn around the loop the offset loaded into Y from &7A will pick up the next address.

LINE 150 — At the beginning of this line is 'check'. This is a line label used by the assembler as a reference point for jumps and branches (we will look in more detail next month). Following this the X, Y and accumulator registers are loaded with specific values before a call is made to the famous OSBYTE call at &FFF4. For the time being all we are interested in is that A = %80 (128) and that this call is equivalent to *FX128 in BASIC.

The purpose of the call is to check the contents of Sound channel 1 in this case, and it returns the number of spaces left in the buffer in register X. If the contents of the X register is transferred into the accumulator then the flag register is set. Thus for no spare spaces (returning 0 in X) then the zero flag will be set by executing the command TXA.

Then by using the BEQ branch comparison, which means if the zero flag is set, then branch to . . . , we arrange to try the test again until the buffer does have room. This is rather like dialling a phone number repeatedly until it is not engaged! 'BEQ check' says — branch to the line with the label 'check' if the zero flag is set.

LINE 160 — Having found space in the Sound buffer, we will now try and fill it by sending a new note to it. This is achieved by calling the routine OSWORD in the operating system. In this case, what I will call OSWORD7 (i.e. with 7 in the accumulator).

As you know we have the required SOUND information now stored in our parameter

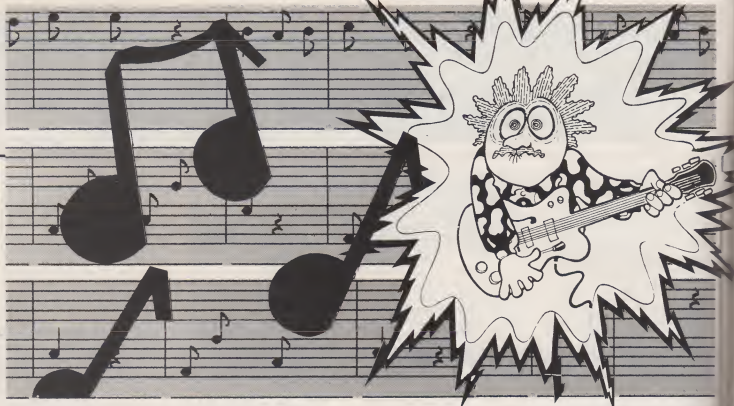
PROGRAM LISTING

```

10 REM -----
20 REM READ AND SAVE NOTES FOR MUSIC
30 REM -----
40 FOR IX = 0 TO 19 : READ PX,DX :
  ?(&D80+IX*2)=PX : ?(&D80+IX*2+1)=DX : NEXT
50 DATA 69,16,69,4,73,4,73,12,69,2,73,9,69,2,
  61,8,53,2,49,16,81,12,73,12,69,2,53,2,73,2,8
  1,6,73,6,69,12,61,12,53,12
70 REM -----
80 REM ASSEMBLE MACHINE CODE
90 REM -----
100 FOR IX = 0 TO 3 STEP 3
110 PX=&D00
120 [ OPT1 : LDA#0 : STA#72 : STA#76 : STA#7
  B : LDA#FF : STA#74 / set the fixed param
  eters of the OSWORD parameter block in zero-p
  age
130 STX#79 : STY#7A / collect the tune leng
  th and the data offset from XX & YX respectiv
  ely
140 .start LDA#1 : STA#71 : LDA#F1 : STA#73
  : LDY#7A : LDA#D80, Y : STA#75 : LDA#D81, Y : S
  TA#77 / store the variable parameters in th
  e block including collecting the first note f
  rom the data store
150 : CHECK LDY#FF : LDY#5FA : LDA#80 : JSR#
  FFF4 : TXA : BEQ check / check the sound bu
  ffer to see if there is space in it, check ag
  ain until there is
160 LDY#71 : LDY#0 : LDA#7 : JSR#FFF1 / se
  t X & Y registers to indicate the parameter b
  lock and call OSWORD with A=7 - the SOUND co
  mmand - feeds a note to channel 1
170 LDA#F6 : STA#73 : LDA#2 : STA#71 / cha
  nge the volume to -10 and the channel to 2
180 LDY#0 : LDY#71 : CLC : LDA#75 : ADC#8c0
  : STA#75 : LDA#7 : JSR#FFF1 / reset to the
  parameter block and add 2 octaves (96) to the
  pitch, then feed the note to channel 2
190 INC#7A : INC#7A : DEC#79 : BEQend : JMP s
  tart / increment the data pointer to the ne
  xt note data - 2 bytes forward - and decremen
  t the number of notes to be played - if zero
  finish else go and do another note
200 .end RTS
210 J
220 NEXT
230 MODE7 : PRINTTAB(5,10) "RECOGNISE THE TUNE
  "
240 XZ=20 : YZ=0 : CALL#D00
250 END

```

CONTINUED OVER



OSWORD call with A=7 (SOUND) requires 8 byte parameter block. Address of start of block given by Y (hi) and X (lo) on entry.
e.g. X=&71, Y=&0 for &0071

PARAMETERS

Address chosen	Function	Byte	Value
&71	Channel	LSB	0-4
&72	Channel	MSB	&00
&73	Amplitude	LSB	&FF-&F1
&74	Amplitude	MSB	&FF
&75	Pitch	LSB	&00-&FF
&76	Pitch	MSB	&00
&77	Duration	LSB	&00-&FF
&78	Duration	MSB	&00

OSBYTE call with A=12B (BUFFER CHECK)

Y=&FF
X=&FB channel 0
X=&FA channel 1
X=&F9 channel 2
X=&F8 channel 3
On return X equals the number of free spaces in the channel buffer.

Other values of X cause ADC and other machine buffers to be tested.

Fig 2. OSBYTE and OSWORD calls used.

block starting at address &71. We can tell the OSWORD system this by loading the X and Y registers before the call is made - Y contains the high two bytes of the address, X the lower two bytes. Thus we make Y = 0 and X = &71 and then make the call which will make the first note play on channel one.

LINE 170 - To give a harmony effect we now change the volume and channel information stored in our parameter block. This is achieved simply by loading the accumulator with each of the required values in turn (LDA #) and storing them in the required memory location (STA #).

LINE 180 - We achieve the harmony by picking a note two oc-

taves (96 semitones) higher than the main channel 1 note. Thus we go to call the OSWORD7 routine again we clear the carry flag (CLC), load the contents of our pitch location (at &75) to the accumulator, then add 96 (ADC #&60) and put the resulting value back at &75 in our parameter block. Then it's 'Play it again Sam!' on the second channel.

LINE 190 - Having loaded both the channel 1 & 2 buffers with the note, they will play almost simultaneously as I mentioned above. So we now move the offset pointer to the data in the next note and then reduce the number of notes to be played (DEC &79). This reduces to zero then the zero flag will again be set.

If the flag is set then there are no more notes to play so a branch is made to the line labelled 'end' (200 which returns control to the main program. Otherwise that returns control to the main program. Otherwise the next instruction Jumps us back to the 'start' line for the next note.

LINE 200 - This line labelled 'end' is purely the return from subroutine (RTS) and bounces us back to the BASIC program.

Finally the tune is played to your amusement - assume you loaded it in properly!

Hopefully this little program will encourage you to play around with short tunes. Perhaps with the routine itself to say all channels - there's nothing stopping you doing more information by using the data store and then loading the variable parameters in the block individually.

Having played a little of the assembler, next month you will look at it in more detail. It will introduce you more to flexibility and the various ways of defining machine code (P% remember).

Music Machine

R.K. Reading

Make music with the micro maestro.

Musical Machine is primarily a teaching aid for people learning a musical instrument like the flute. The program enables you to enter a tune you want to be able to play directly from the sheet music and then make the computer store it as a file, edit it or play it a number of times. This enables the instrument player to hear how his tune should be played. Also the program can be used to play the second part of a duet or can be used to write your own music.

To use the program first load "musica". This contains the instructions for the main program that follows. This program is automatically loaded when the instructions have been read. The program operates at its best if there is a disk drive, for this allows quick and easy access but it will work on tape as long as you remember whereabouts on the

tape your files are situated.

LIST OF VARIABLES

- DIM N(X) For the different types of note.
 DIM R(X) For the different types of rest.
 DIM V(X) For the value of each note.
 DIM L(X) For the length of each note.
 DIM P(X) For the length of rest between the notes.

LIST OF PROCEDURES

- PROCLoad Loads a tune on tape/disk.
 PROCsave Saves a tune on tape/disk.
 PROCplay Enables you to hear

- a tune.
 PROCMake Enables you to enter music.
 PROCedit Enables you to change entered music.

HOW THE PROGRAM WORKS

The first problem I encountered when formulating my ideas for the program was how the information was to be entered for each note. Was the music going to be entered when playing a tune on the computer or from sheet music? From my own use of such programs I rejected the first idea, on the grounds that one could not make very good tunes. Therefore I opted for the second which allows proper and interesting playback.

The next decision was how to enter the music. It became obvious that it would have to be a note and each note would have different variables like the length

($l(x)$), the gap between notes $p(x)$ and the different pitches of the notes $v(x)$. I decided to store these in arrays and therefore every note had a pitch length, value length and gap length.

I then realised that the length of notes and rests varies depending on the time signature of the tune and therefore I had to set the length of the different types of note or rest according to the time signature. This is done in line 900-970.

The best way to understand how the program works is to look at the sound statement. From this you can see that you need at least two variables, the pitch of the note and the length.

You know what you want to end up with, but if you are entering notes from music you have to work out their pitch and length in different stages because the note could have a sharp or a flat or it could be dotted. This is taken into consideration after the type of note is given its original length and pitch values.

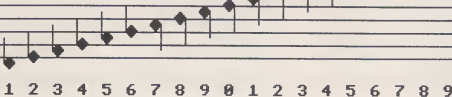
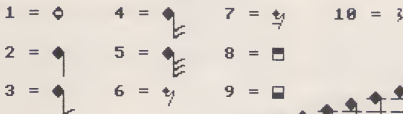
So first you enter the time signature and from this the computer sets the length the note or rest should be played for. Then it will ask questions about the note; if it is dotted it will add more to the original note value, if it is a sharp it will add more pitch value and if the note is a flat it will deduct a bit from the pitch value.

Thus the program works by first setting the initial values and then adding or subtracting, depending on the factors of the particular note.

If a note is slurred a gap between it and the next must be a zero. Therefore the program has to incorporate a delay loop which will be long or short depending on the note being slurred or not. This is done at line 1400 by changing the variable $p(x)$.

The original pitch value of the note is created by choosing a note from the ascending order on the screen and entering 1 to 19. From this number the computer allocates the correct pitch by reading it from data. If you enter 19, which means rest, the computer cannot sound a note that does not exist so it increases the gap from the last note entered by adding to $p(x)$ of the previous note.

MUSICAL MACHINE



- 1 LOAD TUNE 5 EDIT TUNE
 2 SAVE TUNE
 3 PLAY TUNE
 4 MAKE TUNE

ENTER CHOICE?4

The hard part of the program was setting the right lengths for the different notes in each time signature. If you want to insert an envelope into the pro-

gram it may cause the program to speed up or slow down. To counteract this the variables in lines 900-970 would have to be changed.

MAIN PARTS OF THE PROGRAM

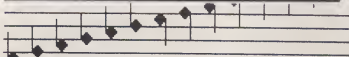
10-760	Sets up screen display.
859-1320	Allows you to enter tune.
1340-1430	Plays the tune.
1440-1490	Deals with entry of rest.
1510-1650	Saves tune.
1670-1810	Loads tune.

PROGRAM DETAILS

10-40	Notes about program.
50	Sets mode.
70-100	Sets variables.
120-300	Defines user defined characters.
320-440	Print text graphics on screen.
450	Joins text cursor to graphics cursor.
460-490	Print text at graphic locations.
500-560	Print notes in ascending order.
570-600	Draws staves from data.
610-620	Data from staves.
630-680	Draws ledger lines from data.
690	Data for ledger lines.
700	Sets up a text window.
730-760	Prints menu on screen.
770	Accepts choice.
780-820	Depending on choice does procs.
860-870	Accepts time signature.
880-890	Checks for illegal entry.
900-970	Depending on time signature sets up length of notes and rests.
980	Accepts note number.
990-1000	Checks for illegal entry.
1010	Accepts note value if 19 goto proccst.
1020-1030	Checks for illegal entry.
1040-1060	Gives pitch value to note entered.
1070	Data for pitch value.
1080	Accepts if note has flat or sharp.
1090-1100	Checks for illegal entry.
1110-1120	Increase or decrease pitch value accordingly.
1130	Accepts type of note.
1140-1150	Checks for illegal entry.
1160	Accepts if dotted note.
1170-1180	Check for illegal entry.
1190-1200	Increase length value of the note accordingly.
1210	Accepts if slurred.
1220-1230	Checks for illegal entry.
1240	If slurred then makes gap between notes.
1250	Accepts enter edit any more notes.
1260-1270	Checks for illegal entry.
1280	If answer yes then goto 980.
1290	If answer no accepts no. of notes in tune.
1300-1310	Checks for illegal entry.

1320	Goto menu.
1350	Accepts how many times tune to be played.
1360-1370	Checks for illegal entry.
1380	Sets loop for times to be played.
1390	Sets loop for no. of notes in tune.
1400	Produces gap between notes.
1410	Plays note.
1420	Loops: stops sound after last note.
1430	Goto menu.
1440-1480	Accepts rest no. goto 1010.
1510	Save tune procedure.
1520	Accepts file name.
1530	Check file name not longer than three letters.
1570-1600	Saves variables into file.
1610	Closes file.
1630-1640	Delay loop.
1650	Goto menu.
1670	Load file procedure.
1680	Accepts file name.
1690	Check file name not longer than three letters.
1730-1760	Loads file.
1770	Close file.
1790-1800	Delay loop.
1810	Goto menu.

PROGRAM LISTING



```

50  MODE4
60  CLS
70  VDU23:8202:0:0:0;
80  VDU19:1.6,0.0,0.19,2.4,0.0,0
90  COLOUR2:COLOUR129:PRINT:SPC(50);"INSTRUCTI
ONS";SPC(18)
100 COLOUR3:COLOUR128
110 PRINT:PRINT
120 PRINT"This program contains the instructio
na"
130 PRINT"for the music program that follows.W
hen"
140 PRINT"the next program has been loaded and
is"
150 PRINT"running the first thing you will be"
160 PRINT"confronted with is a screen display"
170 PRINT"On the screen will be a series of no
tes"
180 PRINT"in ascending order with a code numbe
r"
190 PRINT"under them.Above these notes will be
the"
200 PRINT"different type of note which you can
"
210 PRINT"choose followed by there code number
"
220 PRINT"The computer will first ask you to e
nter"
230 PRINT"1 LOAD TUNE,2 SAVE TUNE,3 PLAY TUNE"
240 PRINT"4 MAKE TUNE,5 EDIT TUNE and you repl
y"
250 PRINT"with the number you want.When making
a"
260 PRINT"tune the computer will first ask"

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CONTINUED OVER

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270 PRINT"NUMBER OF THE NOTE this means you en
tes"
280 PRINT"1 if it is the first note in the tun
e"
290 PROCWAIT
300 PRINT"Next it will ask you to enter the CO
DE"
310 PRINT"NUMBER OF THE NOTE this being the nu
mber"
320 PRINT"directly below the note which is in
the"
330 PRINT"ascending order of notes.Next it wil
l"
340 PRINT"ask DOES IT HAVE A SHARP OR FLAT the
"
350 PRINT"answer being 1 for sharp,2 for flat
and"
360 PRINT"RETURN for neither.It will then ask
for"
370 PRINT"THE TYPE OF NOTE it is i.e. the code
"
380 PRINT"number which refers to,for example,a
"
390 PRINT"crotchet.Next is it a DOTTED NOTE an
swer"
400 PRINT"y or n.Next is it SLURRED answer y o
r n."
410 PRINT"And last of all it will ask if you w
ant"
420 PRINT"to enter more notes or edit any answ
er"
430 PRINT"y or n.If there is a rest you enter
0"
440 PRINT"when it asks for the note number"
450 PRINT"then enter the type of rest it is."
460 PRINT"It won't except a file name greater"
470 PRINT"than three letters long.To edit"
480 PRINT"you enter the number of the note"
490 PRINT"you want to edit and follow the"
500 PRINT"normal procedure for entering a new
tune"
510 PROCWAIT
520 CLS:PRINTAB(8,20):"LOADING MUSICAL MACHIN
E":PRINTAB(15,21):"":CHAIN"MUSICB"
530 DEF PROCWAIT
540 PRINTAB(8,25):"<PRESS ANY KEY TO CONTINUE
">":AS=GET$
550 CLS
560 ENDPROC
PROGRAM LISTING 2
50 MODE4:CLS
60 REM SET VARIABLES
70 DIM N(5):DIM R(10):DIM V(200):DIM L(200):D
IM P(200)
80 FOR X= 1TO 200
90 LET P(X)=1
100 NEXT
110 REM DEFINE CHARACTERS
120 VDU 23,240,24,60,126,255,255,126,60,24
130 VDU 23,241,24,60,126,194,194,126,60,24
140 VDU 23,242,0,32,112,249,115,37,57,2
150 VDU 23,243,255,255,255,255,129,129,129,255
160 VDU 23,244,255,129,129,129,255,255,255,255
170 VDU23,245,0,24,36,66,66,66,66,66
180 VDU23,246,66,36,36,36,36,36,24,16
190 VDU23,247,48,83,156,184,168,164,180,147
200 VDU 23,248,0,128,64,64,32,32,16,16
210 VDU23,249,81,81,77,65,65,33,33,31
220 VDU23,250,16,16,32,32,64,64,64,192
230 VDU23,251,1,1,1,1,66,34,36,24
240 VDU23,252,128,128,128,128,128,128,128,128
250 VDU23,253,128,128,128,128,135,156,240,224
260 VDU23,254,135,156,240,224,135,156,240,224
270 VDU23,226,56,8,16,48,56,12,24,32
280 VDU23,255,128,128,128,128,128,128,128,128
290 VDU23,227,2,4,4,8,8,0,0,0
300 VDU23,225,2,252,4,8,8,0,0,0
310 REM SCREEN DISPLAY
320 PRINTTAB(13,2):"MUSICAL MACHINE":
330 PRINTTAB(12,3):"=====":
340 PRINTTAB(3,5):"1 = ";CHR$(241):" 4 = ";
CHR$(240):" 7 = ";CHR$(242):" 10 = ";CHR$(22
6)
350 PRINTTAB(25,6):CHR$(225)
360 PRINTTAB(16,12):CHR$(227)
370 PRINTTAB(3,8):"2 = ";CHR$(240):" 5 = ";
CHR$(240):" 8 = ";CHR$(243)
380 PRINTTAB(3,11):"3 = ";CHR$(240):" 6 = "
:CHR$(242):" 9 = ";CHR$(244)
390 PRINTTAB(3,21):"1 2 3 4 5 6 7 8 9 0 1 2 3
4 5 6 7 8 9":
400 PRINTTAB(1,15):CHR$(245);
410 PRINTTAB(1,16):CHR$(246);
420 PRINTTAB(1,17):CHR$(247):CHR$(248);
430 PRINTTAB(1,18):CHR$(249):CHR$(250);
440 PRINTTAB(1,19):CHR$(251);
450 VDU5
460 MOVE255,752:PRINTCHR$(252):MOVE543,848:PRI
NTCHR$(252)
470 MOVE255,720:PRINTCHR$(252):MOVE543,816:PRI
NTCHR$(254)
480 MOVE543,752:PRINTCHR$(253):MOVE543,720:PRI
NTCHR$(254)
490 MOVE254,656:PRINTCHR$(252):MOVE254,624:PRI
NTCHR$(253)
500 LET X=96:LET Y=416
510 FOR T=1 TO 18
520 MOVEX,Y:PRINTCHR$(240)
530 IF T>=7 THEN MOVEX+31,Y-16:PRINTCHR$(252):
MOVEX-31,Y-48:PRINTCHR$(252):GOTO5050
540 MOVE X,Y-16:PRINTCHR$(255):MOVE X,Y+48:PRI
NTCHR$(255)
550 LET X=X+64:LET Y=Y+16
560 NEXT
570 FOR X=1 TO 5
580 READ A:READ B:READ C:READ D
590 MOVE A,B:DRAW C,D
600 NEXT
610 DATA 0,416,1280,416,0,448,1280,448,0,480,1
280,480
620 DATA 0,512,1280,512,0,544,1280,544
630 Y=576
640 FOR P=1 TO 16
650 READX
660 MOVEX,Y:DRAW X+48,Y

```

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670 IF P=7 OR P=12 OR P=15 THEN LET Y=Y+32
680 NEXT
690 DATA 795,859,923,987,1051,1115,1179,923,98
7.1051,1115,1179,1051,1115,1179,1179
700 VDU4
710 REM PRINT COMMANDS
720 VDU28,0.31,39,23
730 PRINT"1 LOAD TUNE 5 EDIT TUNE":VDU10
740 PRINT"2 SAVE TUNE":VDU10
750 PRINT"3 PLAY TUNE":VDU10
760 PRINT"4 MAKE TUNE"
770 PRINTTAB(20,28);"          ENTER CHOIC
E":INPUT J
780 IF J=1 THEN PROCLOAD
790 IF J=2 THEN PROCSAVE
800 IF J=3 THEN PROCPLAY
810 IF J=4 THEN PROCMAKE
820 IF J=5 THEN PROCMAKE
830 GOTO 730
840 REM ENTER TUNE
850 DEFPROCMAKE:CLS
860 PRINT"ENTER TIME SIGNATURE TOP NO. FIRST"

870 INPUT A:INPUT B
880 IF A>1 AND A<7 AND B>3 AND B<9 THEN GOTO 9
00
890 CLS:GOTO 860
900 IF A=6 AND B=8 THEN LET N(1)=10.5:N(2)=5.2
5:N(3)=2.625:N(4)=1.3125:N(5)=0.65625
910 IF A=4 AND B=4 THEN LET N(1)=14:N(2)=7:N(3
)=3.5:N(4)=1.75:N(5)=0.875
920 IF A=3 AND B=4 THEN LET N(1)=10:N(2)=5:N(3
)=2.5:N(4)=1.25:N(5)=0.625
930 IF A=2 AND B=4 THEN LET N(1)=8:N(2)=4:N(3)
=2:N(4)=1:N(5)=0.5
940 IF A=6 AND B=8 THEN LET R(6)=2.625:R(7)=1.
3125:R(8)=21:R(9)=10.5:R(10)=5.25
950 IF A=4 AND B=4 THEN LET R(6)=3.5:R(7)=1.75
:R(8)=28:R(9)=14:R(10)=7
960 IF A=3 AND B=4 THEN LET R(6)=2.5:R(7)=1.25
:R(8)=20:R(9)=10:R(10)=5
970 IF A=2 AND B=4 THEN LET R(6)=2:R(7)=1:R(8)
=16:R(9)=8:R(10)=4
980 CLS:PRINT"ENTER NOTE NO.":INPUTX:CLS
990 IF X>0 THEN GOTO 1010
1000 GOTO 980
1010 PRINT"ENTER NOTE VALUE":INPUT C:IF C<19 TH
EN PROCREST:GOTO1250
1020 IF C<0 AND C<20 THEN GOTO 1040
1030 CLS:GOTO 1010
1040 FOR T=1 TO C
1050 READ D:NEXTY
1060 LET V(X)=D
1070 DATA109,117,121,129,137,145,149,157,165,16
9,177,185,193,197,205,213,217
1080 CLS:PRINT"DOES IT HAVE A SHARP OR FLAT 1 0
R 2":INPUT Z
1090 IF Z=1 OR Z=2 OR Z=3 THEN GOTO 1110
1100 GOTO 1080
1110 IF Z=1 THEN LET V(X)=V(X)+4
1120 IF Z=2 THEN LET V(X)=V(X)-4
1130 CLS:PRINT"ENTER TYPE OF NOTE":INPUT E
1140 IF E<0 AND E<6 THEN GOTO 1160
1150 GOTO 1130
1160 CLS:PRINT"IS IT A DOTTED NOTE":INPUT C$
1170 IF C$="H" OR C$="Y"THEN GOTO 1190
1180 GOTO 1160
1190 IF C$="Y"THEN LET L(X)=N(E)+(N(E)/2)
1200 IF C$="H"THEN LET L(X)=N(E)
1210 CLS:PRINT"IS IT SLURRED":INPUTCS
1220 IF C$="H" OR C$="Y"THEN GOTO 1240
1230 GOTO 1210
1240 IF C$="Y"THEN LET P(X)=0 ELSE P(X)=1
1250 CLS:PRINT"ENTER OR EDIT MORE NOTES":INPUT
CS
1260 IF C$="H" OR C$="Y"THEN GOTO 1280
1270 GOTO 1250
1280 IF C$="Y"THEN RESTORE1070:GOTO 980
1290 CLS:PRINT"ENTER AMOUNT OF NOTES IN TUNE":I
NPUTQ
1300 IF Q>0 THEN GOTO 1320
1310 GOTO 1290
1320 CLS:RESTORE1070:ENDPROC
1330 REM TUNE
1340 DEFPROCPLAY
1350 CLS:PRINT"HOW MANY TIMES":INPUTC
1360 IF C>0 THEN GOTO 1380
1370 GOTO 1350
1380 FOR T=1 TO C
1390 FOR Y=1 TO Q
1400 SOUND $0001,0.0,P(Y)
1410 SOUND $0001,-15,V(Y),L(Y)
1420 NEXT:NEXT: SOUND $0001,0.0,0:CLS
ENDPROC
1430
1440 DEFPROCREST
1450 CLS:PRINT"ENTER REST NUMBER":INPUT C
1460 IF C>5 AND C<11 THEN GOTO 1480
1470 GOTO 1450
1480 LET P(X)=1-R(C)
1490 ENDPROC
1500 REM SAVE FILE
1510 DEFPROCSAVE
1520 CLS:PRINT"ENTER FILE NAME":INPUT FILE$
1530 LET FILE=INT(VAL(FILE$)):IF LEN(FILE$)>3 T
HEN PRINT"FILE NAME TOO LONG":GOTO1390
1540 FILE$="FILE"-FILE$
1550 Y=OPENOUT FILE$
1560 PRINT"SAVING"
1570 PRINT#Y,X,Q:FOR S=1 TO Q
1580 PRINT#Y,V(S),L(S),P(S)
1590 NEXTS
1600 PRINT#Y,A,B
1610 CLOSE#Y
1620 CLS:PRINT"FILE HAS BEEN SAVED"
1630 FOR V=1 TO 1000
1640 NEXT
1650 ENDPROC
1660 REM LOAD FILE
1670 DEFPROCLOAD
1680 CLS:PRINT"ENTER FILE NAME":INPUT FILE$
1690 LET FILE=INT(VAL(FILE$)):IF LEN(FILE$)>3 T
HEN GOTO 1680
1700 FILE$="FILE"-FILE$
1710 Y=OPENIN FILE$
1720 PRINT"LOADING":FILE$
1730 INPUT#Y,X,Q:FOR S=1 TO Q
1740 INPUT#Y,V(S),L(S),P(S)
1750 NEXTS
1760 INPUT#Y,A,B
1770 CLOSE#Y
1780 CLS:PRINT"FILE HAS BEEN LOADED"
1790 FOR V=1 TO 1000
1800 NEXT
1810 ENDPROC

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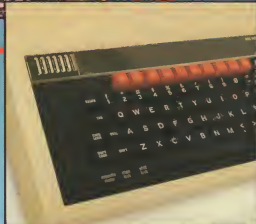
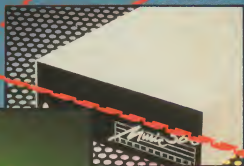
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Econet is basically linear or bus-type (as opposed to radial, tree or ring), but can have connecting cables not longer than 2m going to single stations. The minimum network would consist of a cable with a clockbox and terminators. Econet cables can be 500m or more long and this much costs about £300 to £350. Shorter networks can use a lower cost cable.

The clockbox provides a frequency standard (of 100 to 200kHz) and the terminators are necessary to prevent "reflections" from the ends of the cable, which would corrupt the signals. The clockbox, two terminators and three double socket boxes are sold together as a Start Up kit for £115, including VAT. This minimum configuration would provide communication between stations — which is as much as, or more than, some other networks provide at best.

With Econet however, it is usual to have central filing (from a "file server") and printing (from a "print server") as well. Any number of file servers or print servers may be used on one network. The file servers have been based on various Acorn computers over the years and three "levels" are now offered — as detailed below.

The individual stations can also have their own "local" filing systems (which may be cassette or disc). Those with discs need

Felsted School provides the perfect environment for a study of Econet and to test the very latest version.

only the disc interface hardware, which costs about £100 including VAT, since the Disc Filing System is now combined with the NFS.

The print server machine is fitted with a special ROM — costing about £50 — which makes the printer available to any station on the network — one at a time. The printing takes place "in background", so the print server machine can still be used as a work station. Individual stations can also have their own (local) printer, which need not therefore be available to the network.

This article is an appreciation of Econet, based on seeing a major installation — that at Felsted School — in action, and talking to users and to the Econet design engineers at Acorn.

THE LEVEL 1 FILE SERVERS

The first Econet file servers consisted of an Acorn System 3 micro-computer, with at least 16K of RAM, and one single-sided 40-track floppy disc drive of 100K (see Table 1). The Level 1 file server software offers a partitioned file structure, using single-letter directories, with 31 files per surface — identical to the Acorn (local) DFS (as used later on the Beeb). It is written in BASIC, and hence is relatively slow.

Because of the limited filing system and the low transfer speed, Level 1 file servers usually have only up to about 10 or 20 machines connected. However, this is not a hard limit and up to 40 are possible.

Felsted acquired their System 3 file server in August 1981, and connected three

Atoms to it, each fitted with the Version 1 Network Filing System (NFS) ROM (see Table 2). Later they upgraded it to the equivalent of a System 4 — by increasing the RAM to 48K and substituting two double-sided 80-track floppy disc drives, totalling 800K. Since September 1981, it has been running Level 2 file server software and the number of machines, now Beebs, connected increased to 20 by December 1982. They are fitted with Version 3 NFS ROMs.

The System 3/4 file server has since been transferred to the Preparatory School — where it is still working, with five Beebs connected, all located in a single computer room.

This file server — based on the system — is no longer offered by Acorn but has been replaced by one based on the single-processor Beeb. It is supplied with a floppy disc filing system — with either one single-sided 40-track, or two double-sided 80-track disc drives.

THE LEVEL 2 FILE SERVER

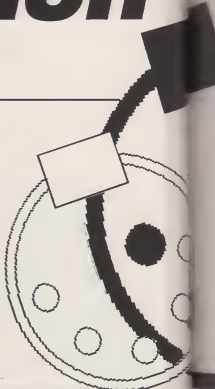
This "Advanced file server" is based on a Beeb with a 6502 Second Processor. The latter is needed to run the larger file server program and to increase the "cache" memory from about 12 to 42K — to improve the speed of the file transfer. Up to 40 users can be supported, with only short waiting times. This file server uses one or two double-sided 80-track disc drives. They are treated as one or two logical drives (as opposed to four physical surfaces).

The Level 2 file server software is written in machine code

— and hence runs much faster. With it, the speed of file transfer over Econet is comparable with that to and from a (local) floppy disc — at up to 8K per second with a floppy disc file server (and up to 16K per second with a Winchester disc file server — see below).

The Level 2 file server software offers a full hierarchical (or tree) file structure, loosely modelled on the Unix operating system. "Pathnames" describe the path from the "root" directory (\$), which may have up to 255 objects — either files or further directories themselves — and so on, until the last directory on that branch of the tree, which contains only files. Since there can be many levels of directories below the root in the pathname, a Level 2 file server allows an almost unlimited number of files per logical disc surface. This is a far cry from the 31 files per actual disc surface of the Level 1 file server!

This file structure is designed to be as similar as possible in appearance and behaviour to the Acorn Advanced DFS (ADFS) — as used on the Electron with the new Plus 3 disc system, a single Beeb when using the Acorn Winchester, and the new ABC Personal Assistant. The ADFS also allows many levels of directories, each with up to 47 objects (directories or files).



sions) can be selected as the "currently selected directory" — using the *DIR partial pathname command. *CAT then produces a catalogue of the files in just that directory. Any file on another path can still be accessed (again subject to permissions) — e.g. for loading and saving — by using its full pathname.

The file size limit is far above the 12K (by allocation) of the Level 1 file server or the 256K (due to system characteristics) of the Acorn (local) DFS. It is in fact 16MB for Level 2 (and Level 3, see below), though it can be limited by allocation.

Access to the higher reaches of the Econet Level 2 file server file structure, up to the root directory, is controlled by passwords. Directories and files can be set for owner or public access to be read only or both read and write. To avoid the need to use the full pathname every time, any directory (subject to the access permis-

sions) can be selected as the "currently selected directory" — using the *DIR partial pathname command. *CAT then produces a catalogue of the files in just that directory. Any file on another path can still be accessed (again subject to permissions) — e.g. for loading and saving — by using its full pathname.

The Version 1 and 2 NFSs were for use with Atoms as stations and Version 2 was not officially released, but Version 3 — suitable for both Atoms and Bees — allows a network address from 1 to 127, as well as a station address from 1 to 254. (Networks may be connected by Bridge units — see below.)

With the Level 2 file server and a Version 3.6 or later NFS, it is possible for the same machine to act as both file server and print server — since printing (from the network) is done in the

background, while the file server runs in the foreground.

Well before the Acorn Winchester disc drives became available, Felsted built their own Winchester disc file server. This runs SJ (Spence Jones) file server software (written by Andrew Gordon — formerly a pupil at Felsted) on a Nascom microcomputer with 64K of RAM. It controls an International Memories Inc. (IMI) Winchester disc of 18MB formatted, which they bought in May 1981. Thanks to the bank-switching feature of its Z-80 Central Processor Unit (CPU), the Nascom has a separate cache memory of 48K. The maximum file size is 8MB — as for CP/M. This file server took over the task of supporting all the work stations on the network.

Some 15 machines are fitted with (local) disc interfaces and DFSs (as well as NFSs). One is needed on each file server machine — for loading the file server software and other network tasks. Several machines have larger 20-inch colour monitors as well as normal 12-inch monochrome monitors.

THE LEVEL 3 FILE SERVER

This was announced at Compec last November and uses the same hardware as Level 2 — a Beeb with a 6502 Second Processor. Compared with Level 2, the software offers exactly the same file structure, but uses a real-time clock (rather than manual input) for date stamping of files. It is intended primarily for use with Acorn's own Winchester disc drives, and allows up to 80 users.

The Winchesters can be of 10MB, costing £1724 including VAT, or 30MB, costing £2644 including VAT. Up to four such drives (together with up to four logical floppy disc drives) can be connected to one Level 3 file server.

Networks may be linked by a "Bridge" unit, which comprises a 6502 Processor, with 8K of RAM acting as a cache memory. This provides asynchronous, buffered communication between the two networks. However, as well as communicating between machines on the two different networks, it is also possible for users to log onto file servers or output to printer on any linked network. (This is valuable if any should "go down".) Bridge units became available from January 1985 and cost around £230 including VAT.

Since the total number of machines connected to the Felsted system is only about 38, (and will still be only say 43 with the Preparatory School added), it could perfectly well be run as one network. However, it has been divided into two parts, with an Acorn Bridge Unit linking them. The internal network room, is some 30m long and operates at a clock frequency of 200kHz, while the External network, with about 12 machines spread throughout the rest of the school, is some 700m long and operates at 100kHz.

A second file server, using an Acorn Winchester disc of 10MB, has been connected to the External network and has

CONTINUED OVER





operated since May 1984. Users are able to be logged on to both Winchester file servers at once, and so have access to the maximum number of files.

There are about six other Beebes around the school, which are not connected to the network. One is used by a master for preparing course material and administration in the workshop (although the network is available nearby). Another is in the ground floor flat of one of the masters, who is disabled. It allows him to write letters and prepare course material, using View. (The flat is some distance from the present extent of the network.)

Connecting the Preparatory School network to the main system will enable it to share the central resources much more easily — rather than being limited to transferring floppy discs — as at present. So far it has not been connected to the main network — because it requires getting the cable across a main road. Alternatively, a BT Kilostream link could be used (see below).

MANAGING THE NETWORK

Econet, like any other network, requires a Network Manager — to ensure efficient operation and carry out a number of tasks. Some may be carried out from the user station, while the file server program is running, including: adding and deleting users of the network, creating in the root directory directories in which users can store their own files and saving useful files in the root directory or library, for users to load and run at their stations. Other tasks have to be carried out from the file server machine while it is not running the file server program. These include: preparing new file server discs and backing them up regularly and transferring files from DFS to file server format.

The Network Manager may also be responsible for setting up and commissioning the installation — e.g. adding stations, arranging for extension of the

cable, relocating the clock box (which must be close to the midpoint of the cable) etc. At Felsted, Chris Dawkins has seized every opportunity to run out cables — which has greatly helped to keep costs down.

ECONET COMMANDS

To log on, when you know that you want the default file server and a directory on that file server — e.g. BB, you may type: *I AM BB. Alternatively, if you want another file server and have a private directory, you may type: *I AM 250 FRED RETURN — where 250 is the machine number of the other file server and FRED is your "username". The file server software then puts up a colon and, when you type your password, it does not appear on the screen.

However, most users at Felsted use a 'BOOT menu logon option. This is entered by pressing Shift/Break as usual and then offers information on which network you are on and which file server you are using and a two-line area for messages, together with 16 options available on single keys (see below).

Most of the other Econet commands are the same as those available with other read and write filing systems, such as the Acorn (local) Disc Filing System. The *ACCESS command is extended to permit writing to, reading from and deleting of a file separately for the owner and for other Econet users.

Certain users are known as SYSTEM users — who have ac-

cess to the root directory, and therefore all directories on a file server disc. One such user (normally the Network Manager) is present already in the Password file of the file server master disc, but the privilege can also be extended to others.

Other commands are intended for use by supervisors or teachers. Thus *VIEW copies another station's screen to yours. *REMOTE takes over another machine completely and disables its keyboard and *NOTIFY allows a one-line message to be sent to another station. *PROT allows you to stop other users from using *VIEW, *REMOTE or *NOTIFY on your station.

Yet more facilities are available via machine code programming, using "Econet primitives". For example, BROADCAST enables a common message or data to be sent to all logged on stations.

SOFTWARE AT FELSTED

The software available on the Felsted network — direct from the 'BOOT menu includes:

- A database of Old Felstedians. This allows information on any former pupil since 1910 to be selected from the 6893 entries in a 1MB file in an average time of three seconds.
- A similar database on present pupils — with some 623 entries. This is used as input to a computer-aided type-setting system, to prepare a printed version each year.
- Separate directories for sub-

jects such as Business Studies and Economics, Chemistry, Geography and Music — each having their own sub-menu, with single-key selection.

- A "directory login", which allows you to log into any of the 120-odd other directories on the system. This is a simple and fast alternative to the standard *I AM FRED-type command, and asks for a password if necessary.

- The Teletext server, from which you can select any "page" on any of the four TV channels. The software — written by Chris Dawkins — also allows subjects such as *NEWS, *SPORTS and *WEATHER to be accessed directly.

- The Microelectronics Education Programme and Computer Park Viewdata systems. These are accessed via a modem and telephone lines.

- A Noticeboard system — which was written by a Felsted pupil. This single Teletext-style Mode 7 screen is also displayed continuously on one large colour monitor and three smaller green-screen monitors in highly visible locations around the school. Two Beebes are currently dedicated full-time to this one task, while two more are used part-time (e.g. between lessons). Four separate message areas are available: "Headmaster", "Common Room" (i.e. other staff), "Sports" and "General". After entering appropriate passwords, any machine on the network may be used to edit these files, which are used to update the screen every minute.

- The "Converse" program — which was also written by a Felsted pupil. It allows up to

seven machines to communicate all at once. Any key depression on any station is BROADCAST by the program and each screen is divided into seven three-line areas — one for each machine. It thus provides a useful conferencing facility. As with the Teletext server. Converse is only possible on a network which — like Econet — permits machine to machine communication via open "channels".

● A workshop material stock control system — also menu-driven.

Felsted also uses an (acoustic) modem — for accessing Prestel and for (external) electronic mail via BT Gold (Mailbox No. 81:FL5001).

The Beeb Operating System makes it very easy to add utilities which extend the NFS. These may be called by * filename *. One such is called *PUTGET and creates a buffer in pages 9, A and C — to enable the transmission of files in 128 byte blocks, rather than character-by-character.

SIDEWAYS ROM/RAM PROGRAMS

Acorn do not offer Sideways

RAM boards for the Beeb, which would allow ROM software to be downloaded from a network file server (or from a local disc drive). However, many sideways ROM extension boards offer one 16K bank of sideways RAM, while Sideways RAM-only boards are available from several suppliers — e.g. 1 x 16K from Hybrid Memory Systems, 2 x 16K from Opus Supplies and 1, 2, 8 or 16 x 16K from Solidisk Technology Ltd.

Many software houses actively discourage such downloading for reasons of copyright. The solution currently offered by Acornsoft to multiple (e.g. network) users is substantial discounts on ROM software when purchased in bulk — e.g. 50 per cent on quantities of 10 or more.

The alternative approach is for software houses to grant or sell a "site licence" — for which there are plenty of precedents for mini-computers and mainframes. Working with other schools, Felsted has reached agreement with some software houses (including Computer Concepts for Wordwise and other ROM products).

The Felsted machines are used extensively for word processing — mostly with Wordwise, but one using View. A vast

amount of written material is prepared in this way.

EXPERIENCE WITH ECONET

As Chris Dawkins points out, while 40 independent machines might each have access to 100 files, each of the networked machines has access to over 2000 files, and there need be no duplication of these. Moreover, with suitable software, single facilities such as a Teletext Adaptor and a Telephone Server (a Beeb dedicated to a telephone modem) can be shared by all 40 machines.

Clearly, several of these programs and facilities would be equally useful in commerce and industry.

The Felsted network file servers normally operate 24 hours a day, seven days a week, year round — including holidays. Reliability has been very good overall — especially when allowance is made for the fact that some parts (the Nascom-controlled IMI Winchester file server) have been built at Felsted, while others (the Acorn Winchester and Bridge Unit) are prototypes, supplied before their official launch.

The number of Econet

systems installed worldwide is over 3000 to date. Most are in the U.K., but they are also to be found in Australia, Germany, India and the U.S.A.

FURTHER ECONET DEVELOPMENTS

It will be possible to use Electrons as work stations in the near future. To provide the Econet interface, they will require Plus 2 add-ons — which have yet to become available. However, they promise to be even less costly than those based on Beebs, while still having proper moving key-switch, typewriter quality keyboards and 80-column display modes — all of which are essential for business use.

In addition, the new Acorn Business Computers are all to be fitted with Econet interfaces as standard. Part of the reason for adopting the ADFS for the Electrons and ABCs is so that there is maximum consistency in concepts and practice between the local disc filing system and the network filing system.

Networks can be joined together with Bridge units, as at Felsted. Acorn themselves have about ten — eight at Cherry Hinton and two in the centre of Cambridge. However, by having the two halves of a bridge unit at either end of a BT "Kilostream" link, all the stations on all the networks can intercommunicate. Thus, as well as extending locally, any Econet system may connect between two or more widely separated sites.

Although there may be a great many machines on such a multiple network system — and even more users than there are machines — the Econet Level 2 and 3 software can handle them. For example, Acorn themselves have around 1000 users — all with their own passwords. These are all held in a single file "PASSWORDS" in the "root" directory, alongside several group directories — each containing the personal directories of up to 255 users.

CONTINUED OVER



POSSIBLE FUTURE DEVELOPMENTS

● **Electronic Mail.** The present one-line message issued with *NOTIFY can only be received by a station that is both switched on and logged on. However, electronic mail could be delivered into a user's "mail box" file on the file server — even when their station was switched off. Acorn have not yet released any electronic mail software, but it is known to be under development.

● **CPU servers.** This is a concept familiar to Acorn, since it works like a normal Beeb and Second Processor. Thus the user's workstation provides the Input/Output processor, which uses the CPU server to provide greatly enhanced computing power. Once again, the great virtue of accessing this over a network is that the resource may be shared between many users.

Simple, single-tasking is possible with all the Second Processors, with the present software. Some of the "Second Processors" (e.g. the 32016 and 80286) can support multi-tasking — but the software needs modifying before this will be possible

over Econet. Again, no product has yet been released, but it is known to be under development.

● **Optical discs** will have storage capacities measured in 100s or 1000s of Megabytes — i.e. 100 to 1000 times as much as the largest floppy discs or 10 to 100 times as much as Winchester discs. Initially they will be read-only, but this is ideal for many applications — where rapid access is required to large volumes of semi-permanent data or text.

Again, the cost and capacity of such resources means that shared access via a network makes much more sense. Acorn Video already offer systems for the interactive control of optical video discs. This has yet to be extended to optical data discs and access via Econet.

CONCLUSIONS

Econet has been designed by Acorn to allow their computers — such as the BBC Micro — to share floppy and Winchester disc drives, printers, telex adaptors and modems (for on-line databases and (external) electronic mail). The cable technology chosen allows file transfer at speeds that are entirely adequate, while keeping the cost to a very low level, compared with other local area networks.

Also, while you do not have to pay for the Econet interface hardware until you require it, full provision is made in the standard cassette Beeb — in both the design and the physical provision of sockets in the main board. The same approach is used for the local Disc Filing System, which may also — but need not — be fitted to work station machines.

However, with its capability of up to 254 work stations per network, (compared with only 16, 32 or 64 on others) and for multiple linked networks, Econet has far greater potential for connecting all the work stations in a company or school — rather than just all those in a department or class.

With over 3000 installations worldwide since the launch in November 1980, Econet may well have the largest user base of any local area network. Moreover, as demonstrated at Felsted, both performance and reliability have been good.

Very soon it will also be possible to use Electrons and ABCs as work stations on Econet networks.

Further ahead, Econet offers the prospects of (internal) electronic mail over single or multiple-site networks and the sharing of CPUs of much higher computing power and optical

discs of very large storage capacity.

I am grateful for the assistance that I have received in preparing this article from Mr Chris Dawkins at Felsted and from the Econet design engineers at Acorn.

FELSTED SCHOOL

The school was founded in 1564 and moved to the present site (nearby) in 1877. It has some 623 pupils — made up of 150 boys in the Preparatory School, 417 boys in the Senior School and 56 girls in the Sixth Form.

All third form pupils receive an introductory course on computing — of one and a quarter hours a week for five or six weeks. There is no formal instruction of fourth and fifth form pupils but those in the sixth form can opt for a two-year course leading to either "O" or "A" Level Computing. (Chris Dawkins is the (almost) full time teacher.)

All pupils can also use computers in many other lessons including business studies and economics, chemistry, geography, mathematics, music and workshops.

Table 1 — Econet File Servers

Software	Hardware	Systems			Processors		Disc Drives	
		3	4	5	BBC's	2nd Proc.	Floppy	Hard
Level 1 (BASIC)	*	*	*	*	Single	2nd Proc.	Up to 2 (surfaces)	—
Level 2 (m/c code)	—	*	*	—	—	*	Up to 2 (logical)	—
Level 3 (m/c code)	—	—	—	—	—	*	Up to 4 & Up to 4 (logical)	—

Table 2 — Econet Work Stations

Software	Hardware	Atoms	BBCs
NFS Version 1		*	—
NFS Version 2		*	—
NFS Version 3		*	*

PRINTERS

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All printers have centronic parallel interface unless otherwise stated. All printers have hi-res dot addressable graphic mode. Please send SAE for full details.

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FX100 160CPS 15" wide friction & tractor feed	£499 + VAT £574
RX80 F/T 100CPS 10" wide friction & tractor feed	£239 + VAT £275
RX80 100 CPS 10" wide tractor feed	£199 + VAT £229
RX100 F/T 100 CPS friction & tractor feed	£385 + VAT £443
8143 RS 232 Interface for FX and RX printers	£39 + VAT £45
8148 RS 232 Interface with 2K buffer x on x off	£60 + VAT £69
Ribbon Cartridge for RX80 FX80 & MX80	£5 + VAT £6
Ribbon Cartridge for FX100 & MX100	£7 + VAT £8

MP165

165CPS 10" carriage friction and tractor feed	£260 + VAT £299
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SEIKOSHA

BP 420 designed for the business world, 420CPS in draft mode, 110CPS in NLO mode.	£1095 + VAT £1259
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SMITH CORONA

Fastext 80: 80 col, 80CPS. Friction feed standard	£149 + VAT £171
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TAXAN KAGA

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160CPS 15" wide 27CPS NLO 24 x 16 matrix	£390 + VAT £449

CANON

PW1080A
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£299 + VAT £344

PW1156A
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COLOUR PRINTERS

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Canon PJ1080A 7 colour 40CPS ink jet printer	£433 + VAT £499

DAISYWHEEL

JUKI 6100/I PRINT

20 CPS Bi-Directional Logic seeking 10 12 15 CP1 + PS spacing 2K buffer best selling Daisywheel	£324 + VAT £373
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	£95 + VAT £109

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DM8112 12" Green screen 18MHz Hi Res £96 + VAT £99

DM8112 Hi Res Green Screen with tilt stand £109 + VAT £126

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1451 MS 14" RGB Medium Res Colour £251 + VAT £280

1441 MS 14" RGB High Res Colour £417 + VAT £479

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- * DUP: To copy and rename a file on disc
- * FORMAT: Formatting program for 40 & 80 tracks
- * FREE: This utility provides a disk usage analysis
- * MDUMP: Enables you to display and modify any part of BBC memory
- * MERGE: Merge a number of text files into one file
- * RELOCATE: Downloads a basic program to &E00
- * SDUMP: Screen dump for EPSON in all graphic modes
- * VERIFY: Verifies every sector on a disk
- * MENU: A flexible menu program

PRODUCTS

Microcomputer Model B	£299 + VAT	£344
Mod B - disk interface	£369 + VAT	£425
Mod B - Econet interface	£349 + VAT	£401
Mod B disk and Econet interfaces	£409 + VAT	£471
Compatible 100K disk drive	£112 + VAT	£123
Compatible dual 800K disk drive	£312 + VAT	£359
280	£347 + VAT	£399
5502 Second Processor	£173 + VAT	£199
IEEE stick	£327 + VAT	£375
IEEE Interface	£282 + VAT	£325
Econet plus 1 interface	£52 + VAT	£60
Postal Adaptor	£115 + VAT	£132
Telex receiver (Aug)	£196 + VAT	£225
Cassette recorder and lead	£30 + VAT	£35
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Upgrade kit (free fitting)	£70 + VAT	£80
Charge for A to B upgrade kit	£20 + VAT	£23
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All above drives are low power slimline (0.3 A typ at +12v and 0.4 at +5v per drive) Normally extra power supply is not required. The BBC Computer power supply is designed to drive to low power drive (IT IS NOT DESIGNED TO DRIVE INTERNAL ROM BOARD)

SS DD diskettes (10 Box)	£18 + VAT	£20
DS DD diskettes (10 Box)	£23 + VAT	£26

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SANYO 550-IX
As above but with dual drives 2 x 160K
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SANYO 550-360X
As 550 but with dual drives 2 x 360K
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SANYO 550-800X
As 550 but with dual drives 2 x 800K
£999 + VAT = £1149

SANYO 550-10MX
As 550 but with MSDOS 2.11 Operating System and a single 10 Megabyte hard disc and 360K floppy back up.
£1195 + VAT = £2295

APRICOT PC
"Portable Executive Computer" 16 Bit Micro, 256K RAM up to 144 megabytes floppy disk storage 3 1/2" Sony disks. Portable brief case styling. Modem with auto dialler (optional) hard disc optional. Vast software library (compatible with Sinus Apricot with Double Drive, Monitor and Free Printer £1990 + VAT = £2289
Apricot with Double Drive, Double & Monitor & Printer £1990 + VAT = £2289

APRICOT XI
As above but with 10MB Winchester Drive and Single 315K Drive plus Superwriter Supercalc and FREE JUKI 6100 Printer
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16 Bit Micro, 256K Ram, double 160K disc drives, MSDOS Operating System, free Green Monitor, free software Calcastar, infastar, Datastar etc
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SANYO 555-360X
As 555 but with 2 x 360K Drives
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SANYO 555 800X
As 555 but with 2 x 800K Drives
£1199 + VAT = £1379

SANYO 555 10MX
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BBC 2: BBC Micro Model B + Disk Interface, View (or Wordwise) Wordprocessor, 100K Disk Drive, High Res Green Monitor, Quendata 20 CPS Daisywheel Printer, 1 Box of Disks and all the necessary cables
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BBC 3: Same as System BBC 2 but with 400K Drive
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BBC 4: Same as System BBC 2 but with 400K Drive and JUKI 6100 Daisywheel Printer
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BBC 5: BBC Model B + Disk Interface, View (or Wordwise) Wordprocessor, 800K Dual Disk Drive (Mitsubishi), High Res Green Monitor, JUKI 6100 Daisywheel Printer, 1 Box (10) of 80 Track DS discs and all necessary cables
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SAN 1: Sanyo MBC 550 Series 16 Bit Microcomputer, 256K Ram, Dual 160K drives (2 x 160K), High Res Graphics (600 x 200 pixels in 8 colours), JUKI 6100 Daisywheel Printer, High Res Green Monitor, 1 Box of 10 discs, Wordstar Wordprocessor, Calcastar spreadsheet and all the necessary cables
£1095 + VAT £1260.00

SAN 2: Same as SAN 1 but with Dual 360K Drives (2x360K)
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SAN 3: Same as SAN 1 but with Dual 720K Drives £1295 + VAT £1490.00

SAN 4: Sanyo MBC 555 Series 16 Bit Microcomputer, 256K Ram, Dual 160K Drives (2 x 160K), High Res Graphics (600 x 200 pixels in 8 colours) JUKI 6100 Daisywheel Printer, High Res Green Monitor, 1 Box of 10 discs, Wordstar, Wordprocessor, Calcastar spreadsheet, Mailmerge, Spellstar (dictionary), Datastar (database), Repostar plus all the necessary cables
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SAN 5: Same as SAN 4 but with Dual 360K Drives
£1295 + VAT £1490.00

SAN 6: Same as SAN 4 but with Dual 730K Drives
£1395 + VAT = £1605.00

If you require High Res Colour Monitor instead of High Res Green Monitor in Sanyo Systems please add £320 + VAT = £368 to the above prices.

*128K RAM Upgrade for all above Sanyo systems (makes a total of 256K RAM) £150 + VAT = £172.50 including fitting.

Software Charts

GALLUP BBC TOP 20

- | | |
|------------------------------|-------------------|
| 1 Elite | Acornsoft |
| 2 Sabre Wulf | Ultimate |
| 3 Manic Miner | Software Projects |
| 4 Jet Pac | Ultimate |
| 5 3D Grand Prix | Software Invasion |
| 6 Scrabble | Leisure Genius |
| 7 Frak! | Aardvark |
| 8 Mr Ee | Micro Power |
| 9 Football Manager | Addictive |
| 10 Eddie Kidd Jump Challenge | Martech |
| 11 Fortress | Pace |
| 12 Snooker | Visions |
| 13 Twin Kingdom Valley | Bug-Byte |
| 14 Chuckie Egg | A 'n' F Software |
| 15 Aviator | Acornsoft |
| 16 Chess | Acornsoft |
| 17 Challenger | Mastertronic |
| 18 Mine Shaft | Durrell |
| 19 The Hobbit | Melbourne House |
| 20 Hunchback | Ocean |

GALLUP ELECTRON TOP 5

- | | |
|-----------------------------|-------------------|
| 1 Elite | Acornsoft |
| 2 Chess | Acornsoft |
| 3 Micro Olympics | Micro User |
| 4 Gunsmoke | Software Invasion |
| 5 Eddie Kidd Jump Challenge | Martech |

Retail sales for the month ending January 8 1985

Compiled by Gallup for the industry's weekly trade magazine, Computer and Software Retailing. For details contact John Sorrenti, Computer and Software Retailing, Liberty House, 222 Regent Street, London W1R 7DB. 01-434 2131.

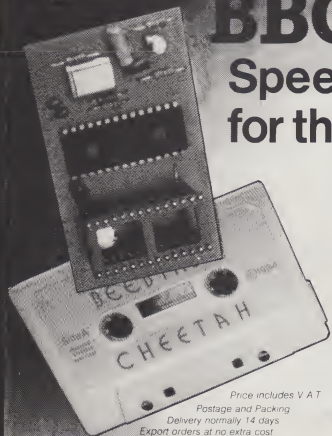


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For the BBC Computer



Micropulse 5.25" disc drives cased in high quality steel are fully compatible with the Acorn/BBC disc filing system and contain the highest quality TEAC mechanisms, fitted with head-load solenoids to prevent disc corruption if the computer is switched off while the disc is in the drive. All the Micropulse disc drives are supplied with BBC cables, formater utility disc and a comprehensive 59 page disc filing system manual.

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- MP101** Single 40 track (100K) disc drive with internal power supply £120.00
- MP102** Single 40/80 track switched (100K/400K) double-sided drive with internal power supply £189.00
- MP200** Dual 40 track (100K) disc drives with internal power supply £239.00
- MP800** Dual 80 track (800K) double-sided disc drives with internal power supply £348.00
- MP802** Dual 40/80 track switched (2 x 100K/800K) double-sided drives with internal power supply £379.00
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- MP11** 3" single 40 track (100K on each side of the disc) drive powered by the BBC computer £129.00
- MP23** 3" dual drives 40 track (100K) (on each side of the disc) powered by the BBC computer £249.00



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For the BBC Computer



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- MP21** Micropulse Mirror (on 3" or 40 or 80 track 5.25" disc) cassette-to-disc utility, transfers approx. 10 cassette-based programs to the Mirror disc £9.00

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SUPERVISOR (econet ROM file server)

The fastest BBC econet file server available. Supports all BASIC radom access commands, full length files and full set of econet commands. Extra commands and utilities built-in. Uses ordinary BBC DFS discs. No complex operation or 2nd processor required £99.00 (econet is a registered trade mark of Acorn Computers Ltd.)
Retail shop open 9.00 a.m. to 5.30 p.m. Mon. - Sat.
Visa or Access orders: simply phone (0928) 35700. (10 Lines).



For further information please contact:

Northern Computers Ltd.
Churchfield Road, Frodsham, Cheshire WA6 6RD.
Tel: Frodsham (0928) 35700 (10 Lines)

MicroClass

Our first lesson brings you up to date with what's happening to the Beeb in the classroom.



MAKING TOMORROW'S HISTORY

What do you know about the year 1086? For many readers the answer might well be "very little" until the Domesday book is mentioned. Will 1986 be remembered in 900 years time? The BBC are hoping it will, because they intend producing a second Domesday Book. It'll be in a very different form from the first, as all the information will be stored on two optically-recorded video discs which will hold the equivalent of two sets of Encyclopaedia Britannica.

In December 1984 all the schools in the country were invited to take part in an ambitious project. Those schools who took up the challenge (10,000 were required) will collect information about Britain based on Ordnance Survey maps. With the maps will come a set of discs containing a database questionnaire about the local area, e.g. geography, land use, amenities.

They will be asked to present approximately 20 pages of description and a selection of photographs which represent their area. All this, with the exception of the photographs, will be collected with the help of the schools' microcomputers and will form the basis of the first disc. The second disc will contain information from national data sources on natural resources, transport, social activities, arts and crafts, plus 40,000 pictures from various archives.

Having seen some of the work resulting from the pilot scheme, I must admit I find the project not only ambitious but tremendously exciting. To have the facility to zoom in to a large scale map of any part of the country and convert data to multicolour overlays, and to have data and photographs available on any part of the country sounds like a teacher's dream. So, why is it I have several niggles at the back of my mind?

My first is whether the majority of teachers are ready for the leap forward. In many primary schools the microcomputer is barely out of the box, while comparatively few secondary schools to my knowledge have integrated the computer into their humanities cur-

riculum. While at a first glance the material being collected appears to be somewhat secondary orientated, much of the task of collecting information is likely to be done by primary and middle schools.

Most primary schools are still using cassette recorders with their micros, which is not the easiest way of dealing with data, and many are desperately trying to make money to buy a second micro, a disc drive and/or printer — certainly there's been little or no help from my own Authority! The latest information suggests that the BBC Laser Vision player will cost £900, and schools will require a second processor plus a special Acorn interface.

At a time when many PTAs are being asked for cash to buy essentials such as paper and pencils rather than "the extras", one must wonder where the money's coming from. If schools are not going to be able to benefit from their work because they can't afford the equipment, are they going to be keen to take part?

One magazine recently suggested that my much loved BBC micro should be costing about £180 by present market standards, yet there are minimal discounts available because of its virtual monopoly of the educational market and, of course, its software is incompatible with other machines. The BBC predicts that their Laser Vision player, which is being designed by Phillips Electronics Ltd, will become the accepted standard for education use. Does this really mean that it too will be incompatible with all others?

It's intended that the discs and the player will be available by Michaelmas 1986. Perhaps they will, but will Acorn have the interface ready? Past experience suggests that spring or summer 1987 might be nearer the mark for the first trickle!

My last worry comes back to my colleagues once again. As I sit writing this, the newspaper headline stares up at me — "Bad Teachers Face Pay Penalties". Are we in for another year of discontent and disruption and will it affect the project, or can we "sock it" to Sir Keith, produce a project of which we can be justly proud, and prove that the state of education is far from as black as its head would have everyone believe?

Des Thomas



A TOUCH OF CLASS

Microvitec, household name and highly likely to be the manufacturer of the monitor you use in school, have come up with a sensational product to compliment their range.

We've all read about the use of touch screens in office and industrial computing and you may have seen them at shows. Now the Microvitec Touchtech 501 brings the touch screen to BBC/Microvitec users.

The device clips onto the front of the monitor and tilts it to a position suitable for interaction with the user. It takes five volts of power from the BBC auxiliary power supply and "talks" to the computer via the RS423.

MEP SOFTWARE SUPPORT

Microvitec are launching the Touchtech 501 together with a starter pack of educational software devised by the MEP. The device has great potential as a replacement for QWERTY with young learners and the physically or mentally handicapped. Here is a run down of the software.

Touch gets children started by reporting back grid references to the toucher! **Artist** takes things further with a six foreground colour palette (on white). You paint with your fingers — true digital art. Artist is especially designed for pre-readers.

Cubes is what it sounds. **Money** allows children to handle cash without getting their hands dirty, pointing to coins and making up change. This one is most suitable for pre-primary children.

Odd-man is an Ega Beva offering. Picking out the odd letters and drawings helps character recognition.

Simone (a female Belgian Simon!?) is a version of that well known game of flashing colour sequences. A memory test.

Music is a sophisticated developer of new sounds and melodies while **Words** deals in anagrams. The player is restricted to transposing two letters at a time but there are helpful clues. Finally there is a player/player or player/computer version of noughts and crosses, **OXO**.

Touchtech 501 is well documented for users and programmers, an addition of a small BASIC routine should allow many current programs to utilise the touch screen concept. Prices have not been released but, given that Microvitec are offering a product which is likely to sell their monitors as well, it shouldn't be too steep. Details in our next issue. Bet you can't wait to have a go at finger painting.

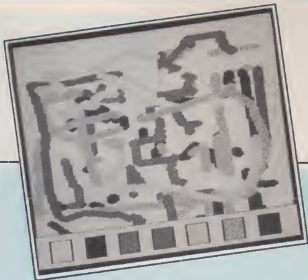
VIDEO VIEWS

Aimed at teachers, parents and advisers, the first two videos in a series from Videotext Educational Publishing are designed to show how the microcomputer can be integrated into the primary classroom of the eighties.

In these two films, *Flowers for the Teacher* and *Magic Without Wizards*, the aim is to dispel some of the myths and prejudices which surround the use of the micro in primary education and to demonstrate that it can have a valuable place working alongside the teacher.

The videos do not attempt to define a "right way" of using computers in the classroom but to point out what is possible. By exploring these possibilities, the films hope to offer a fresh viewpoint from which to examine the role of the micro in the primary school.

Flowers for the Teacher



CONTINUED OVER

documents a class of nine to ten year olds working on a project centred around the software package "The Flowers of Crystal". Based around a fantasy adventure, the work which results is very real, involving activities which range across the whole of the school curriculum. Language, maths, art, craft, drama, science and social studies are integrated into both the project and the working day.

Magic Without Wizards again looks at a school where the staff has enthusiastically accepted the computer into the classroom and made it an integral part of school life. In many schools the micro still exists apart from the main business of teaching. In order to break down this pattern, the school featured in the video has devised a set of criteria for using it, where it can benefit a class activity it will be brought in, but not otherwise. The programme examines a variety of activities that have evolved at the school which involve the computer as a tool — a tool which assists both teacher and children in their work.

Each 30-minute tape is priced at £16.95 plus 95p for postage and packing. For an order form and further information contact Videotext Educational Publishing, Orders Department, Eagle Star House, New North Road, Exeter EX4 4HF (tel: 0392 219309).

COMPUTING THROUGHOUT THE CURRICULUM

Cambridge Micro Software launched their Homerton College educational software range at the beginning of January with a speech by Mr Robert Dunn, Parliament Under Secretary of State, Department of Education and Science.

Mr Dunn confirmed Sir Keith Joseph's interest in micro-technology in education since "our future economic well-being is closely linked with the ability of



industry and commerce to make effective use of microelectronics".

Mr Fred Daly, Director of the MEP Homerton College Computing and Curriculum Development Group, emphasised that the software was not designed as a "surrogate teacher" but that it was formulated to enrich the curriculum and provide support for teachers.

Programs to look out for are Tessellations (mathematics) £21, Chemical Collisions (chemistry) £15.95, Lift (physics/applied mathematics) £16.50, Floater (physics/applied mathematics) £16.50, Quelle tete/Jeu des ménages (French) £15.95 and Kopfjager/Umziehen (German) £15.95. These prices don't include VAT. All programs are available on BBC B 40 and 80 track discs.

For further information contact Lorna Williams at Cambridge University Press, Publishing Division, The Edinburgh Building, Shaftesbury Road, Cambridge CB2 2RU.

SMILE

Microsmile is a BBC package

containing 30 mathematical programs suitable for both junior and secondary children. The programs range across the spectrum of mathematics and aim to encourage children to think mathematically. Areas covered include number pattern, shape, place value, decimals, coordinates, logic, motion geometry, angle, vectors and fractions as well as containing games and puzzles.

Microsmile was devised, developed and classroom tested by practising teachers involved in the IEA mathematics project SMILE. The package is in full colour with extensive use of the graphic and sound potential of the Model B. It comes on three separate discs with a 24-page booklet. The booklet fully documents the programs, giving an appropriate level of difficulty and suggestions on how they can be used and developed.

Microsmile costs £10.00 for educational establishments in the Capital Region and £15.00 elsewhere. For an order form contact the Centre for Learning Resources, 275 Kennington Lane, London SE11 5QZ (tel: 01-633 5971).

MICRO MATHS

Capital Media are a company who aim to acquire, produce and distribute good educational software, making both programs and documentation available to schools at the lowest possible price commensurate with a high standard of product and service.

Titles available for the BBC are Mathematical Games and Activities, for use by individual children or small groups working without direct supervision, which costs £5.00 for educational establishments in the Capital Region and £6.00 to establishments outside London; and Mathematical Investigations in the Classroom which consists of ten programs where a practical activity is simulated and data collected and tabulated so that children can discover the general rules and develop logical strategies, priced at £6.00 to purchasers from the Capital Region and £8.00 to others.

Capital Media's address is c/o ILECC, John Ruskin Street, London SE5 0PQ.

BBC LOGO

LOGO Software Ltd have published a full Logo for the BBC. Their Logo is the product of two years of development and has been designed to meet the requirements of a Feasibility Study for the Department of Trade and Industry.

LSL LOGO is written in Assembler to be economical and fast working and fitted onto a single 16K Eprom chip. It takes up only one socket on the Model B, leaving the others free for BASIC, word processing, disc filing and other applications.

The package is available to schools and colleges through E J Arnold & Son's School Computer Service and others may order it from LOGO Software Ltd, 316A Richmond Road, Twickenham, Middlesex TW1 2PD at the inclusive price of £67.85. For a free booklet entitled Why Logo write to LSL, Freepost, Twickenham TW1 1BR.

OSPREY!

Bourne Educational Software are launching a competition based on their Osprey! program in conjunction with Boots and the RSPB. The competition will be for the best contributions based on the history of the Osprey and its return to Scotland, set in the wider context of nature conservation and wildlife preservation.

Osprey! has proved to be an ideal stimulus to the understanding of birds and care of wildlife, and also provides ideas for activities away from the computer.

The competition is split into two sections with prizes for both individual and group entries. First prizes in both will be specially commissioned crystal Ospreys, with ten runner up prizes of the RSPB's Book of British Birds.

Entry forms will be enclosed in copies of Osprey! sold in Boots from February 1, and will also be available from any Boots computer department or direct from Bourne Educational Software. Closing date is June 30.

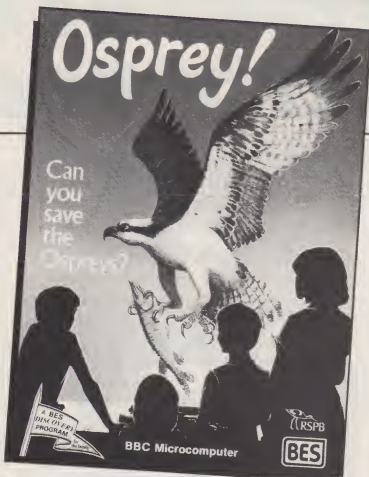
SYSTEM IN SCHOOL

A variety of educational software is now available from System Software as well as a couple of schools administration programs.

Their titles include Write-On, a program to help the development of ideas in the early stages of literacy; Titrations, an aid to the teaching of titration calculations; Survive, a program applicable to humanities, history and social studies and Intervention, an extremely flexible business simulation run by a controller.

Title	Publisher	Price
Datext	Optima	'9.95
Teletext Editor	Beebug	'10.00 '12.00 on disc
Edit 7	Crystalsoft	'5.00
Pixel Plotter	Toad Educational	'14.95
Edfax	Arnold-Wheaton	'30.00

Having our own Mode 7 utilities inspires us to list some of the excellent commercial software available.



Admin titles are being expanded and range from Options, which provides form lists, option lists, subject lists and analysis to Cover, which gives a flexible approach to daily staff cover.

NETWORKING

Schools and colleges will be able to make more effective use of their computer equipment with the introduction of a new low-cost microcomputer network system. Richmead Micro have released Meadnet, a system that allows up to 16 BBC microcomputers to be connected to a single RML 380Z allowing common access to the disc drives and printer of the 380Z.

Before cheaper micros were available, most secondary schools used the 380Z by Research Machines Ltd. However when the BBC was launched it became popular due to its relatively low cost, allowing several computers in a classroom instead of one. The next problem to be faced was how to provide access to expensive peripherals such as disc drives and printers. The answer is a network such as the system Meadnet are providing.

With Meadnet a full implementation of the BBC filing system is provided, which allows loading and saving of both BASIC and machine code programs as well as random access

data file handling. The system is also compatible with View, Wordwise, Edword etc. Programs can be easily transferred from cassette or disc since no user memory is taken up by the system.

Meadnet was designed by a teacher and a software engineer and aims to take into account many of the problems likely to be encountered in a classroom environment. The price is £275 plus £20 for each BBC station.

For further information contact Richmead Micro at 29 Easby Way, Lower Earley, Reading, Berkshire RG6 3XA (tel 0734 665771).

EDWORD EXTENDED

Edword, the educational word processor, has been updated to run with Acorn's new DNFS chip which combines both disc and network handling.

Although Edword is compatible with the disc file facilities of the new chip it cannot be used with the networking facilities. Clwyd Technics Ltd have therefore released Edword 2 on Eprom but will continue to provide the original Rom based Edword for those who want it.

Clwyd Technics are at Unit 4B, Antelope Industrial Estate, Rhydymwyn, Near Mold, Clwyd CH7 5JH.

IN BRIEF...

- Back in January we reviewed Archaeology from the Cambridgeshire Software House. Although excellent, the one complaint was that it lacked a sample datafile. This has been resolved because the datafile on Fishbourne is now available from Barry Holmes at Saint Helen's CP School, Bluntisham, Cambridgeshire. To obtain a copy write to him enclosing a formatted 40-track disc plus 75p.
- Clwyd Technics have brought out a Break Key Switch. At £5 it's very useful for all of you still using cassette recorders — no longer do users have to worry about pressing that dreaded key and having to start from scratch.



SYMPHONIC

Clive Grace

Turn your BBC into a music making machine. We review Acorn's Music 500 synthesiser and ATPL's symphony music system.

For a long time now the only way to make music on a Micro was to use the internally driven sound chip. It has taken a surprisingly long time for somebody to think of actually making something pleasing to listen to in the form of music, and although the Beeb's ability to manipulate the waveform of a sound to suit a particular envelope and then to reproduce that sound at will has great potential, the problem has been that BASIC is probably the worst language in which to write music.

No matter how structured the code may be, BASIC is still a linear language unlike conventional music notation which is based upon sequential events. The conductor of an orchestra does not flit quickly from player to player, but assigns particular sequences of notes to sections which are needed — he doesn't actually control the music but keeps a series of events in their particular places.

In the past there have been many attempts at standardising a form of computer composition language. But in nearly all cases these have failed to accept that conventional music notation is, in the computer environment, a very illogical means of scoring; its very structure requiring it to look ahead to each successive bar for possible inflection movements or sustain. Of course the composer/player is well aware of the musical rules and has the ability to "scan ahead" in preparation for the next sequence of notes. This is impossible in the computer environment where such haphazard behaviour complicates matters. The possible solutions are to either connect a more friendly form of scoring device to the computer, such as a piano

keyboard, or to completely change the composition language, the latter being far more difficult.

One of the more successful attempts at connecting a piano keyboard to a computer has been with the Synclavier synthesiser, a very expensive system which allows use of the keyboard in real time and stores the musical equivalent elsewhere. This can then be translated (by software) into "conventional" notation, however the system is very limiting as there are things that a Synclavier cannot do. The music it produces is still not as accurate as it might be, for example with chord sequences and unusual time signatures, making music with complex rhythms and microtones such as classical Indian Folk music impossible. But no matter how good a scoring system might be, it still avoids the language problem.

There are now two products which turn the BBC micro into a music making machine. Symphony is a keyboard/software package that uses the BBC's internal sound chip to make music via a keyboard while Music 500 is a fully professional stereo synthesiser with its own programming language.

ACORN MUSIC 500

Music 500 is essentially a synthesiser extension to the BBC with a programming language to drive the system called AMPLE. It is by far the nearest way of composing and playing music on a computer. The unit itself is housed in a metal BBC beige case which strongly resembles a disc drive unit. It looks very functional

and, with just a switch and a stereo port at the back, the design is very utilitarian. Included with the package is a manual and a cassette containing the various files which make up AMPLE, as well as some demonstration files.

Transferring the files from cassette to disc gave no problems because a TAPEDISC program is supplied as an opening file on side one of the cassette, with clear and simple instructions. The process took no longer than 15 minutes in all.

GETTING STARTED

Connecting the Music 500 unit to the computer involves plugging a decent length of cable into the 1MHz Bus, then connecting a suitable cable to an amplifier (a high quality one is recommended but an ordinary HiFi amplifier will do the job adequately) and connecting some speakers.

That is essentially it as far as hardware goes, pressing Shift-BREAK causes the !BOOT file to load and in no time at all the AMPLE version message greets you:

AMPLE model BCE Version 1.0
(C) 1984 Hybrid Technology
%

The "%" prompt is similar to BBC BASIC's ">" prompt. Thankfully the manual includes a testing section which just generates a continuous Middle C, and pressing ESC silences the Music 500 and brings you back to the ">" prompt.

There are a number of demonstration pieces which are good to listen to as well as providing invaluable information as to how certain sounds and pieces

are made up, but this will not be of any interest to the user until multi-part pieces are being written.

ABOUT AMPLE

AMPLE is an acronym for Advanced Music Programming Language and was developed and written by Hybrid Technology alongside their design and development of the Music 500 system. Chris Jordan, one of Hybrid's main men, was responsible for implementing the SOUND commands in BBC BASIC, and his long involvement with computer music makes his grounding very firm indeed.

AMPLE is a true concurrent programming language, one of the first to appear on the BBC micro. Concurrency has been a feature on much larger mainframe systems which allows the user to perform more than one task at a time. Parallel processing is not available on eight bit processors, but with its blindingly fast use of interrupts it really doesn't matter when you consider that 80% of the 6502 is being wasted without interrupts, so concurrency allows more than one task to be performed at once. This need not include just playing music, but also any task that can be typed in. *CATaloging a disc for instance.

AMPLE is a stack orientated language which has great similarities to FORTH in that all numbers are Post-Fix and a stack is available. It can also create words which are then as valid as existing AMPLE commands, but unlike FORTH these are not actually incorporated in the compiler, but in a library of words which are all interacting and immediately available, more in the

OVERTONES



vein of LOGO and its subsets.

The actual notes in music are very simple. "A" stands for a fundamental note which is of a certain pitch, "B" is a little higher, and so on, all the way to "F". AMPLE stores these sequences of notes as letters and can be immediately played by first typing "SOUND SCORE" and then any valid musical note. Therefore typing "ABCDEFG" will give a rising scale through Middle C; the "." symbol is used to determine a "rest" which temporarily causes a rest in the sequence of notes. The pitch can be set by placing a number followed by a colon anywhere in that sequence of notes. Its default is 0: which means that 0:C is Middle C, and a lower case letter states that the note is going down in sequence so that a string like:

1:CcCdDd^EeEe

will cause a C to be played followed by a Middle C (going down to Middle C pitch) and so on, resting after d and then playing the E sequence. Incidentally even though "." is not a break, its use at the end of a particular sequence makes it an ideal way of stopping.

The note length can be varied accordingly by using a number followed by a comma, so that:

0: 48,CCD 72,b 24,C 48,DEEF 72,e 24,d 48,c DcBc

will play the national anthem with all the necessary note lengths. A simpler method is by "tying" the notes together by using "/". Effectively halving the amount of note length changes. Likewise sharps and flats are represented by a "+" or a "-" sign is used to naturalise the note. To actually create words containing a sequence of notes is even simpler, by enclosing a name in quotes you can create a sequence:

"Frere" [48,0:CDEccDEcEF 96,48 G,eF 96, G 24,GAgf 48,ec 24,GgGf 48,ec CgC/CgC/.

The Music 500's sound generating hardware is second to none, boasting an impressive 16 sound channels, each with a sampling rate of 46.875 kHz. These can be chained together to add more subtle effects to each sound and all 16 can be used in

this way making a huge 750kHz total sampling rate.

One of the reasons why Music 500 is so versatile in the sounds it can create is its huge array of modulators, allowing the user to control the very sounds that come out.

MODULATION EFFECTS

Ring Modulation is a technique which combines two different signals by mixing two sounds together, which has the effect of making the new signal the sum and the difference of the new sound. The possible sounds are extremely weird and are excellent for atmosphere (Brian Eno and Tangerine Dream are notorious Ring Modulator users). Also the amplitude of the two channels may be altered, making it possible to fade in and out of the effect.

Frequency Modulation is all the rage nowadays and is seen on new synthesisers including Yamaha's DX series. FM combines two tones together making more subtle and commonly "usable" sounds, especially when an OFFSET is included so as to alter the frequency offset (without

pitch) which creates a wavering vibrato effect. Many of the synthesisers today use FM as a means to "fatten up" sounds and to give them a little more ambience, however many recent synthesisers have tended to sound alike due to a lack of ability to set the depth of the FM effect.

White Noise effects are also possible by defining an envelope using the random number generator. I use these sounds mainly on percussion such as "snare" and "cymbal" sounds to represent strong, hard hitting tones or even smooth rolling sounds, increasing the amplitude gently, then quickly dying away at random intervals, suggesting waves crashing on rocks.

Waveforms can also be created by specifying the shape of the waveform, point by point. This seems to be about the easiest and most long-awaited method of getting an envelope into Music 500 via AMPLE. The method is called Geometric Wave Definition or, as the manual calls it, Geometric Synthesis. This method is good at setting up the basic elements of White and Pink noise by writing a random number to the definition:

% "randwave" [128 FOR(RAND? INDEX WG)FOR WGC]

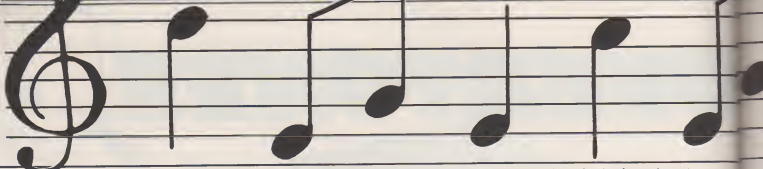
% 5 WMOD randwave

thus "randwave" is created by looping 128 times, each time putting a number in a stack. INDEX simply acts as a counter in the FOR()FOR loop to point to each successive geometric point and is put in by WG! which writes to a Geometric waveform. Finally WGC copies it to the specified waveform which is in this case WAVE number 5. There are 13 in all to be stored at one time, and careful storage of unused procedures can increase that number indefinitely.

ENVELOPES

As with the BBC micro there is the facility to alter the envelopes of a particular signal and these

CONTINUED OVER



can be altered by a number of methods, each of them quite complicated and not really recommended until you at least know something about the nature of envelopes.

Amplitude envelopes are based on a system familiar to BASIC users called ADSR envelopes. The user can design and alter a basic shape with the parameters ATTACK, SUSTAIN, DECAY, RELEASE and the system is good for controlling an overall sound's basic shape. Pitch envelopes vary the sound so that they can create variations within notes, such as a reedy trail to a particular sound to give it a harp-sicord type effect, and are controlled by the PITCH AND SHIFT words.

MULTI-PART MUSIC

As AMPLE is a concurrent language it is simple to set up more than one piece to play at a time. The example below shows how to set multiple players and is a typical example of how each task is set up:

```

"play" [
0 VOICES 1400 TEMPO      %Reset voices and set tempo
1 EMOD ADSR 1 SUSTAIN 30 %set a ADSR definition
DECAY                    %This piece has 4 Players
4 PLAYERS                %Set nature of ADSR
1 EMOD ADSR 100 SUSTAIN %Left play the theme
1 PLAY1 - 3 POS trumpet %middle plays the bass
theme )PLAY              %right plays the melody
2 PLAY1 0 POS bassing bass )PLAY
3 PLAY1 3 POS harping
melody )PLAY

4 PLAY1 3 VOICES        %Player 4 has 3 voices
- 1 POS                 %Just off Stereo Middle
SCORE                   %Work from a Score
1 VOICE piano
2 VOICE piano
3 VOICE piano chords   %Voice 4 plays 3 note Chord
)PLAY                   %End the Def for player 4
GO                       %Start all the players in seq
]                         %Ends "play" definition
    
```

The play definition is quite a simple one in that the user has to set up where each channel is defined and where in the stereo field the sound is going to be

directed. The play routine calls up the definitions "trumpet", "bassing", "harping" and "piano" which are definitions setting up sounds by any of the possible methods. Armed with its individual sounds, "play" will then look at the "theme", "bass", "melody" and "chords" sections which are the routines actually holding the music in the form of letters and timings.

The language's structure is, I hope, fairly obvious and bears little relationship to FORTH's 1K byte "screens". Each section is EDITable so, instead of listing the whole program, all that is needed is:

```

%"chords" EDIT
%LIST
10."chords" [
20.12.
25.4 FOR(
30.2 FOR(0:C(EG)//////) FOR
40.2 FOR(0:D(FA)//////) FOR
50.2FOR(-1:B(DF)//////)FOR % -1: LOWERS OCTAVE
60.2FOR(-1:A(CE)//////)FOR %NOT NECESSARY BUT
CLEAR
70.)FOR
80.]
%
    
```

and concise error report. There are many reports in AMPLE 1.00 and these are quite the best I've seen in any language. The REPORT command also displays the line in question with a "!" symbol underneath the area in which the compiler considers there is an error. A very nice touch is that the error stack is not corrupted by further keyboard entries, so a mis-spelling of REPORT will not lose that all important message. The report stays within AMPLE until the program has been successfully compiled or a new procedure is attempted.

The structure of AMPLE in a

As well as fast forward, music can be stopped temporarily by using the ON and OFF FREEZE commands.

AMPLE is a big step for and one which will take a lot of knowledge of music and rhythm. For the beginner, probably one of the hardest features of AMPLE is the waveform development time. Normally with such a system it is necessary to draw out the waveform and set about designing it. After some very mixed attempts at making my own envelopes I can only confirm to distraught users that it does eventually click. There are a lot of pitfalls to fall into and a lot of cribbing from the demonstration files was needed before I actually managed to make any headway with this aspect of AMPLE. But, because it sacrifices a little immediate friendliness for one of the most flexible waveform modelling systems around, I am willing to sweat a little in my troubles.

MUSIC 500 KEYBOARD

musical sense is straightforward and shows a great deal of forethought. It is possible to set up a whole song still using the bare bones of the "play" routine by calling each section from another one. This makes end listings look something like:

```

"song" [ intro verse chorus verse
chorus inst chorus verse ]
"back" [ bintr bvers bchors bvers
intro solo chorus bvers bchors ]
"drum" [ roll pat1 pat2 pat1 pat2
pat3 pat2 pat1 pat2 ]
    
```

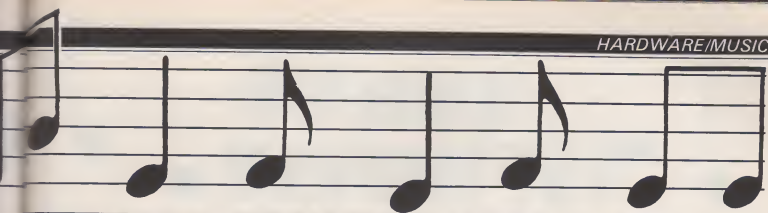
If a section of music right at the end of a piece is continually being edited, but the user wants to hear the music with the other instruments, AMPLE allows the user to "fast forward" to any section in the music. This is done by specifying the number of times a particular bar is to be skipped, ie:

```
192 16 # * FAST %skip 16
4/4 bars (as 192 represents a
4/4)
```

The most obvious addition to Music 500 is a full sized piano keyboard which when connected to AMPLE allows the programmer to define a word and then play the piece on the keyboard in real time. Hybrid are in the process of finishing their own Music 500 synthesizer keyboard which will span four octaves, and the ATPL symphony keyboard is 100% compatible with Hybrid's keyboard thanks to the fact that the two companies are actually helping each other out in making products compatible and mutually expandable.

THE HYBRID PHILOSOPHY

As with the BBC Microcomputer system, the Music 500 is only a part of the whole. The real centre is not necessarily the synthesiser but the software that drives it. AMPLE is the nearest the computer musician has got to finding a language which is not only machine independent, but



can allow itself to have additions made to it without jeopardising the performance of other modules, be they hardware or software. If MIDI was a requirement then the module in AMPLE communicating with the environment would simply be lifted out and replaced with an equivalent. Likewise all the major drum synthesisers and rhythm composers can be controlled under AMPLE and a time code system for synchronising Music 500 with tape machines and other equipment is being developed now.

Many future products coming from Hybrid are hidden away on the manual's cover illustration, including an improved editing facility using windows and an unusual device called "The Baton" which will effectively allow the user to conduct their own piece of music.

GENERAL USAGE

The Music 500 system is a very comprehensive software hardware package which knocks spots off any attempts in the past to make a language fit for both Computer people and Musicians. The language is incredibly easy to use with many helpful error messages. All the error messages are presented in a manner to aid fast debugging and testing of programs. There are facilities to control music by random elements and to nest sequences in loops. Many levels of nested loops can be set up using both the FOR and REP structure which make listings easy to read. The fact that the compiler accepts free form text (ie it doesn't care how the listing is laid out on the screen)

results in easy to read programs which also show just how structured music really can be, which is impossible with ordinary notation.

With the addition of either ATPL's excellent Symphony keyboard or Hybrid's own, Music 500 is more likely to be accepted as a conventional synthesiser by sheer virtue of its huge array of signal processing gates and envelope editors. The sounds possible on Music 500 rival synthesisers ranging from the whole Yamaha DX series (which includes their MSX computer) up to the Prophet range. But, be warned, the chorus sounds like those you hear on Genesis albums (Tony Banks is notorious for using Prophets) are possibly the most complex sounds you'll ever want to program. I would like to see a library of definitions set up to faithfully mimic and improve on current "popular" sounds, after all Acornsoft have started doing this with popular arcade games such as Monsters, Defender and Snapper.

CONCLUSIONS

For the home user Music 500 and AMPLE open up sound possibilities only dreamt of on large £1500-£3000 conventional synthesisers. The fact that manual dexterity with a keyboard is simply not important is a brave step, and one which will take a lot of trouble out of composing. In my mind it is a step in the right direction into the wonderful world of music and at £199.00 for the complete hardware/software package, there are going to be a lot of happy Computer Musicians.

ATPL SYMPHONY KEYBOARD AND SOFTWARE

ATPL are already well established in the field of hardware additions for the Beeb. The general quality of their products is excellent and their "Sidewise" ROM expansion board (reviewed Oct 1984) is generally accepted as the best ROM board available.

ATPL's approach to "Symphony" is completely different from Music 500 in that it uses the internally driven sound chip (76489 chip) which is a simple chip based on three channels where frequency and output volume can be defined plus a pure noise generator.

The whole package consists of a four octave keyboard and some software. Both cassette and disc versions are supported and can use either the Beeb's internal three inch speaker, or can be connected to larger amplifiers with a simple hardware modification. There are many methods available so an approved service centre will know how to do this.

Through the Beeb's speaker the sound is surprisingly good for single notes, although when chords are played the many conflicting harmonics are too much for such a small speaker and colour the tone quite a bit. This is to be expected and gives the sounds an unnatural "reedy" quality so for most of the time I ran Symphony through a Roland Cube, adding some compression to fatten up the sound. A HiFi would do just as well and for many users

this will be the most popular configuration.

THE KEYBOARD

This is a fully professional keyboard which is very nice to feel and it has a similar springiness to synthesisers in the £1500 price bracket. The casing is ruggedly made out of painted metal although the colours may vary between models. At each end are two plastic edges which can be mounted in any standard keyboard enclosure or rack.

The footswitch is used to sustain notes, very much like that of the piano and plugs into a jack socket at the back on the right hand side. On the same side but underneath is the ribbon cable which plugs into the user port. There is no need for additional power as everything is done via this port.

The keyboard is compatible with Music 500 and future releases from Acorn/Hybrid Technology so many users may like to buy symphony for its keyboard alone, and not the software. Although ATPL have written some software to modify AMPLE to drive Music 500, Hybrid have informed me that it does not affect the performance of AMPLE and is compatible with their other planned products as well, which is good news to all.

THE SYMPHONY SOFTWARE

This is a BASIC/machine code program which can store up to

CONTINUED OVER

Clive Grace has now returned to the studio with Music 500 and Symphony and will report back in a forthcoming issue on how AMPLE fits into the professional music environment.

The results will be made available as an exclusive cassette tape offer to readers of A&B Computing, so you can hear just how good Music 500 sounds!

100 sounds in all. The package is menu-driven and all the menus are written in BASIC so the user can modify them if he wishes. The software is complemented with a thin but readable user manual, in fact their description of the BBC's envelope facilities is so well written somebody should include it in a larger "Sound" work. All the necessary information is well laid out with some clear illustrations, the examples are all drawings rather than printer dumps with shading to highlight the relevant positions on the screen.

The sounds are stored in Banks of 10 function keys. Using the Shift function keys together calls up each bank which contains 10 sounds. These include sounds such as "Harpiscord", "Piano" and "Train", but by far the most pleasing are the Organ sounds, "Pipe Organ" having just the right hollow sound to it. Add a little ambience by putting some reverb (or play the thing in the toilet) and you've got a passable rendition of y olde. Although the parish church organ sounds for organ are very accurate, the Harpiscord and Piano sounds are definitely suspect, but this is asking too much of humble BBC sound chip. After all it was intended as a general sound device, so we cannot expect the subtleties of a Bosendorfer Grand or even a Wurliitzer organ, but it has a jolly good attempt at it nonetheless.

Some of the sound effects are excellent, their "Whistle" sound is just right for copying trimpheons (Middle C is about right) as well as some nice train effects. Weird and esoteric sounds include "Moonbase" and "Onaip" (piano backwards). In order to get some heavier sounds coming out of the Beeb, sounds which the chip cannot normally achieve, Symphony fattens up the sound by including a carefully controlled noise channel which has its pitch adjusted. This is no mean programming feat so, well done APTL, the effect is very good indeed.

The second and third options include LOADING and SA-

VEing the sound files. These are saved as numbers so that it is impossible to overwrite the synthesiser program, so a file "1" will be saved as "SOUND1" on the disc. Options 4 and 5 exchange and transfer the envelopes from one definition to another, making it possible to store a whole repertoire of sounds at the start and some more "experimental" ones at the back.

Keyboard commands include the " and " keys to move in full octaves. If the note is so low that the 76489 cannot handle it, it moves back to the top. There is also a pitch control which varies the key of an instrument. The keyboard is essentially based on the C keys so, by altering the pitch, the Middle C key can sound in B flat making key transposing an easy option. This is still backed up by a fine detuning facility which is the same as a "Bend" key on a synthesiser. This affects all four channels although, unless bassier sounds or percussive/white noise sounds are needed, the fourth (noise) channel is always switched off.

The response is good for a manual type reed organ, and fast work is really better achieved by increasing the attack rate on most of the sounds. The organ sounds are effective when used with three note chords but seem to definite sound is needed, which can be achieved by switching the Clarinet and Flute sounds from Monophonic (one note at a time) to Polyphonic (in the Beeb's case three sounds at once).

In all, the Symphony software is good for simple sound and music making and it is fun just playing along with some simple songs. With the prospect of some sequencing software in the future, you can take Symphony a little further than just an average Bontempi sound. The keyboard alone is worth the £135.00 which includes a manual as well as some software (disc or cassette). The important music software is written in machine code for speed and reliability whereas the menus and options are all handle in BASIC. This means that if the user wishes to write some additions to Symphony, it

is simplicity itself.

MUSIC 500 SOFTWARE

ATPL are well aware that producing the only currently available keyboard with a decent action and a wide enough octave span means that many Music 500 users will wish to purchase it and

The Demonstration software once loaded from within AMPLE by:

% "DEMO" LOAD RUN %

will set up some predefined waveforms as well as communicate with the user port. Certain keys affect the sounds that are made and they are:

Shift	f0-f9	Selects the Amplitude Envelope
	f0-f9	Selects a Waveform
Ctrl	f0-f9	Selects a Pitch Envelope
	0-9	Selects a particular rhythm Tempo, or none at all
	F	Makes the Tempo faster
	S	Slows the Tempo down
	>	Up an octave
	<	Down one octave
	RET	Go to the % Prompt in AMPLE

fit it into their system. Well, thanks to both Hybrid and APTL, this is now possible through some software written in AMPLE which gives the user eight note Polyphony and full control over the envelope definitions, as well as a small rhythm box accompaniment which sounds exactly like the real thing. Of course if you wish to modify the sounds you are welcome to, in fact APTL give full details on how their patch to AMPLE works so the user can call up the same routines in his own programs. This uses CODE, a feature of AMPLE which calls an external machine code routine (or Operating System call). The software is very simple to use and turns the BBC into a full function organ.

AMPMOD is a BASIC/6502 program which modifies the AMPLE language to read from the User Port. Initially the Music 500 keyboard was to run through the 1MHz Bus, but this has now been changed so it will run using the same communications protocol that Symphony does. It simply patches the program by adding a software hook to the "Image" file on your AMPLE backup disc and then finishes: AMPLE is unaffected and you can now drive the keyboard.

The sounds are very good indeed and a wide variety of usable effects can be made (over 1000 to be precise). A maximum of eight notes are available and can faithfully make some extremely accurate organ sounds. By simply *EXECING an ASCII file of another waveform definition (AMPLE has no ability as yet to append files unless *SPOOL-ed etc), your own sounds can be incorporated with few problems. The rhythm accompaniments can all be edited as well as changed, so "that rhythm that's been on your mind all day" can now be played to death.

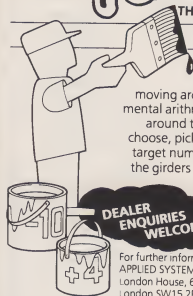
We will all have to wait until Hybrid finish their keyboard storing/scoring addition to AMPLE before we can actually incorporate the Symphony keyboard in the composition side. Still, with APTL's addition and with modification to the synthesiser software, the BBC micro can be a "proper" performance synthesiser.

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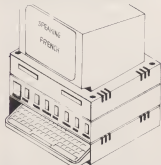
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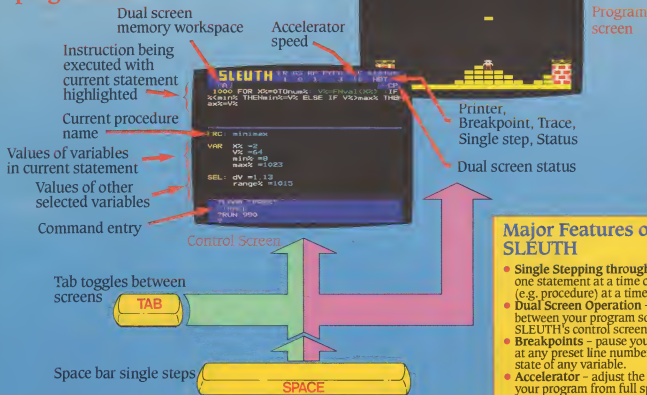
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any variable or update memory. You can even change the line number of the next instruction to be executed or alter the logic within a program statement. Then simply press the Space Bar to watch the next instruction execute.

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SLEUTH is ideal for the novice and expert alike and will prove to be instantly invaluable, saving hours of debugging time. In addition, the single stepping facility makes it a powerful teaching aid.

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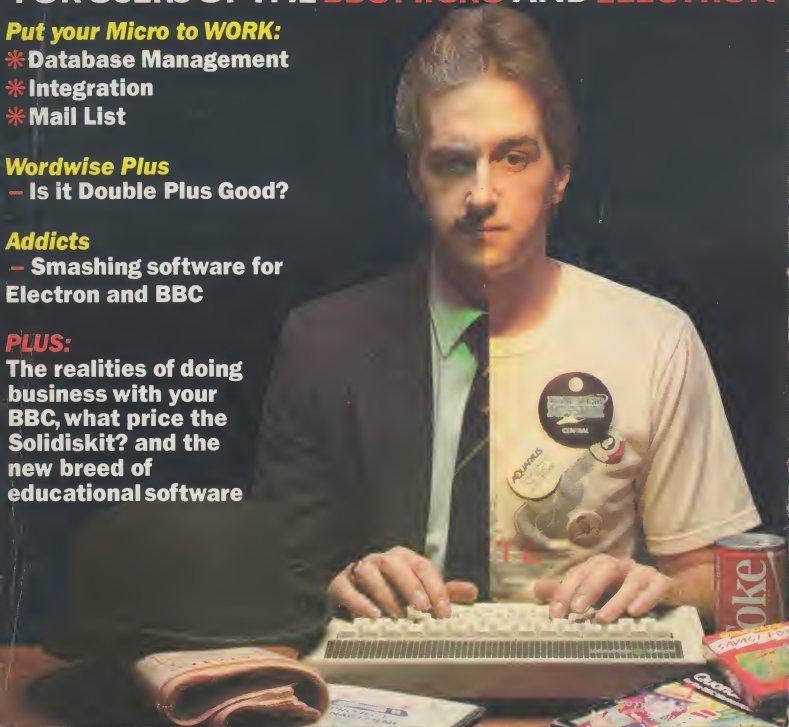
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A&B Computing is constantly on the look-out for well-written articles and programs for publication. If you feel that your efforts meet our standards, please feel free to submit your work to us for consideration for publication.

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Electron Plus 3**



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Cover Photograph courtesy of NASA

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Dragonsworld will win you over, Touchtech, the touchscreen, will demand your interest and Feedback will keep you informed.

Down to Earth is an equally inspiring follow up to Global View and there is a whole host of reviews, of hardware, firmware and software. Don't miss it.

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A & B

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COMPUTING

FOR USERS OF THE **BBC MICRO AND ELECTRON**

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Pleasure Dome*

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**Generate your own
adventure**

**Two Electrons to
be won**

**Enter Dragon
World**

REVS - on review

PLUS:

**Hard Discs, Wordwise
Plus programming,
Making the Most
of Logo, Down to Earth,
Feedback - new reader
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Next Month

Attractive computer graphics are quickly making their mark in many walks of life, for practical presentation of facts, for games and for computer fine art.

In the August issue of A&B Computing, out on the 5 July, you will be able to sample some sensational computer graphics, beginning with the cover. There are features on how it's done, and how you can do it too. There's also some terrific software to let you create cartoon characters, accurate line drawings, three dimensional objects and much more. Plus a review of the official Acornsoft Graphics Extension ROM.

NEW: Unique to A&B Computing — a foolproof method of entering program listings!

From next month all listings will contain a simple yet thorough error checking system, line by line. Find out how it works in next month's issue.

Wordwise Plus is turning out to be so much more than just a wordprocessor. Jonathan Evans has produced some highly practical software exploiting the interactive abilities of the program.

Alan Rowley begins his expert look at events.

Jon Vogler bring you some of the finer aspects of business computing with the help of the Torch Graduate

Trevor Attewell gives the tracker balls a try. How easy do they make it to work with the micro?

Gordon Taylor combines an Acorn Winchester disc and Viewstore, the latest ROM addition to the View family with...what results? Find out next month.

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Domesday Project

Fiona Eldridge

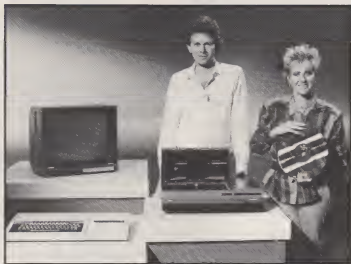
Are you taking part in the BBC's Domesday Project? Or more to the point, do you know what it is?

Is all that Domesday conjours up a distant memory of second form history lessons? Something to do with William the Conqueror wasn't it? Even if that's all you know of Domesday then you're not too many years behind for William's Domesday Book of 1086 was the inspiration for the BBC's massive Domesday Project — a Domesday 'book' for the 1980s that would have been beyond William's wildest dreams.

Of course, the Domesday of 1986 will be very different from the original. In the first place, William's Domesday only surveyed a fraction of the land of Great Britain, whereas the Domesday Project will cover the whole of Great Britain — from the Shetlands to the Channel Islands. Secondly, William the Conqueror ordered the 'survey of the lands of England' to be carried out by his officials for financial reasons: he wanted to see just how much his newly conquered land was worth. Questions were asked, answers extracted and the value of the land and small-holdings assessed — right down to the last pig.

Domesday 1986 is very different. All the data and pictures are being submitted to the BBC by volunteers or collected from national data resources and the Project is covering far more than just land use and value. The BBC hope that the Domesday Project will show a complete picture of life in Britain in the 1980s, from local land use and amenities to industry, ecology and culture nationwide.

The most exciting difference between the two Domesdays though is the new technology being developed especially for the Project. As parchment is rather difficult to come by these days, all the information on local areas is being compiled on BBC micros in schools, colleges and community groups and submitted to the BBC on floppy disc. All the local and national information, pictures and maps for the new Domesday will then be stored on two interactive video discs: a 'people's database' of local information on the whole country, and a massive database of national statistics. Together, the



Michael Wood and Sarah Greene with the Domesday System — BBC, monitor, videodisc and Domesday disc.

discs will hold enough information to complete two sets of the Encyclopaedia Britannica.

All the information — text and pictures — will be displayed on screen via a computer linked to an interactive videodisc player. The videodisc player is being developed by the BBC in conjunction with Philips Electronics and it's hoped that both discs and player will be available by the end of 1986.

SO WHAT'S NEW?

When A&B last reported on the Project (Microclass, April 1985) it was still in its infancy and it was hoped that some 10,000 schools would help take part. Domesday 1986 is now well under way and it's quite likely that as a BBC owner or user, you're already taking part. All the schools receiving the necessary documentation in March and the BBC are amazed with the response they've received. Over 13,000 schools and thousands of colleges and local groups are currently busy collecting information and taking photographs of their local areas.

In order to collect very 'local' information for the local disc, the entire country has been divided into about 23,000 4 x 3km blocks. Obviously in urban areas there are several schools in a block of this size so a certain amount of cooperation is required. Conversely, there are large tracts of land, particularly

in Scotland, with little or no population so local landowners are also contributing information.

The BBC are, not surprisingly, very excited about the Project and having seen a demonstration of the System, I must admit to being very impressed. Using the local disc you can select any locality in Great Britain and 'zoom in' to look at an Ordnance Survey map of that area in ever greater detail. Control is quite simple using the cursor keys and even easier with a mouse (the videodisc player will be mouse compatible). You can then access information and photographs on local land use, natural resources, amenities, landmarks or find out about the origins and history of the locality. In fact, anything that the people compiling the data in that area thought would be of interest.

Just think how useful this facility could be for schools or organisations planning a holiday or field trip. A suitable place can be selected, vetted and the itinerary planned without a single suitcase being packed!

Work on the local discs should be completed and submitted to the BBC by the end of July in order that all the data can be processed at Loughborough University during the summer holidays. Instead of enjoying a peaceful vacation, the university should be a hive of activity this summer as temporary computer staff expect to be inundated with thousands of BBC

floppy discs from all over the country. If your school or college is taking part, don't forget to send in your discs before the end of term or there could be a lot of frustrated thumb-twiddling going on at Loughborough this summer!

The national data disc is equally impressive. The main menu covers five topics: Commerce and Industry, Culture, Ecology and the Environment, Science and Technology and Society. Either by menu or direct access if you know what you are looking for, you can search for information on practically any subject. Just as an example, on the prototype disc, I saw population density maps, photographs of famous British stamps and the (estimated) market shares of the national dailies over the last ten years but with the resources of the National Data Archive at the disposal of a skilled team of researchers, the potential of the national disc is enormous. Because the discs are 'interactive', you can choose to access the data in several ways — statistical information can be represented in pie chart or bar graph form, computer generated graphics can overlay maps and you can define your own key to any particular chart to gain the exact information you require.

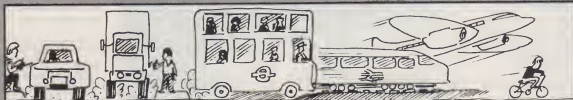
A feature of the national disc that I particularly like is the ability for the user to take several surrogate journeys through a typical 1980s environment. Looking at photographs taken at one metre intervals — forwards, backwards and to either side — you will be able to 'walk' through a wood, along a seashore, through a town or into a house without having to get up from your chair. This is not supposed to replace the real thing, rather to encourage people to go and explore for themselves an environment that they might not otherwise have seen, as well as provide a picture of a typical 1980s environment that may well disappear in the future.

CONTINUED OVER

DOMESDAY 1086 • A SURVEY OF THE LANDS OF ENGLAND



DOMESDAY 1986 -- CREATION OF PEOPLE'S DATABASE OF THE UNITED KINGDOM?

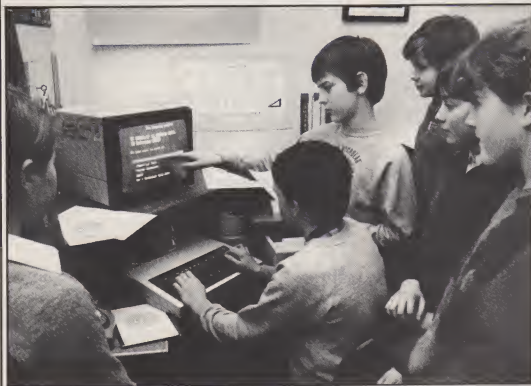


WHO USES A CAR? .. A 125 TRAIN? .. A 747 JET?

TRANSPORT



Who has a horse? Who has a boat?



Children of St Nicholas' School, Kenilworth at work on the Project.

CANDID CAMERA

To coincide with the 900th anniversary of the Domesday Book, the BBC will be screening a six-part television series about Domesday, presented by Michael (In Search of the Trojan War) Wood in the autumn of next year. The television series will complement the Project in looking at the original Domesday, and how Britain has changed in the intervening 900 years. Watch out for more news once filming gets under way.

You might have seen the 'Introduction to the Domesday Project' programme shown on BBC1 at the end of April. If you didn't, don't despair as there will be another programme this September with the latest news on the Project and the results of the national photographic competition in which you can take part.

Amongst the 150,000 or so stills that will be on the Domesday discs, the BBC would like 5000 pictures showing life in the 1980s, as seen by the Great British public. So here's your chance to take part in the Domesday Project 1986 -

Agriculture and Food Production



How Many Beasts? How Many Serfs?

whether or not you are already. Apart from the incentive of possibly seeing your picture on disc, you could win valuable photographic equipment if your photograph is a category winner. Full details and conditions of entry are on the entry coupon at the bottom of the page. (If you don't want to decimate your copy of A&B, you can obtain further entry forms from your local BBC centre or send an aae to the competition address.)

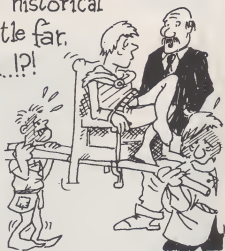
WHAT PRICE, DOMESDAY?

In an earlier issue of A&B, the Domesday Project was described as "one of the most ambitious cultural and technical projects of all time". Having seen a working demonstration of just a fraction of what the system will be able to do, I

don't think that this is an exaggeration. As a historical record and an exciting and versatile reference tool, the Domesday System should find its way into schools and colleges, libraries and many other institutions throughout the country. It has an infinite number of possible applications and should be the springboard of innumerable imaginative projects. My only major doubt is the cost.

No definite price is fixed as yet but it is likely that the videodisc player will be just under £1000 and the two Domesday discs about £50, or £100 for a set that includes the television series as well. Even supposing that a potential buyer already has a BBC micro and monitor (a television would not give a signal of sufficient quality) the Domesday system will not be cheap. For a commercial company or cor-

Don't you think you are taking the historical angle a little far, Fortescue...!?



Domesday cartoons by Jonathan Hall.

porate organisation, perhaps £1100 is not such a large sum, but for a school that can hardly afford white paper or pencils, such a price might put the Domesday System out of reach.

The Domesday Project National Photographic Competition

CALLING UK photographers! This is your chance to have your pictures included in the Domesday Project which is arguably the most exciting new national archive for 900 years. Photographic prizes worth £4,000 can be won.

Over 150,000 stills will be on the Domesday video-discs and what's needed are pictures which are not just technically and artistically pleasing but especially imaginative in bringing to life an aspect of the UK in the 1080s.

There are six categories: 1, Street life; 2, Country life; 3, Fences; 4, Leisure; 5, Work; 6, Home life. Only 35mm slides, taken in the 1980s and oriented horizontally, can be accepted. Please read the rules carefully.

The project is offering attractive prizes for the best pictures submitted, according to a panel of judges including project editors, advisers from technical consultants Kodak Ltd, and independent experts: your choice of photographic materials and equipment up to a total of £1,000 for the best overall picture and £500 worth for the best in each category.

But what's really wanted are the country's 5,000 most informative and imaginative pictures to store on the Domesday discs. Senders of pictures selected will each receive a commemorative certificate.

Rules and entry form are alongside; the contest address is Domesday Photo Contest, Hemel Hempstead, Hertfordshire HP1 1JU and the closing date is 27 September 1985.

- 1 UK residents may enter, except employees and their families of the BBC, Kodak Ltd and others associated with the contest.
- 2 Entries must be 35mm transparencies taken in the 1980s oriented horizontally. No colour format can be accepted and no glass-mounted slides may be submitted.
- 3 Prizes will be awarded to the senders of slides which, in addition to technical and artistic quality, most aptly and vividly depict an aspect of UK life in the 1080s in the chosen category. Senders of pictures selected for the Domesday discs will receive a commemorative certificate.
- 4 Last date for receipt of entries is 27 September 1985. Winners will be notified by 8 November 1985, and prize-winners' names and counties will be available after that date from the competition address, on sending an aae. Major prize-winners' names and counties may be announced on TV.
- 5 Each slide may be entered for one category only and may be accompanied by a separate handwritten copy of the entry form. Photocopies of the entry form are acceptable and further forms are available from the contest address (send last) and from other BBC centres. Each slide must also be labelled on the reverse of the mount with the entrant's name, address and the category for which the slide is entered. More than one category may be entered and more than one slide may be submitted in any category, up to an overall maximum of 12 slides per entrant, provided they are all submitted in one entry package.
- 6 Entrants must hold copyright in the slides they submit. This copyright will remain with the entrant but it is a condition of entry that the BBC's Domesday Project may reproduce and publish without charge any slide and Domesday discs or in associated information and publicity materials, including TV broadcasts and public exhibitions. No usage beyond the needs of the Domesday Project will be made without further permission from the entrant.
- 7 All entries will be returned during December 1985, provided no additional equipment is enclosed. The organisers reserve the right to make duplicates of any slide for the purposes of the Domesday Project, subject to rule 6.
- 8 Judges' decisions will be final and no correspondence will be entered into. The judges reserve the right not to award prizes where the quality of any category field is not the required standard.
- 9 While every effort will be made to safeguard entries at all stages, liability cannot be accepted for loss or damage, however caused. Proof of posting will not be accepted as proof of receipt.

THE DOMESDAY PROJECT NATIONAL PHOTOGRAPHIC COMPETITION

(Technical conditions: Kodak L10)

Post to: DOMESDAY PHOTO CONTEST, Hemel Hempstead, Hertfordshire HP1 1JU

ENTRY FORM: Please send a completed copy of this entry form for EACH slide entered. Up to 12 slides may be submitted by each entrant.

ENTRANT'S NAME: _____

ADDRESS: _____

Category this slide is entered for (tick ONE only):

- Street life in the 80s Leisure in the 80s
- Country life in the 80s Work in the 80s
- Fences of the 80s Home life in the 80s

Caption and description (BLOCK LETTERS, PLEASE, ONE PER BOX)

Short caption, including name of place where taken:

(eg: MODERN LIBRARY IN ANYTOWN)

Further description:

(eg: NEW LIBRARY COMPLEX IN ANYTOWN DESIGNED BY A.R. DITCHET AND FEATURING A REVOLUTIONARY NEW TYPE OF BOOK STRUCTURE)

NB: please enclose aae if return of your slides is required

DECLARATION

I have read and agreed to accept the rules of the contest, including the duplication of any of my slides for the purpose of the Domesday Project, subject to the provisions of Rule 6

Signed: _____ Date: _____

Not So Hard Discs

Jon Vogler

If the expense of a hard disc system is all that has prevented you from buying one, think again. You might change your mind.

"Attempt the end and never stand to doubt; Nothing's so hard, but search will find it out."

from *Seek and Find*
by Robert Herrick, 1591-1674

WHY BUY AN EXPENSIVE HARD DISC DRIVE AT ALL?

Why did you replace your tape cassette with a floppy disc drive? The answer of course is that the floppy disc drive is far faster, more convenient, involves less work by the computer operator and offers random access. Then perhaps you advanced to a dual, double-sided floppy drive and a better filing system so that more files and more file capacity could be fed quickly into the computer. Once you had started using proper business programs, or a combined word processor and data base for mail merging, you would not dream you could ever tolerate a single disc, let alone a cassette set-up.

The leap from even the largest capacity floppy disc drive to a hard disc is just as great. Vastly more data is available and it can be read and written much faster. Suddenly every file you could possibly want is (almost) instantaneously at your disposal. They load faster and more quietly. Best of all is reliability. Because floppy discs are

placed on dusty desk tops, scratched and bent and have biscuits eaten and hair combed over them, their reliability is very poor. Winchester can fail but I have not had a single corrupt file in the four months I have been using one. No more sickening screen messages: "disc fault" when even the most expensive floppy discs do not quite engage correctly. Above all there is no infuriating shuffling of discs in and out; reaching for your loose leaf index, finding that you have not updated it, wondering on which disc, three days ago, you saved the file you now want.

WHAT IS A "HARD DISC"??

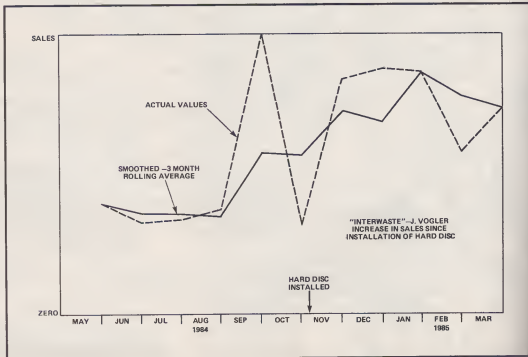
"Hard" or "Fixed" or "Winchester" discs have been used on almost all large "mainframe" computers and have been around much longer than the "floppy" discs and drives with which most readers will be familiar. The way in which data is "written" to them and "read" from them is almost the same as floppies but the discs bearing the magnetic recording surface are permanently mounted inside a dust tight casing. Because the heads do not have to follow the uneven path of a flexible disc and because dust particles cannot interfere, the discs can spin faster: 3600 rpm compared with about 200 rpm for a floppy. The read and write heads do not touch (and wear) the surface of the discs as they do on a floppy, but float on a cushion of air, five millionths of a millimeter (five microns) thick! They can discern data that is packed far more densely, typically 160 or 320 tracks compared with 40 or 80 on a floppy and 33 sectors on each track, compared with 10 (or 20 on "double density"), so that each sur-

face (2 per disc) can hold two and a half million characters of information. Because the discs are not changed they can spin continuously and no time is lost in starting and stopping.

The Winchester unit is usually bought from a specialist supplier: the firms mentioned here just add electronics, cabinet, software, etc. The unit is sealed and, although air can enter, it is filtered so that any particle bigger than two millionths of a millimetre is excluded. A smoke particle is typically 250 millionths of a millimetre wide, so if a friend lights up the tobacco smoke will not enter that critical five micron gap.

HOW THE BENEFITS APPLY IN PRACTICE

For any one using the computer for serious business operations, the benefits are substantial. In the three months since TORCH lent me a hard disc, I calculate my personal productivity has increased by about 30%. This is not just a desk calculation; you can see it in



my (computerised) sales ledger: the number and value of invoices that I have sent to customers during the period bears it out. Fig. 1 demonstrates this; I have reduced the graph to a base line of 100 for reasons of confidentiality but if any reader wants to audit the figures, he or she will most welcome. Finally I decided I could not live without the unit and bought it outright: the justification for the investment is set out below.

Increased productivity for the single user is not the only compelling reason for buying a hard disc: the other is to serve a network. The use in the classroom, of many BBC micros all linked together with ECONET or some other network, so that the teacher can, without moving, intervene to help or supervise any pupil, has been widely discussed. Less has been written of the business potentialities, but a large office or small factory can get huge benefits by linking the transport office, the stock controller, the buyer, the accounts clerk and so on to the same computer programs and files. This has been possible with big, hugely expensive, computer systems for years. Now it can be done for a few thousand pounds but not,

realistically with floppy discs: they will work perfectly well on networks but can hold too few files for practical purposes. If the accountant is working on the sales ledger floppy when the buyer wants to amend the purchase ledger on a different disc, things become confused, slow and irritable: not the ingredients of business efficiency.

WHY THIS REVIEW ONLY COVERS THREE HARD DISCS

I started work on this review eight months ago. TORCH and GSL both responded promptly and efficiently to my request for review hardware. QUEST and INTEC, both of whom had been running adverts for hard discs for the BBC, promised review units which never appeared. I telephoned both half a dozen times during the next four months and received promises,

excuses, laments; but no unit. The problem seems to be that the discwork, but cannot run the highest "level" of ECONET. Then ACORN advertised a hard disc. I visited them and was promised a review unit: same story. Even after ACORN's crisis was over I got promises, confusion and delays, but no hardware I could tell A & B readers about. I was resigned to writing a rather limited review of only two units when MIDWICH advertised one. Within days they had sent it me. Then it blew a fuse. More laments? Not a bit of it. At the earliest possible moment Midwich sent an engineer to find out what was wrong and a replacement unit so A & B readers should have their review. That shows the kind of service that some companies can provide.

I hope either that it will prove possible for QUEST, INTEC and ACORN to provide review units in the next few months, or else that they will withdraw them from the market. In the meantime readers should exercise the utmost caution before buying equipment that the manufacturers are unable to submit to reviewer's scrutiny. If any A & B reader has experience of these products, please write and tell us.

GSL WINCHESTER DISC DRIVE 1 THE HARDWARE

GSL started life as suppliers of electronic equipment to the Ministry of Defence and it was in this role that they developed their Winchester Disc Drive. It looks like it! It is built to withstand a Sherman tank driving over it or even use by a schoolboy: the steel sheet cover is at least twice as thick as that used on the cabinet for my Cumana floppy disc drive. It is fitted with a RODIME hard disc unit, made in Scotland. The connection from the hard disc to the BBC is very simple, a ribbon cable into the 1MHz bus socket underneath the computer and a mains lead. It is equipped with a key as an additional security measure.

When you buy the hard disc, in any size: 10, 20 or 40 megabytes (and you can go even bigger, up to 400 megabytes in theory — that is equal to about four Encyclopaedia Britannicas! but over 80 megabytes is the largest supplied so far) you in fact get two systems as the unit incorporates AMCOM's E-NET — a networking system that operates through BBC Econet hardware but is able to handle up to 200 computers. Although it can be used as a "stand alone" hard disc drive, it is not ideal because:

- 1 It is physically very large: a pity because it contains mostly fresh air: there is space for a second hard disc unit (or a "streamer-tape back-up": a cassette unit whose huge tapes will store the entire contents of a 20 megabyte disc in about ten minutes) and the transformer and controller boards are generously surrounded by space. The space it takes up on a desk can be limited by positioning other things on top of it, such as the monitor or floppy disc unit: even so it is rather greedy of space.
- 2 The cooling fan is noisy (about twice the sound intensity of the Torch unit and a real distraction in a small room).
- 3 It does not contain a floppy disc drive; you would have to buy one as well.

2 SOFTWARE

The obtrusive hardware is not really significant when performing its intended function: as the master of a tribe of networked slave computers, spread around various offices and departments of a small commercial office or factory. It is with this in mind that the extensive software is planned and it is powerful, practical and effective. It can be broken down into three categories: the utility package, the file server commands and the Winchester commands.

The utility package comes on a separate floppy disc and is concerned with setting up users: each computer that is networked into the system has a different user number and, associated with this, its own password. Only by using that password can that user write

to "record data or alter" a file but without it files can still be read — provided the "security priority" of the file permits.

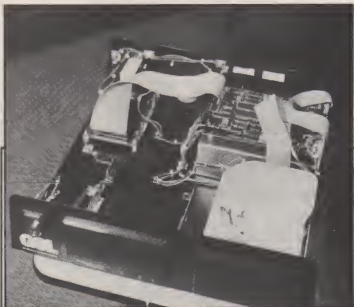
The file priority code is also assigned to each user: the higher your code, the more files you can read: at the top the system manager has the highest priority and can read everything. One cannot read the files of other people with equal priority so, if the sales manager and works manager both have priority 20, they could not read each other's files but could read those of the despatch department (priority 10). The managing director, with priority 40, could read either of their files however. Users can also be grouped together in "forms" for access: for example if there were four different sales departments, each with one or more computers, they could be grouped together as a single form and those files that they alone use could be so coded to restrict access by any other department.

The amount of disc drive space to which each user has access can be determined by the system manager and GSL go to considerable lengths to encourage users to select file sizes that will make it easy to back-up onto floppy discs. If you create a hard disc file that is too large to back-up onto a single floppy, you are encouraged to break this down to "sub-drives" each of length equivalent to a single floppy. The system uses the AMCOM floppy disc controller which it describes as more advanced than the Acorn DFS. Although the advantages appear small to the single user, it is this that has resulted in GSL producing a highly professional system where others have failed completely.

The file server commands are concerned with operating the network. For example, they permit the system manager to alter the priority level of a file or a group of files or the slave machines to send messages to the master computer.

The access users have to random access files: although it may be desirable for several people to be able to read the sales ledger, it would be disastrous if they tried to sell the same product, to a different

CONTINUED OVER



The GSL unit takes up a great deal of desk space as it contains mainly fresh air.

4 This provides good cooling and space for a second unit or a streamer tape.

customer, at the same moment and there are commands to try and control this.

Close supervision — obviously aimed at education but invaluable in conferencing or in any business, such as broking or process control, where things happen fast (and often irreversibly) and the supervisor wants to know what subordinates are doing at the time, not afterwards. For example, the user of the master computer can:

- 1 Receive reports on which slave computers are using the system; for example to save or load files, and what errors are occurring.
- 2 Pass messages to one or many slave users; for example, to demonstrate techniques.
- 3 View everything that is happening on a slave computer (without the slave user knowing anything about it — shades of 1984!).
- 4 Actually take over the screen of a slave user.

There is a nice vein of humour in this system: for example the command to pass messages to many slave stations is called — "SHOUT" while, if a user tries to delete a file that is marked with another user's number, an admonishing "NAUGHTY!" appears on the screen.

The Winchester disc drive commands are very similar to the standard ACORN DFS commands: "ACCESS", "ENABLE", "WIPE", "BACKUP" etc, but in addition there is a range of commands

associated with creating a "hierarchical" file structure and this is a great strength of the system. A hierarchical structure is one like a traditional line management "family tree". A main catalogue can contain anything up to 63 "sub-drives", of any size between 1K and the full disc size available and able to contain up to 255 files. These sub-drives however can, in turn, contain a further three levels of sub-sub-drives. By simple commands such as "GOTO" and "GO-SUB, you can work your way "down the tree" and, by "RETURN, back up again. (If you go too far back up, you get a cryptic error message "stack overshoot" which no doubt means something extremely computerish and technical but is of little help to the average business person.) One can list all the sub drives defined within the current drive and one can also give a single letter label to up to 5 sub-drives to save typing in long drive hierarchies.

As the normal BBC disc filing system categories, such as "directories" and "libraries" are also available, these, coupled with the variety of user numbers, variety of priorities, and a hierarchy system

that in theory permits up to one thousand million file names (in practice: any number, limited only by disc capacity) there are no less than four different methods of organising files and this is particularly important in large organisations where security and confidentiality of information are of vital importance. I found it difficult to learn these systems, and the handbook was not fully adequate in helping me. However, once a system manager became familiar with it, no doubt these problems would be rapidly overcome and the power of this comprehensive file management system could be fully utilized.

I had two main criticisms. The first was that I could find no way of finding, at any time, any file anywhere among the various levels of sub-drives on the system. When one is using a large disc, possibly with thousands of separate files, some will actually get lost; especially if one forgets the name or the subdrive on which one saved them. Some rapid way of finding them is essential. GSI suggest one should use "USER, which lists all the files on the section of the hard disc allocated to a user, and encour-

rage users to write their own simple program to perform this automatically for all users. However, this command is not mentioned in the handbook and I take the view that such features should be available for those without the time or skill to write their own programs.

Secondly, the error message information was poor. I have already mentioned "stack overshoot"; I was none the wiser when I got "Winchester error 21" and nowhere in the handbook was there a list telling me what this particular error was. GSI issue a printed sheet of error messages but it is not very helpful.

Apart from this, the GSI Winchester drive performed as an efficient hard disc unit, giving extremely rapid access to files in an effective and reliable fashion.

3 HANDBOOK

The handbook is actually published by AMCOM, not GSI, and I found it well-produced and easy to read. It lacked a proper index but the contents list was fairly comprehensive. A new, indexed edition is promised. As well as



being short on error messages it ought to include a complete chapter on how to build up a logical structure of hierarchical files, complete with a few diagrams. In particular it should show the relationship between files and sub-drives that relate to the same drive.

4 ASSESSMENT

The 10 megabyte disc sells at £1450 plus VAT and the 20 megabyte at £1750 plus VAT. Both of them are practical and satisfactory and good value for stoutly-made hardware plus networking software if you are content to work with the BBC operating system, but will not work with a Z80 second processor. For a single user the cost is rather heavy, as you will need to buy a floppy disc drive in addition, but for running a network, the excellent software and filing system will take a lot of beating. GSL say that they are about to launch a stand-alone business unit, with a Z80 giving CPM compatibility, and selling at around £1850. It will use their own software, not AMCOM's and I await it with keen interest. I just hope that the new business unit will be a bit more economical.

MIDWICH 5 MEGABYTE UNIT

In contrast to the voluminous GSL, the Midwich 5 megabyte hard disc unit is exceptionally compact and admirably shaped so that it sits comfortably on top of my floppy disc drive. The floppy is necessary because the 5 megabyte model comes without an integral one, although the larger 20 and 25 megabyte models, promised shortly, have built in floppy back ups. This compactness is achieved by mounting the fan underneath, with the power supply upside down and directly above it. The other end of the box is completely taken up with the Shugart Winchester drive and the circuitry mounted directly above that.

The metalwork is substantial and well finished, but the front of the unit is in rather cheap looking black perspex, on which the familiar Midwich green logo does not stand out. In operation a glaringly bright LED flashes behind the per-

splex to indicate that the Winchester is reading or writing. The unit comes with a ROM that replaces the DFS ROM inside the BBC micro and a utilities disc.

The Midwich unit works with "Levels 1 and 2" of Econet, serving about 40 users and is predicted to work with "Level 3" which is currently being released. However on Level 2 only about half the total capacity can be "on-line" or accessible at any time. (Readers not familiar with Econet: see insert box). Midwich have got over the problem of keeping track of large numbers of hard disc files by splitting the disc into 26 different "volumes" (further confusion for those already bemused by files, directories, libraries but at least logical!) each of 200K bytes, the size of an 80 track, single density, single side floppy disc. These can be treated almost exactly like floppy discs but give hard disc performance. For further compatibility with floppies, four floppy drive numbers are also provided in the same sequence. For readers who are about to exclaim:

"But what about my accounting program which knows that the applications program is kept on drive 0 and the data file on drive 1? How will it know to look on drives 10 and 16?"

Midwich have thought of this one. You can "assign" any drive numbers to drives 0,1,2, or 3. These are only "logical" drives, neither the hard discs, which start at 4 or the floppies which start at 30, physically occupy them. Such assignments are made with a simple "ASSIGN" and can be altered at any time — an imaginative system of great flexibility. When using Econet Level 2 and the problem referred to above, those parts of the disc that are inaccessible at any moment can be assigned to accessible parts when required, but must replace other, dormant files.

I have one criticism which is that there is no way of finding a particular file. To have to search among 26 different volumes is why people balk at buying the Encyclopaedia Britannica and the Midwich hard disc has the same problem. Midwich recommend that users carefully "Title" each volume but as titles are restricted to 12 characters, this is not really practical.

The other delightful thing about the Midwich hard disc is that you can also allocate each volume to a different kind of filing system, straight BBC (called MWT5 and almost exactly equivalent to DFS), Econet or CP/M for use with ACORN's Z80 second processor. This is a splendid feature, sadly missing on both the Torch and GSL hard discs, but unfortunately, having bowled so brilliantly, Midwich then totally fail to take the catch! Nowhere in the 70 page handbook is there any instruction as to how to transfer to other filing systems. As the Econet and Z80 handbooks certainly do not give you this information, you are left unable to do anything. I successfully managed to designate four volumes as CP/M surfaces A,B,C and D but could not manage either to format them or to copy CP/M files to them. Nor was there any indication as to how the computer would know whether a file specification containing an A: or B: would refer to the floppy or the hard disc volumes. Midwich should include this information in the handbook as a matter of urgency. I have since been told by Midwich that the unit will not currently run with the Torch Z80, although such a unit is planned. And that with an ACORN Z80, the hard disc will only operate like a pair of fast floppies, so there is no access to masses of file space except by "assigning"; and that even this is better than the ACORN hard disc which will not work with their own Z80 at all!

I was therefore only able to operate in the straight BBC mode and found it pleasant and fast: a text file which took 23.7 seconds to load into WORDWISE from 80-track, single-density floppy discs got home in just 12.7 seconds from the hard discs with a barely audible sound. However, once I got beyond simple loading and saving operations, troubles began. There is a PROTECT command which serves the same function as the "WRITE PROTECT" tag on a floppy disc. On invoking this, I was told:

"ERROR ON SYSTEM DATA BLOCK. CHECK WITH MANUAL"

CONTINUED OVER

The GSL uses E-Net with a hierarchical file structure. This screen shot shows the process of going down the ACCOUNTS branch.

```

Drive : => ACCOUNTS
Length &000k   Number of files &3F
Option 0       User 0000
Directory $    Library 0000.$
Work $

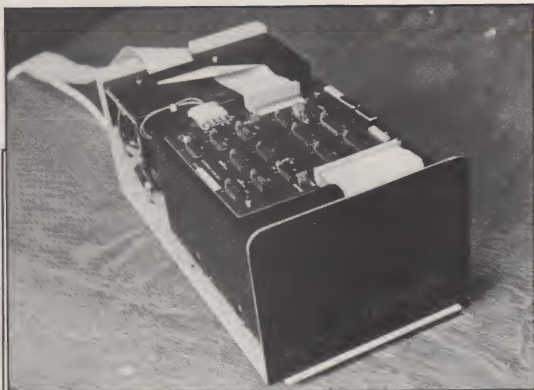
      UTILITY      L      NOMLED
      SALELED      PURLED
      OFFICE

>XGOSUB OVERHEAD
>X
Drive : => ACCOUNTS
Length &0020k   Number of files &27
Option 0       User 0000
Directory $    Library 0000.$
Work $

      SALEREPS      WORKS
      SITEINST      TRANSPORT
      SERVICE       TECHREPS
      MANAGMT

>_

```



Midwich 5 hard disc: small and compact.

Likewise with the command which selects the volume that will boot start when you hold SHIFT and tap BREAK. Other commands, to do with locking and unlocking, backing up and deleting files, stimulated the error message:

"WINCHESTER DISC FAULT IC"

I duly looked up the error message list in the handbook, but this particular one was not mentioned. I tried all the normal tricks: switching the computer off, switching the hard disc off, switching everything off then switching them back on again. The second time I did this, the unit blew a fuse and I had to be rescued by a helpful Midwich engineer.

Midwich have gone to considerable trouble to pack the equipment extremely carefully and it was delivered by a courier service who are normally used to handling delicate equipment. Mounted on the box is a device known as a "shock-watch": a slim glass ampoule which turns red to indicate rough handling. The shock watch on my unit was definitely blushing, but there was no visible sign of damage to the packing or the equipment, which functioned perfectly when first installed and for the first two or three hours of use. I can therefore only conclude that the above problems are the kind of "bugs" commonly encountered on new products and would

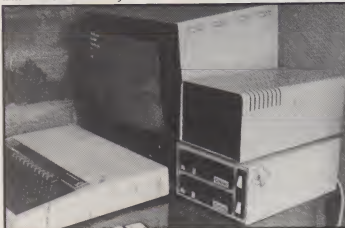
urge readers to take the necessary precautions:

- 1 Buy through a local dealer (close enough for convenience if you have to return the equipment).
- 2 Alternatively consider Midwich's excellent offer of a 24-hour "get you working again" service, costing £65 per year.
- 3 Get the dealer to demonstrate, in the showroom that the machine will work with your computer and in particular that the Protect, Boot, Access, Backup, Destroy and Title commands all operate.
- 4 If you are a Z80 or Econet user, insist on receiving full instructions and demonstrations of how to transfer individual volumes to these filing systems.
- 5 If you operate a network, take advice whether you need

Level 3 (probably only if you run a substantial database) which is expensive or can get by with Level2.

ASSESSMENT

If the above matters can be overcome, Midwich's 5 megabyte hard disc is a good product at a comparatively low price. For the small business or home user, who does not need huge capacity but wants speed, silence and freedom from floppy disc errors and shuffles, it is an obvious choice. It offers the substantial benefit that, if they graduate on to an ACORN second processor, they can still use this unit, provided someone tells them how!



The Midwich unit sits conveniently on top of the

floppy disc drive. (The drive is external and not built-in.)

TORCH HDPZ80 20 MEGABYTE HARD DISC

The unit comprises a steel box eight inches wide, 10 inches deep and no less than 13 inches high: a most distinctive new object on your desk. Densely and craftily compacted, this contains:

- a single dual sided floppy disc drive
- the 20 megabyte hard disc
- the hard disc controller board
- the Z80 second processor
- and, if you want and can afford it, a Neptune third processor with a Motorola 68000 chip and 256,000 bytes of random access storage which can be increased to a million bytes and can run Unix and many other operating systems.

When you remember that, 10 years ago this was about as much computing power as the Pentagon had available, this is a rather potent machine to have at your fingertips.

There are one or two disadvantages: lets dispose of them right away. Firstly, the cables are so short that this beast has to live right beside your BBC. My first action when I had unpacked it was to get a hand saw and carve a great chunk out of my nicely carpentered computer desk. Surprisingly, I found little inconvenience: in fact it provides a rather handy table on which to place paper while I am printing and the carefully engineered air cooling slots at the top continue to function even when I mis-use it in this way. Secondly, there is a continual hissing sound: this is due to the cooling fan rather than to the disc unit itself and is so swishy and soothing a noise that I soon forget it is there. It contrasts pleasantly with the raucous sound of my floppy disc drive: when the disc is operating, you can just hear a subdued clunk if you put your ear very close to it. I remember the overheating problems I had last summer, due to the Z80 being underneath the lid of my Beeb, and am looking forward to this summer with the Z80 out of the Beeb cabinet and properly cooled.

Compared with the CSL disc drive, it has a very small "footprint": no more than a sheet of A4. The floppy disc drive is at a most



The Torch Unicorn has to sit very close to the BBC. In practice this is quite convenient.

convenient height and seems to be far better engineered than any other I have used: I have not had a single "disc fault" error message. Of course it is used so much less frequently that this is perhaps not a fair comparison. The unit links into the BBC micro in three ways: into the disc drive socket, into the 1MHz boss socket and into the tube. There is also a ROM chip which has to be fitted in the BBC.

The Z80 is a Z80B, which runs substantially faster than the Z80A in the Torch disc pack and one really does notice the difference. There is practically no waiting for software to load. I have not yet tried out the full glory of the "Unicorn" ("UNIX on a CORN"): the 68,000 processor and Unix software pack but shall report on them in a future issue.

USING THE TORCH SYSTEM

There are other, more subtle reasons for the great increases in productivity described at the start of this article. The first is to do with "command files". These are one of the most attractive features of the Torch Z80-based CP/M system: one can write short, simple programs to carry out a sequence of

activities that are frequently repeated. I use one, for instance, to load my Sage accounting program, provide a soothing screen colour, switch the printer on and define user keys; another to find a given name and address on the database and print it on the front of an envelope of a given size. The problem in the past has been that, once a floppy disc has been filled with some major application program, there is only limited space left on it for the command files. Command files are all about *SPEED!* They are of limited value if you have to shuffle discs in the middle of their operation.

Now however, I write short, simple command files for every task I undertake. There are four or five for different sorts of correspondence, two or three for word processing different kinds of document, one for doing the books, one for timing a computer operation, one for loading the keys with basic utilities, one for cleaning "garbage" off the discs; backup files and formatted files and test files and temporary files, one for making daily back-ups of the data base and another for the accounting program and so it goes on. Whereas six months ago an average business application involved typing strings of words, it now rarely involves more than two or

three single key strokes at a time. It is the difference between mowing the lawn with a "shove it as hard as you can" hand-mower and using a power mower: you still hold the handle but only to exert a little guidance here and there.

Before I had to remember detailed sequences ("BL4E4WM" represented a business letter, to be word processed, printed on A4 paper with an A4 envelope, which is one of a general category of mail files). If my secretary or could not remember it meant looking them up in that wretched loose leaf file. Now we can use Torch's formidable do-it-yourself menu creation program "EXECUTIVE AID". This enables you to devise a hierarchy of menus: a bit slower than keying in your own commands straight off, but the only alternative once your operations reach a certain degree of complexity.

There is a vast array of other, superb software. "FIND" will tell you where any file is, with complete "wildcard" operation if you have forgotten exactly what you called it. Use "LS" and you can list the name of every one of several thousand files in front of you: neatly sorted by disc "surface" and alphabetically, with file size, user number and protection all optionally shown. "VARDISC" enables you to carve up the 20 megabytes

into whatever chunks you prefer and "BACKUP" saves hours by not copying a file onto your "archive" disc unless it has been altered since it was last backed up. There is no facility for "tree" directories: the system is so simple and quick they are not needed and would be cumbersome.

Finally, there is the facility for multi-user operation with Torch-NET. I have bought a second Beeb so that my secretary and I can work simultaneously; so that I can test add-on hardware without disabling my writing system; so that I can edit one text, while another is printing or while looking up a train time on PRESTEL; and above all so that there is a second machine available in the event of a breakdown (it has not happened yet but becomes increasingly inevitable as the keyboard has been hammered for about five hours a day, almost continuously, for two years). With Torch-NET all machines are working units; you do not sacrifice one to be the file-server. This is the ideal for a medium-sized business: lots of low-cost work stations (under £900 each for Beeb, Econet, Z80 and monitor) each with access to formidable in-house computing power.

INVESTMENT DECISION

Although prices have been dropping steadily, a hard disc is still the most expensive component of a small micro-computer system: around £1000 for every 10 megabytes of storage. Under what circumstances is such a business investment justified? If you run training courses with a classroom full of Beebs, the calculation for a hard disc is simple. For the "stand-alone" businessman it is more difficult but goes something like the following for the Torch and a similar sum could be done for each of the other units.

SAVINGS

1 Hourly charge rate for computer and user. If you think this is high,

CONTINUED OVER

you are either undervaluing yourself or not being realistic about your business overheads! Many well-qualified professionals would set this at £20 or higher! 182 Number of working hours computer is in use per day

5 - Number of working days per year 200

4 Increase in productivity by using hard disc. Actually, as indicated above, it can be far more, but let us be cautious. 20%

5 Annual value of improved productivity = 20% of 200 x 5 x 18 = £1600

6 To this, add savings in purchases of floppy discs (costing £25 for ten 360K discs) about £150

7 Total gain £1750

CAPITAL COSTS

1 Cost of hard disc £2000 2 Less resale value of dual disc drive and Z80 disc pack (even if you use it on a second BBC) £500 3 Less tax allowances (on 50% capital value) £300 4 Nett capital cost £1200

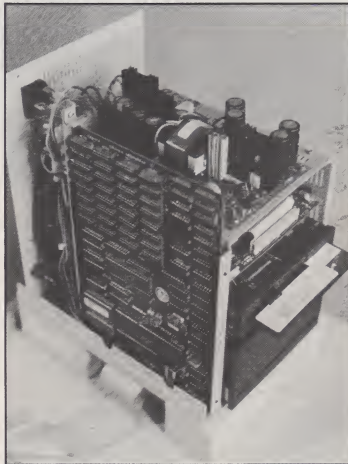
RETURN ON INVESTMENT

A figure to satisfy any banker: around 150%! This is good economics by any standard, even better when you remember that there will be further capital allowances in subsequent years and, as soon as a second user shares the disc pack, even if not for the full working day, then further productivity improvements will be achieved.

IS UNICORN A WISE INVESTMENT?

Investment analysis is all very well but there is also the other question: risk. For most small businesses, £2,000 is a lot of money. What if something goes wrong? In the March issue of A & B Computing I made it quite plain why I believed that the BBC family of computers offered such an attractive "upgrade path" and that they were competitive with any other busi-

ness micro computer system available. There are a number of people, who think they know, that have cast serious doubts as to whether the Unix system can dislodge MS-DOS (the original, from which IBM's almost identical PC-DOS operating system was copied).



The Unicorn packs into a small case about the same computing power as the Pentagon had a few years' back! At the bottom is the hard disc unit, above that the floppy and then the hard disc controller board, finally

Obviously everyone must come to their own conclusions and many may say: "I am going to be on the safe side and buy an IBM PC-AT or an Apricot-XI". The reason why I myself am not taking this path is as follows:

Computer technology is changing so rapidly that any

investment will be "out of date" in one (or certainly two) years. Therefore, any decision is going to prove to be the "wrong" one. The choice is therefore to do nothing or to buy the best value equipment that does the job. For me, the Unicorn is head and shoulders above anything else available. - I have now

realisation described above. My personal investment analysis looks very similar to the one outlined above; in fact it is rather more attractive. I can therefore justify this investment, even if I replace it into two years time. While I should be deeply sad to see Acorn fold up, this would not threaten my personal operations. There are over half a million BBC computers in service, so a lot of people will continue providing maintenance and repairs over the next two - or even five or ten - years. Secondly remember it is a BBC, not just an Acorn computer and I have no doubt at all that the BBC will arrange continued support. - Although Torch was almost taken over by Acorn a few months back, the deal was never finalised. Torch continues as a totally separate company and I personally believe that they are vastly better managed. Their future product development, of which I saw some fascinating glimpses on a recent visit, is in no way dependent upon Acorn. - For those who want to use the BBC as a business machine on its own, with some of the excellent software from Gemini, Meadows Computers and others that I have reviewed over the past year or so, the future looks perhaps less attractive. Not because the machines and software will not continue to work but because software houses will be very chary of committing substantial programming effort to produce software for a machine that has not got a secure future. This, justifies what has been an underlying thread in these articles for many months: the BBC with a Torch Z80 is a far better prospect as a business computer than one without.

COMPARISON

Table 1 shows the prices and capacities of the three hard discs tested. An allowance has been made for the other items included in the package: networking software, integral floppy and second processor. On this basis the TORCH costs slightly less per megabyte of storage, but not enough to be significant.

In fact the three devices are so different that few readers will find

got so used to the BBC, and the Torch operating system, with my books on Sage accounts and with Perfect software and DBase II tailored to my business's needs that I have a big personal "learning" investment plus a "customizing" investment, represented in the command files and personal orga-

ECONET

Econet consists of separate hardware and software. The hardware comprises:

- A modification to each BBC computer that is to hang on the network, costing around £70 fitted. One BBC has to be designated as the file server and cannot be used for other purposes at the same time.
- A "clock" device with its own transformer, costing around £50.
- Cables and "terminators" connecting the various parts.
- A "file server" which can be a floppy or hard disc.

Econet hardware can be used to run other LANs (Local Area Networks) such as Amcom's E-net or Torch's Torchnet.

The software varies in complexity between three different levels:

Level 1 This basic system can carry out simple operations on floppy disc files of less than 10 Kbytes.

Level 2 Needs a 6502 second processor and can handle random access files.

Level 3 For use with Winchester discs: just being released.

difficulty in choosing which is appropriate to their needs.

For the large network of BBC users, not requiring to operate "professional" (ie CP/M) business software but faced with the problems of keeping separate users independent, supervised and content, the GSL units are the obvious choice, with the 20 megabyte unit being well worth the somewhat higher price for all but the most cost-parring applications.

For the small network or stand-alone user, content to stick with the BBC operating system but wanting more speed and "less flop", Midwich offers a strikingly lower capital cost.

For the serious business, running accounts, mailing lists, budgeting or inventory control, either as a stand-alone system or with a number of networked micros, the Torch is the only serious choice.

What I hope this article will convey is that a hard disc is no longer a remote idea, a preposterous indulgence for any hard-headed, cost-conscious business person. It is a cost-effective tool for achieving unbelievable productivity gains, offering a return on investment that makes it folly not to buy one if the computer is a serious part of your business operation. The units described here cost around two months' salary for one middle income employee and can pay for themselves inside a year.

Otherwise you may one day be heard saying to the liquidator the words of the Book of Common Prayer:

"Then thought I to understand this but it was too hard for me!"

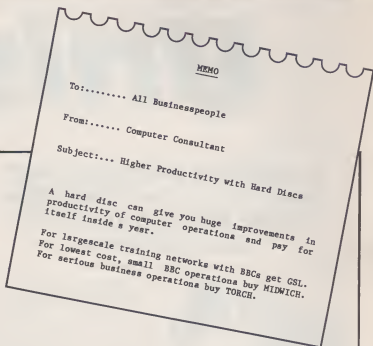


Table 1

Manufacturer	GSL	MIDWICH	TORCH
Capacity in megabytes	10 (20)	5	20
Fitted with integral floppy?	No (No)	No	Yes
Estimated value			200
Second processor built in?	No (No)	No	Yes
Estimated value			300
Price incl network software?	Yes (Yes)	No	No
Estimated value (£)	100		
Price (incl VAT)	1667 (2012)	977	2240
Cost per megabyte?	157 (96)	195	87
Uses BBC operating system?	Yes (Yes)	Yes	No
Operates with Z80?	No (No)	Partially	Yes

a Comparison of hard discs

TASK	TIME WITH FLOPPIES	TIME WITH HARD DISC	PERCENT GAIN
Load SAGE accounts with files (including inserting floppies) (floppies already in and centred)	34 secs	14 secs	59
	28 secs		50
From main menu, display trial balance, item by item (SAGE accounts)	64 secs	43 secs	33
Load PERFECT FILER database and find one member out of 400	27 secs	13 secs	52
Display this article on screen and scroll through (PERFECT WRITER)	212 secs	188 secs	11
Check spelling of 1800 word article with PERFECT SPELLER	40 secs	28 secs	30
AVERAGE PERCENTAGE GAIN			39

b Time savings from hard disc compared with floppies

Making the most of Logo

Ann Owen

Two more Logos introduce themselves to Making the Most.

You will be aware by now that, after a considerable wait for any Logo at all, the BBC is now blessed with four possibilities. Only Acornsoft Logo is marketed for the Electron Plus One.

The two newcomers to this column are Logotron Logo and LSL Logo. Both are one chip 16K implementations of the language. Logotron's version is written by French company, Systems d'Ordinateurs Logo International. All the documentation however has been researched in Britain in consultation with school teachers.

Logo Software Limited formed especially to write their version. Both languages are written in Assembler (Acornsoft's is written in BCPL). This fact affords some considerable speed advantages over the double chip version but the 16K limitation does mean that some facilities are not within the chip. This doesn't mean that such facilities cannot be created as Logo procedures when needed.

HISTORICAL LOGO

Logo was developed out of the language Lisp but an important breakthrough and its most distinctive feature, emphasised by its use on microcomputers, is Turtle graphics. Versions of Logo on the Apple microcomputers and for CP/M machines have been the most influential, bringing them into the home and onto the desks of school children.

Logos for the Apple, Atari, IBM and Spectrum have influenced the development of these BBC versions. Logotron's version inherits features from three of the above but also incorporates new features to take advantage of its BBC environment and of new ideas about the use of Logo now developing in this country.

LSL Logo is less "standard" in

the way it carries out many operations. But not to the extent that translation between Logos becomes impossible. There is an MEP project going on at the moment to develop floor turtle software and this will be available in a form suitable for all four BBC Logos.

Both 16K Logos do take a stand on some features however, sometimes through necessity. Both programs are excellent however and the programmers have done a good job in achieving their individual specifications. What we are faced with is a wealth of Logos, a veritable conspiracy. "Hands on" is recommended for anyone seriously contemplating what is a substantial.

EXTENSIONS

Both Logos are naturally enough aimed at the school market with children in mind. Logotron however has especially emphasised the inherent ability of their language to expand, as Logo can, for specific applications, without compromising on speed of operation. LSL is also very capable of this expansion via Logo procedure definition. Both sets of documentation provide considerable amounts of material to work through, including useful procedures.

One drawback of having to fill the gaps by defining your own Logo procedures is the need to efficiently file away these extensions for immediate access. If you are using a tape based machine then loading and saving large numbers of procedures and keeping track of them is not easy. Both Logos seem to assume a disc system much of the time.

The individual characteristics of the Logo file handling are therefore very important parts of the language. Logotron has SAVE filename name/list, which allows you

to easily save the whole workspace or to specify a variable or procedure name or list of names for saving. LOAD recalls the file. LSL SAVE covers only named or listed procedures. Although it is very easy to list all your procedures with PROCS, it would be nice if you could save the workspace. The manual defines a procedure ALL which can be used for saving more than one procedure.

The procedures are saved as text files and can be accessed by a wordprocessor, "TYPED" etc. LSL's SPY and Logotron's DRIBBLE open a name file into which all following input is saved. This is a permanent record of a Logo ses-

sion and can be printed out if needed. LSL also has OPENREAD and OPENWRITE, EOF and CLOSE commands.

Logotron employs a very handy method, directing what appears on screen to the filing system of your choice. SETWRITE filename opens the file. SETREAD filename is used to read a text file created by SETREAD or DRIBBLE, and after SETREAD has been set, RC (Read Character) and RL (Read Line) read information from the named file. SETREAD [] is the equivalent of BASIC's CLOSE 0 and the newly appearing *CLOSE, shutting down and tidying up all open files.

PROGRAM LISTING

TO CHOOSE ALIST

```
MAKE "ITEMNO 1 + RANDOM COUNT :ALIST
MAKE "CHOICE ITEM :ITEMNO :ALIST
PRINT :CHOICE
END
```

```
MAKE "PRESENT [DOLL TRAINSET COMPUTER]
MAKE "JARGON [ROM RAM HIRES BIT BYTE
PCB BUS I / O]
```

Lessons in the natural extendability of Logo. LSL already had the primitive WHILE built in. The Logotron listings above demonstrate how versions can be defined.

PROGRAM LISTING 2

```
TO ARM
REPEAT 10 [FD :DIST RT 18]
REPEAT 10 [FD :DIST LT 18]
END
```

TO HELIOS

```
HT
MAKE "DIST 30
MAKE "ANGLE 0
REPEAT 20 [PU HOME RT :ANGLE PD ARM
MAKE "ANGLE :ANGLE + 18 SETPC
SUM ( RANDOM 3 ) 1 ]
END
```

CONTINUED OVER

PROGRAM LISTING 3

```

TO RING
REPEAT 6 [TRIANGLE SQUARE RT 60]
MAKE "DEGREES HEADING
SETH :DEGREES + 15
RING
END

```

```

TO SQUARE
REPEAT 4 [FD 250 RT 90]
END

```

```

TO TRIANGLE
REPEAT 3 [FD 250 RT 120]
END

```

PROGRAM LISTING 4

```

TO TRIANGLE
MAKE "SIDES 3
POLY
END

```

```

TO POLY
REPEAT :SIDES [FD :EDGE RT 360 / :SIDES]
END

```

```

TO SQUARE
MAKE "SIDES 4
POLY
END

```

```

TO CIRCLE
MAKE "SIDES 30
POLY
END

```

```

TO TUNNEL :EDGE
SETMODE 0
REPEAT 10 [MAKE "EDGE :EDGE + 5 CIRCLE]
END

```

PROGRAM LISTING 5

```

TO WHILE CONDITION ACTION
IF NOT RUN :CONDITION [STOP]
RUN :ACTION
WHILE :CONDITION :ACTION
END

```

```

TO BORE
WHILE [0 = 1] [DIALOG]
END

```

PROGRAM LISTING 6

```

TO REPEAT_UNTIL CONDITION ACTION
RUN :ACTION
IF RUN :CONDITION [STOP]
REPEAT_UNTIL :CONDITION :ACTION
END

```

```

TO BORE
REPEAT_UNTIL [0 = 1] [DIALOG]
END

```

```

TO DIALOG
PRINT [TELL ME SOMETHING? GIVE ME A FACT...]
MAKE "STRING RL
PRINT [I TOLD YOU SO]
WAIT 10
CT
END

```

PROGRAM LISTING 7

```

TO DIALOG
PRINT [TELL ME SOMETHING? GIVE ME A FACT...]
MAKE "STRING RL
PRINT [I TOLD YOU SO]
WAIT 10
CT
END

```

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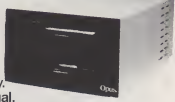
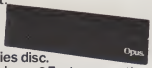
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Flexible Options

Clive Grace

The Beeb has always been considered a versatile machine, its many expansion ports have ensured that it has been accepted in laboratories and for scientific research up and down the country, whereas its colour and general ease of programming immediately ensured its success as an educational tool for nearly all levels of computer based education; and with the advent of the Z80 second processor and the wealth of CP/M software, the Beeb has now made its mark in the personal business computer world.

But in the field of industrial and control applications the BBC Micro has been sadly lacking, it suffers major deficiencies when it comes to controlling machinery or reading from instrumentation on the factory floor: the fact that it has no "standard" interfaces, its Analogue to Digital conversion is for many industrial applications simply too slow and the 6502 processor is a nasty little beast to get to grips with concerning I/O and peripheral driving in comparison with other processors.

True, for many requirements the Beeb's I/O capabilities are as comprehensive as a micro can get, but industrial requirements are far more exacting and rigid. The 6809 processor is an unusual beast to

A guide to the 6809

say the least, it is an old and very powerful design from the Motorola Corporation and has been around for many years, but it is still unrivalled in terms of specification and architecture. Some of you may have heard of the so called "wonderchip" the MC68000 which has been said to revolutionise the world of CPU controlled systems. It is being used in systems which require astronomical amounts of processing and

memory (in comparison to the home computer). Computers such as the Apple Macintosh to Computer synthesisers such as the Kurzweil all require this amount of processing, computer graphics require so much memory and fast processing times that the new generation of chips have had to "grow up" to be not only flexible but fast with it, the same 68000 is based on the general architecture as the M6809.

The main advantage and power that the 6809 has over other 8 bit processors is that it has two eight bit accumulators which are usable as a single sixteen bit register. There are three general purpose index registers, a hardware stack pointer and a program instruction counter. The other advantage that the M6809 processor brings is its ability to run advanced software tools simply not available on the 6502 as well as an industry standard operating system called FLEX.

FLEX is probably one of the most underrated operating systems of all time, it has features which literally use the 6809 processor to its full potential by taking CP/M's concept of the User/BIOS interface a step further by comprehensively linking a computer's individual I/O requirements in a series of overlay files. These files may be tailored by the user or by the company implementing FLEX (normally the latter), so in this case FLEX can support both the BBC's sound and graphics facilities as well as more immediately useful interfaces such as the user ports and analogue ports on the Beeb. FLEX does however require some prerequisites, a double disc system is absolutely essential as is a 8271 based DFS (Watford's DFS as well



CONTINUED OVER

```

#HELP FLEX
FLEX 0.1
C <adr1> <adr2> CRC check
D <adr1> <adr2> Dump memory
F FLEX warm start
G <adr> Go to Hex address
I Initialise Monitor
K <adr1> <adr2> <data> Fill memory
L <adr1> <adr2> <FROM> Load 6502 RAM
M <adr> Memory examine
O <adr1> <adr2> Offset calculation
P <adr1> <adr2> Test memory
R Registers
S <adr1> <adr2> <TO> Xfer to 6502 RAM U Upload FLEX

```

```

DS 1.20
>

```

Fig 1. The CUBE Monitor ROM

as their DDFS will work perfectly, the DDFS being in single density mode).

There are at present only two companies building 6809 second processors for the BBC Micro, Control Universal (who went to see last year) and Cambridge Microprocessor Systems (CMS). Both design complete 6809 systems around the BBC Micro for serious and industrial applications, supporting their second processor boards with industry standard "Euro" racking systems which allow extra hardware devices to be plugged in and taken out and to control devices amongst many other various tasks.

CUBE EUROBEEB/ BEEBFLEX

The Control Universal board is enclosed in a four slot mini Euro rack which contains both the housing and the power supply for the 6809 processor board as well as a second card for 64K Dynamic RAM chips, the remaining two slots can be used for extra analogue to digital converters or EPROM blowers or high resolution Graphics cards (all made by Control Universal).

The housing is made from rugged metal in the same cream colour as the BBC's case, the Euro cards are further protected by aluminium retaining plates, where there are interfaces to connect to the outside world a suitable hole is made, in the 6809 CPU Card's case these include a hole for the Tube interface which is a length of ribbon cable which is over 4 feet long!! at last a Tube device which

can sit a reasonable distance from the Beeb. Also included is a FLEX configuring ROM which plugs into one of the BBC's sideways ROM sockets, this allows the BBC Micro to communicate with the Euro cards via the TUBE, the ROM is also used to format discs to the FLEX standard.

Installing the CUBE ROM is a simple matter of unscrewing the BBC's retaining screws and simply plugging it in any vacant sideways ROM socket, fixing the TUBE interface to the top of the micro's case by sticky rubber feet and plugging the ribbon cable into the TUBE socket, you can then replace the lid of the Beeb and upon issuing a "FLEX" command you may now enter the FLEX monitor. Fig 1 Shows all the CUBE Monitor commands. The CUBE monitor is a basic version of the FLEX standard monitor which allows the user to examine any part of the 6809's 64K DRAM chips which includes the whole FLEX environment as well as any workspace, it allows information from the BBC's memory to be loaded into a suitable address in the 6809, with care I was able to load the very same View file from a BBC Micro with a 6502 second processor into the CUBE memory. By then saving the file (still in FLEX) I was able to read the file in using SCREDITOR, a FLEX based word processor. More "Standard" features allow examining blocks or bytes of memory and examining registers on the 6809 in a typical 16 bits per line representation, the monitor also allows the user to generate Cyclic Redundancy Checking (CRC) numbers for the 6809 DRAMs and any 6809 ROMs, more of which later. Connecting BeebFlex proved simple and reliable and with the inbuilt power supply serving the entire

four slot rack, the user need not worry about current drain on the Beeb's board, there is provision for future expansion cards from Control Universal which are also available.

In use the CUBE 6809 board was a little sensitive to dirty mains, anyone switching on a light in another part of the room were liable to crash the system. Normally the mains system is fully screened before any power gets to the delicate chips inside so I was lucky to have my test bench's power supply fully screened during the review. I would have liked to have seen at least a LED on the front suggesting that the unit is on, unfortunately the only way to find out, next to looking over the unit at the position of an on/off rocker switch is to feel the side of the case to detect if the unit is humming softly.

CMS-6809 Single Board

A very different beast is the CMS 6809 second processor. Their product plugs into the BBC Micro via the Tube without any power supply requirements, using all low power RAM/ROM technology. The single board approach makes for a more compact card which can attach itself under the Beeb's case by using rubber feet which stick the board to the upper inside case, out of harm's way and as it requires no other power from the TUBE it can operate quietly and coolly with even a fully populated issue 7 BBC board. The unit worked fine with a DDFS board, the Aries Board as well as a fully populated 16 socket ROM board, by virtue of its compact size, it is very easy to forget that the beeb has its own operating system at all! and living snugly inside the BBC's case meant that a whole host of "where shall I put this box now" problems were avoided.

As with the CUBE system, CMS use a Monitor ROM to both format FLEX discs and to communicate with the system for passing information across from BBC Micro to FLEX environment, Fig 2 shows some differences in the monitor ROM as some important commands are included.

As can be seen, the CMS monitor has all of the usual features one would expect, it has a few similarities with the CUBE ROM but has more facilities such as its ability to set up to three Breakpoints, search for a specified string in the 6809 RAM map or a Jump to address/Goto monitor start address command.

Typing "FLEX" puts the user in a Mode 0 screen with a much nicer display being simply white on black, other Modes can be selected by typing BV (Ctrl V) followed by the Mode number, in operation the CMS and CUBE systems are very similar except that the CMS board is slightly faster on disc accesses than the CUBE system especially when loading FLEX.

There is an optional battery backup for the on board CMOS devices as well as two 28 pin byte wide memory sockets. With the existing system this is taken up by one ROM chip, but providing the user writes their own ROM software, there is no need to have this installed unless under program development. Incidentally, the board has the capability of being a fully stand-alone industry standard 6809 computer with the addition of a few extra components, and the reduction of a ribbon cable, making a target system easy to install.

The difference between the CUBE system and the CMS board is mainly one of size, the CMS board does not require a separate power supply, and has the RAM chips situated as a bank of eight DRAM chips, all serviced by use of a bipolar PROM, this saves physical board space and can in the long run only help matters as the board sits comfortably inside the BBC Micro. CMS boards do support Euro racking and they market a very nice racking system for many different rack widths which includes its own power supply and supports all standard Euro rack cards as well as the complete CMS range. It has the advantage of being available if a rack extension is necessary whereas the CUBE board actually requires the presence of the rack in order to supply power and to communicate with the 64 DRAM chips, this is added on to the price of the CUBE board, making an initially expensive product. With the CMS racking

```
#HELP FLEX
Enter 6809 monitor by #FLEX
Use U0 to boot from FLEX disc
Or control F to boot from rom
```

```
CMS monitor commands
B <adr1> Set up to 3 breakpoints
C <adr1> <adr2> CRC check
D <adr1> <adr2> Display memory
E      Display stack page
F FLEX warm start
G <adr> Go to Hex address
I Initialise Monitor
J <adr1> Go to hex, return to monitor
K <adr1> <adr2> <data> Fill memory
L <adr1> <adr2> <FROM> Load from 6502 RAM
M <adr> Memory examine
O <adr1> <adr2> Offset calculation
Q <adr1> <adr2> Test memory
R Registers
S <adr1> <adr2> <TO> Xfer to 6502 RAM  U <n> Upload FLEX from drive
n
W <adr1> <adr2> <hex string> search for string
```

```
OS 1.20
>
```

Fig 2. The CMS Monitor ROM with extra commands

expansion, their 6809 board is given the capability of driving other Euro cards which are again fully supported from within CMS. They consist of a high resolution colour graphics card which offers 64K dedicated graphics memory and a resolution of 512 X 256 pixels and four colour planes. The screen is easily controlled from languages such as PL/9 and includes both black and white displayed simultaneously with full colour, the BBC Micro can thus drive a screen from its own graphics memory and using FLEX, drive a second screen. The most amazing feature of the graphics card is its ability to hardware vector the screen which means extremely fast processing speeds are capable (CMS benchmarks state that the card is capable of drawing over 1.5 Million dots per second, and I believe them!).

The card has two distinct modes of operation, a colour mode where it can display 8 colours per pixel or 8 colours (flashing) or 8 colours and a separate intensity plane, or a black and white mode with 16 levels of grey. There is an internal ROM which handles the character set and drives a text mode which supports all possible colour combinations (85 colour). With the inclusion of the lightpen socket, it is quite plain that this is a very flexible graphics tool, extending the Beeb's capabilities quite a bit. Industrial CAD applications are the most obvious use for this board, although as a general

screen driver, its performance is still excellent.

The other cards include a Twelve Bit Analogue interface. This performs the task of connecting the computer to the outside world, it essentially does the job of the Beeb's own A/D port but far more accurately and with speed which would be of main use in real time processes. CMS' very own 6502 second processor which can be accessed and controlled from within FLEX, has a far more flexible memory setup than Acorn's, a nice point is that this processor need not require precise lengths of ribbon cable and looks to be a little less cumbersome and can be controlled and daisy chained from other Euro boards.

FLEX SOFTWARE

So the FLEX system is operational, but unless the user wants to program in pure Hex Mnemonics, the user is likely to require some software. My thanks go to CMS and Control Universal for supplying me with exceptional software to fully test systems. As could be expected both the CMS and CUBE software interacted with no problems, the software I was given to look at included "PL9", a programming language which is enough to make me want to give up all other languages. "FORTH" the all purpose control language, released by CMS, "C" a full implementation with a full specification

floating point compiler, Lucidata PASCAL which is a true P-Code, full spec Pascal compiler as well as SCREDITOR, the aforementioned Word Processor for FLEX systems, as an extra. CUBE had supplied me with the ATPL EPROM programmer with both BBC and FLEX software to drive it from both ends of the system. It is perhaps in this light that we can see just how viable FLEX is as an operating system and how it overcomes the problem that all operating systems have never really been able to overcome, even CP/M and that is one of true portability.

The disadvantage with having a "standard" machine and operating system is plain to see when we look at the latest attempt with the Z80 chip in Japan with MSX, Microsoft's so called answer to CP/M on home computers. In short it is awful and isn't even a true "standard" as MSX cassette tape formats are not even compatible. The Z80 suffers when "standards" are imposed because as a processor, it is getting a little long in the tooth, and the CP/M system is only as good as its weakest machine, FLEX has the advantage here in that most 6809 machines supporting a disc drive (either 5.25 or 8 inch) normally support FLEX or OS9 which is semi-compatible. The disc format is exactly the same on 5.25 inch drives and can thus read any FLEX disc, the whole processor is used whereas some CP/M companies have made use of EMT calls which although allow

them to read CP/M discs do not allow CP/M discs created on that machine to be read by all the other machines, which somewhat defeats the point.

FLEX does not have any of the irregularities of CP/M nor does it have much business software, as it centres around engineering and the like, therefore a host of high quality languages and toolkits have emerged which use the power of the 6809 to its full.

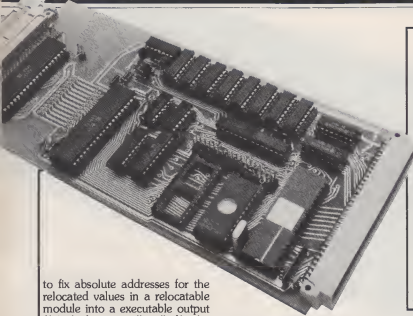
LUCIDATA P-CODE PASCAL

PASCAL is from the very first page in the manual a well crafted product, the implementation sits well within FLEX and has a very friendly user interface and can support the TYPEs Boolean, Scalar, Char, Byte and Integer, the compiler is extremely efficient and compiles code down to .BIN files suitable for execution in FLEX. I would imagine that Lucidata PASCAL will already have many satisfied users, especially in an environment where Pascal is long accepted and a wealth of routines exist for those wishing to use it.

INTROL "C"

"C" was probably one of the most talked about languages of 1984 and certainly software houses were falling over themselves to release a version for CP/M, Macintosh etc etc, now FLEX users can compile full specification "C" files for their own systems. The software house, Introl Corp are confident on its capabilities with additions such as a full 6809 assembler for translating assembly language text files into relocatable object files as well as its ability to create relocatable (position independent) code via the Loader (this is used as in all decent C Compilers

CONTINUED OVER



to fix absolute addresses for the relocated values in a relocatable module into an executable output file) which is normally called by the Linker.

Also included is a library manager system which resolves all references to procedures or routines outside of the file currently being compiled, this library manager searches a special library file and extracts only the modules needed to link the file; this can be used by the programmer to individually create new libraries and to maintain existing ones.

The whole "C" compilation process takes quite a while but what remains is about the most efficient and exacting a compiler can get to run under a run-time system, there is also the future ability to operate the library manager part of the compiler in a number of "modes" where the user is allowed to enter commands allowing simple additions and deletions, naturally an interactive mode allows the user to enter direct commands straight from the terminal or to temporarily store the linker/loader process or even to use a command file mode similar to the IBOOT directive in Acom's DFS commands.

WINDRUSH PL/9

PL/9 has been a long awaited answer for not only myself but for many programmers who simply

cannot get down to writing long assembler programs for tasks that require compactness and speed and have suitable interfaces to the system hardware. With compilers there is also the legal requirement which sometimes makes the run time system only available after a licence has been bought, normally quite expensive if a product is to be sold on a large scale.

For program development there is normally the cycle of source created by an editor and then written back at the end of an edit, then the compiler is loaded for compiling and testing and if unsuccessful the file is again loaded into the editor for debugging. Most programmers agree that this is cumbersome on single user systems of Microcomputers, so PL/9 has the added advantage of having the editor, the compiler and the debugger stored in the same program, the system uses the FLEX transient program area for "Trace" and "Debug" options. In all the compiler requires 16K to operate leaving a full 32K for the source and binary files for testing and then for compilation the user invokes a single command to compile the code into pure stand alone code for use in either ROM or RAM areas in the 6809.

The Trace-debugger allows the

```

001  INCLUDE IOSUBS;
002  INCLUDE REALCON;
003  INCLUDE PRNUM;
004
005  PROCEDURE FACTORIAL (REAL NUM);
006
007      IF NUM <=1 THEN RETURN REAL 1;
008
009  ENDFPROC REAL NUM*FACTORIAL (NUM-1);
010
011  PROCEDURE TEST: REAL NUM;
012
013      NUM=0;
014  REPEAT
015      NUM=NUM+1;
016  PRINT (" \nFACTORIAL ");PRNUM (NUM);
017  PRINT (" IS ");PRNUM (FACTORIAL (NUM));
018  UNTIL NUM=10;
  
```

Fig 3. Shows a Factorial solving Algorithm.

user to single step or breakpoint through a PL/9 program and a source line which enables the user to examine variable names throughout the whole debug session. The structures are loosely based around the control structures found in "BASIC", "PASCAL", "C" but not including the exotic data types in the latter two. There are no functions included which support I/O routines or special peripheral devices, this is because the PL/9 compiler has to work on a number of FLEX machines with different specifications. CMS were very kind in including the most important I/O routines (including Graphics and Sound which are easy to set up anyway). PL/9 uses these "Functions" if they are present by INCLUDING them in a file, an obvious solution really. Fig 3 shows a typical example of PL/9 code before it is submitted to the compiler.

PL/9 makes good use of the 6809's rather unusual architecture by fully supporting data types, BYTE (8 bit) and INTEGER (16 bit) as well as REAL (32 Bit .. 8 bit exponent and 24 Bit Mantissa) the floating point is accurate to seven decimal places, PL/9 is one of the easiest languages to come to grips with, the code is very easy to write

(and read) there are few syntax limitations, and is obviously structured. There are however a number of problems involved when calling routines which access output devices such as the User Port, some protocols have to be written into the INCLUDE functions but these are very easy to set up (for instance using the RS423 as a 1200 baud receive and 75 baud send for 6809 Terminal software).

I thoroughly enjoyed using PL/9 and I am quite frankly surprised why I haven't heard more of this wonderful programming language, it now makes tasks previously only possible with an assembler open to either those who cannot be bothered to use machine code (it is tedious at the best of times no matter how great the intellectual satisfaction) or an easy way to write readable and debuggable code which is absolutely necessary in a real programming environment where money is at stake. In all but the most stringent cases, the rest can be left to spotty little boys with glasses and dandruff, PL/9 is a "real" programming language I can truly feel at home with. It has the best of all possible worlds, in which the compiler is fast in creating stand alone ROMable code. In short, I'm hooked.

Product	Control Universal	CMS
6809 2nd Processor	£395.00	£249.00
Flex ROM	£inclusive	£59.00
Cables	£inclusive	£15.00
Flex O/S Disc and Manual	£69.00 (paperback)	£85.00
Assembler	£separate	inclusive

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

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

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Creative Sound

```
%6I4E7I2CCCC
6I4E7I2CCCC
6I4E7I2CCCCR
%6I4E7I2CCCCR
6I4E8/.
```

1222 Bytes, 80 Bars

Top of data: &49F9

Press SPACE BAR to begin

The music compiler working its way through MCL data.

Creative Sound by Hybrid Technology's Chris Jordan and Music/Micro correspondent David Ellis is the latest in a long line of interesting musical releases for the BBC Microcomputer in the last 6 months.

In this book and book/disc/cassette package, we get the synthesis of Chris Jordan's expertise with the BBC (he designed the SOUND and ENVELOPE statements for the BBC and Hybrid produce the Music 500) and the writing and musical skills of David Ellis, well known for his columns in the music and computer press.

The style is chatty and humorous which helps break up the technical aspects. Some of the content is fairly demanding of the reader, especially without previous contact with either the music or microcomputer world.

If you want to know about the antecedents to the current technology, you will find an enthusiastic history at the start of Creative Sound. And if you want to catch up on the latest in synthesiser/microcomputer combinations and the quite close links between the two, then the authors are just the people to keep you up to date.

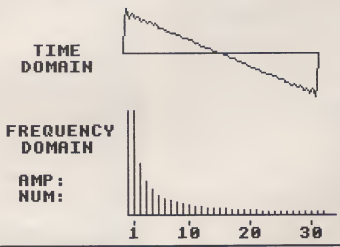
Creative Sound is based on the BBC Microcomputer and the book is packed with listings, ranging from one line of SOUND statement to eight pages of synthesiser, or music compiler. The authors do well to avoid the constant repeats of the User Guide on SOUND and ENVELOPE but satisfy our curiosity with constructive examples. There is as much to see on screen in the way of Fourier synthesis and SOUND and ENVELOPE demonstrations (very nicely programmed and presented) as there

is music to listen to. The text has plenty of diagrams and screen shots and information on program use.

The authors' interest in music rather than noise is demonstrated by a very short acknowledgement of games noises and sound effects. From there it's on to real time music, a mini studio for record, edit and playback, a preset, programmable and echo synthesiser and a programmable sequencer.

The two main chapters of interest to already accomplished micro musicians will be those on composing by computer and composing with the assistance of the computer. Mozart's musical dice game with which he composed waltzes is reproduced for the micro. It makes fascinating listening and is followed by investigations into minor chords and fractal tune generation. Composing by statistics

Fourier Synthesis plotting away.

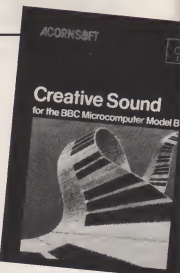


always seems a bit cold and the authors appropriately fill in the academic background to work in this field. You'll be delighted to know that this chapter closes with a program for composing coloured music and the self-filling Muse.

The computer assisted composition revolves around the idea of a MCL (Music Composition Language). From an earlier music interpreter and forays into Canons and Phase Music (which necessitates some complex reconfiguring of the O.S. sound software), emerges a music compiler. An easy to use combination of keyboard characters form the composition codes (AMPLE programmers will be on familiar ground) which are compiled into an efficient (two byte per note) intermediate code for interpretation and playing.

The music, original or copied from sheet music, is entered into DATA statements and can easily be "EXECed onto the end of the main program. Various examples are provided, from Bach to the ear piercing Continuum by contemporary Hungarian composer, Gyorgi Ligeti. The compiler is not just a digital jukebox however. It forms with the rest of the programs in Creative Sound a formidable musical toolbox for the experimenter. The programming is to a high standard in its own right and not just throwaway illustration of the text content.

The authors finish off Creative



Sound with the least creative section but nevertheless a useful look at musical education software aids. Taking their cue once again from the superpower examples from America, the authors produce some humble BASIC listings for pitch training, pitch tuning, interval drill, keyspinner (minor or major keys?), key confuser, scale recognition and rhythm drill. All should prove useful to the teacher of music or the individual inspired to gain some conventional music skills at the same time as working on his first AMPLE concerto!

For anyone already bitten by the music bug Creative Sound is essential reading and programming. For anyone teetering on the brink, £9.95 is not a lot to pay for a good informative read, some valuable programs and music to show off with! If you enjoy the luxury of being more into music than programming then the £17.95 (book plus cassette) or £19.95 (book plus discs) is a worthwhile investment, just so that you can get your hands on the working programs that much quicker.

An early pioneer of computer music, Max Mathews, is quoted in Creative Sound: "Computers will add a new dimension to music—especially the home computer. It will be sufficiently easier to play that many people who otherwise could only listen to music will become active musicians. This may be the biggest accomplishment of the home computer market." Dave Ellis and Chris Jordan are doing their bit to make this prediction come true.

BBC Road Safety

Des Thomas

Road Safety and the Micro.

"Our children have much to fear from man's inventiveness, for such is the pace of modern technological development that they have constantly to adapt to new situations at home, at school and, most of all on the roads, where they are subjected to more and greater risks than ever before. In modern society the traffic accident has replaced malnutrition and disease as the biggest single threat to young life and limb... What makes this continuous waste of human life even more shocking is that so many road tragedies could be prevented. Analysis reveals that human error is a major factor in almost every accident and while engineering improvements in car and road design help to ensure that such errors become less likely to lead to accident and injury, it is education which offers the surest method of reducing the incidence of errors themselves."

"Children and Traffic - Road Safety Education Project", Macmillan Education.

If you've stood outside a school at the end of the afternoon session, you might question the last statement. Forget the children for a moment and look at the adults who have all been through the system - the ice cream vendor parked as near as he can to the school entrance; parents gossiping and blocking the pavement with prams so that the children have to step into the road to pass; the toddlers playing in the gutter; the double parking; parents throwing open the rear offside door and beckoning to the infant poised on the opposite kerb or turning their cars in the school gateway and waiting in the area clearly marked SCHOOL ENTRANCE for a quick getaway.

What about the planners who designed the school with only one entrance/exit for use by cars, delivery lorries and children; and, of course, there are the children themselves! Not unnaturally, the most commonly used teaching method is teaching by example, but it's obvious from the above - and I don't think that the area outside my school gates is any better or worse than any other - we set our youngsters a very poor example.

Road Safety is a subject often brought up in assemblies, some schools incorporate it into some of their topic work and a large number, often in co-operation with a small band of willing parents and/or the Road Safety Officer, run a Cycling Proficiency Course sometime during the year. As we started to set up our course this year, I

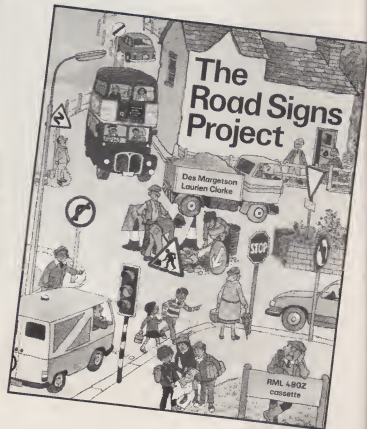
decided to look around to see if there were any computer programs available which might help - after all aircraft/space pilots are not asked to risk life and limb or expensive craft until they've spent some time on a simulator. Indeed, I was pleasantly surprised, not only by the amount of software available to support road safety projects in general but also at the quality of it, and I don't suppose for a minute I've found it all.

CYCLING PROFICIENCY

Since my search started with programs for the Cycling Proficiency Course, let me begin by taking a look at two sets of programs specifically designed to help with that.

The *Road Safety Programs* are designed to illustrate graphically the tasks given by Road Safety Officers/teachers as part of the Cycling Proficiency Scheme (or by teachers doing a project on road safety), ie they are intended to be used as an electronic blackboard. The quality of the graphics is such that they serve their purpose extremely well, and will certainly brighten up any presentation.

The programs can be briefly described as follows: *The Bicycle* draws all the major components of a bicycle in a logical sequence to build a complete bicycle. Two options are available: a) a fully automatic drawing, and b) a step by step drawing, each step easily controlled by the user, with no time limit. A version of the BMX bicycle



is also included. *Traffic Lights* depicts a road-user's view of a set of traffic lights. The sequence of lights, and their interpretation, is again controlled by pressing the Space Bar. Options include the facility to suppress text until required, addition of an independent filter arrow and addition of a fixed sign, ie turn left only.

Pelican Crossing: first option allows the user to select pedestrian's or road user's view of Pelican crossing lights, with a representation of the lights as seen by the other, and sound when appropriate. Further options include a fully automatic sequence and a manual sequence controlled by the user. *Road Signs* includes two sets of main road sign configurations. The first set includes four examples of the warning, mandatory, prohibitive and information signs many of which have particular relevance to cyclists, while the second set gives 11 further examples from the first three groups.

The second set, entitled *Signs*,

covers three turning manoeuvres the cyclist is expected to know: turning right from minor road to major road, turning left from minor road to major road, and turning left from major road to minor road. The programs may be used in three ways:

Demonstration is a graphic demonstration of the manoeuvre, requiring no further keyboard operation once the option has been chosen. Each action taken by the cyclist is described at the bottom of the screen.

Order of Events: the actions required to carry out a manoeuvre are displayed in random order on the screen. When all the actions have been placed in the correct order, the cyclist will carry out the manoeuvre. If an event is not in its correct position, the cyclist performs the manoeuvre until it reaches the incorrect event and the user then has to correct the error.

User Move: the cyclist can be guided through the manoeuvre on

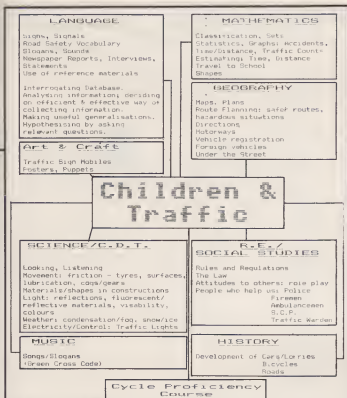


Figure 1 Topic Web

Figure 2 & 3 Screen dumps of Bicycle and Road Sign from The Road Safety Programs.



Loose chippings

the screen using the function keys. Beware of traffic!

The programs are accompanied by a set of 14 workcards designed to give a structured development to the pupils knowledge of using the road, directions, signals, posi-

tioning, junctions and signs, and vocabulary. Having seen the first set of programs, most users will be disappointed in the quality of the graphics and lack of colour. They left me looking forward to the interactive video. Nevertheless,



CARD 14 Vocabulary and Use of Junctions

- Who has priority at this junction?
Is it car A turning left or is it cyclist B going straight ahead?
- Who has priority at the junction?
- In which order should these proceed?
- What is the order of priority here?

Figure 4 A workcard from Bike

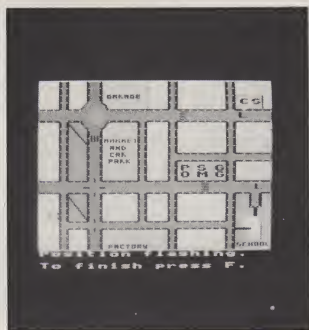
they serve their purpose, even if they do so with little panache.

ROAD SAFETY PROJECTS

The Humberstone Road Safety Project contains two programs in

which the emphasis is on problem solving and forming appropriate strategies in the context of road safety. In the first program, *To School Carefully*, which is intended for the 7+ age group, the object is to plan as carefully as pos-

CONTINUED OVER



TO SCHOOL CAREFULLY — PUPILS' WORKSHEET

Name of group: _____ Level: _____

	What you need to know	✓ your 'yes'
LEVELS 1, 2 and 3	On Monday it is delivery day at the factory There are lots of heavy lorries around Try not to walk near the factory	DAY: MONDAY
	On Thursday it is market day There are lots of cars using the car park. Try not to walk near the market	TUESDAY
	On Thursday it is factory delivery day	WEDNESDAY
	On Friday it is market day	THURSDAY
		FRIDAY
	WEATHER:	
	On wet days, the footpaths across the churchyard and the park are very muddy You should not use them	WET DRY

	CALL AT:	
LEVELS 2 and 3	Your friend's house is F on the computer map.	Friend's house
	Your uncle's house is A on the computer map	Uncle's house
	You post letters inside the post office	Post Office
	The supermarket sells fruit and drinks	Supermarket
	The greengrocer sells only fruit and vegetables	Greengrocer
	The corner shop sells to drinks but not fruit.	Corner shop

LEVEL 1

Mark your home on your map sheet. Mark your route

LEVELS 2 and 3

Mark any places where you need to call on your map sheet. Mark your route

LEVEL 3

Did anything happen on your way to school to make you change your plans? If so, mark it on your map

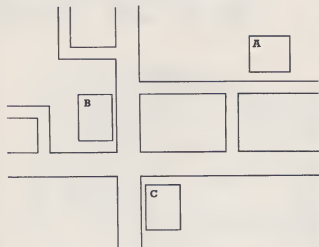
REMEMBERIf you cross the road outside your home, your room or door will see you safely across
Look for safe places to cross, and ALWAYS use the GREEN CROSS CODE

Figure 5 Screen Map and worksheet from To School Carefully

PUPILS WORKSHEET — MAKE IT SAFE

On this map you should mark

1. Primary school, Old Peoples Home, Secondary school
2. Main Road
3. Regions 1 to 6
4. Existing signs and signals
5. Items you have added or removed



Your budget is 20 points only

Traffic Lights	cost	4 points
Pelican Crossings	cost	3 points
Zebra Crossings	cost	2 points
Stop Sign	costs	1 point
Give Way Sign	costs	1 point
Removing an item	costs	1 point

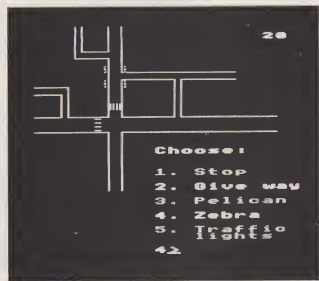


Figure 6 Map and Worksheet from Make It Safe

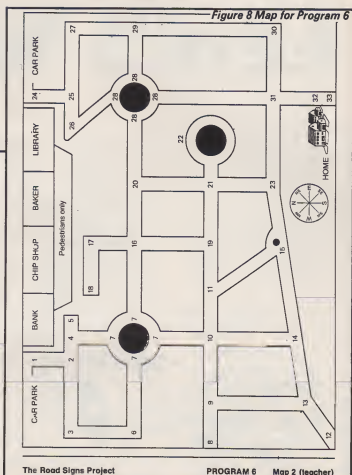
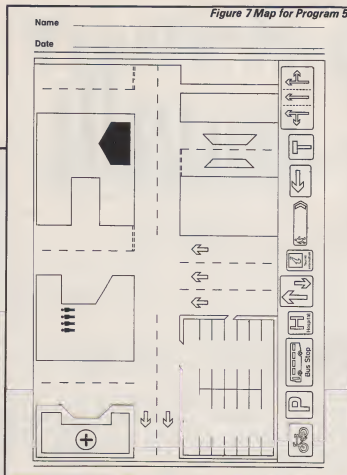
sible a route from home to school. A map of an urban setting, comprising a typical grid system of roads with main and side roads, is presented. On certain days parts of the town are particularly busy and care must be taken to avoid the areas.

The program has three levels of difficulty, which determine the number of variables the children have to manage. For the first two levels, all the relevant information is provided before the journey is undertaken, but at level three, unplanned for contingencies may occur which involve 'on the spot' decisions concerning a revision of

the chosen route. If the user group (it's considered best to use the programs in a group as the discussion generated is valuable in the decision making process and the development of communication skills) tries to cross a road without remembering the Green Cross Code or at a dangerous place then a message appears on the screen.

When the group has arrived safely at school, a screen-presented evaluation of the performance is available.

Make It Safe — intended for the 9+ age group — requires the group to consider the placement of road furniture to improve the accident statistics within a series of regions on an estate, thus making



a housing estate a safer place to live. A map of an imagined housing estate is provided, complete with some road furniture. The accident statistics for six pre-chosen regions are shown on the screen. These depend on the placing of two schools and an old peoples' home.

The group discuss what improvements are to be made within the budget allowed (shown by the number of points rather than money) and they have the opportunity to alter the situation, taking into account the nature of the road concerned. Graphic representations of the furniture can be moved to any position on the map and, if inappropriately placed, a message will be displayed giving a chance to reconsider the position chosen. Will the accident statistics be improved by the alterations made? The Road Safety Computer predicts changes in the number of accidents based on the decisions made.

Decision making and problem solving are key words associated with software distributed by Fernleaf and, I must admit, I like their general approach to the use of computers with children. These programs are no exception to this, and I'm sure will be a very welcome addition to any project involving

road safety. I particularly liked the latter program — I'm sure many children could teach the so-called experts a thing or two! I'd like to see a utility program which would enable the users to develop their own screen map — maybe of their own locality — within this program. Teachers wishing to follow up the idea of route planning/giving directions should consider *Town* (reviewed in A&B April 85), which will allow them to plan their own road network, eg the area around the school.

The Road Signs Project is a suite of eight programs based on a familiar feature of everyday life — road signs (what else!). The primary aim of the project is not for children simply to learn the meanings of the signs, but for the road signs to be used as a basis for other learning experiences. The programs are accompanied by a comprehensive Teacher's Guide and a very useful set of 48 black line masters provides various exercises, route maps and graded activities, which are closely linked with the programs.

Program 1 deals with the recognition of a small number of road signs and helps to develop an understanding of the connection between signs and meanings. In part one, the "easy" ones, the user

has to type in the meaning of the signs, while in part two, there are some answers to choose from. Program 4 deals with Order and Warning signs and asks questions about each of them, while Program 5 introduces information signs and stresses the positive side of the system which controls traffic movement. The user is shown a town map in full — a printed copy of this is available in the pack — then only a small piece. One of the ten information signs available at the bottom of the screen has to be placed in position. At the end, a circle is drawn around the ones that are wrong. Unfortunately, there's no opportunity for a change of mind!

Programs 2 and 3 deal with traffic lights. The first section of program 2 asks the child to identify the traffic lights as displayed on the screen — colour recognition, associating colour with meaning and identifying correct sequence, while the second part involves prediction — which pattern will the lights show next? Program 3 puts the information practised in the previous program into context, the user having to drive a car around a road circuit involving traffic lights for three minutes. There is a speed option, which is useful for the younger children or those whose co-ordination and reaction is slow

— ask a few adults to try!

Program 6 co-ordinates the previous programs by presenting a screen map incorporating several of the signs already encountered, introduces directional signs and uses road signs in conjunction with travel. Users have to plan routes from home to the shops. The emphasis changes in program 7 from interpreting road signs to using the road network and concentrates on direction finding. Two activities are suggested: find the route (quickest?) from Startown to Whitbeach or explore the blank parts of the map (again provided in the pack) and fill them in. The graphics, which depict the scene with the directional signs that the driver would see when approaching a junction or bend are very effective, as in the other programs.

The last program is a demonstration of all the major road signs used in the other programs. The Teacher's Guide gives information on ways in which these can be incorporated into other programs — a very thoughtful touch for those wanting to try their hand at writing programs.

This is a very comprehensive package. It has been well structured and so provides activities to support a project with children of a

CONTINUED OVER

Name _____

Date _____

- Find 4 different ways to travel to Whitbeach.
- When is the best time to visit the seaside? Give the reasons for your choice.
- Describe 4 different ways to get to Drypool and back to Startown.
- What kind of outings do you like best?
- Write about or draw a picture of an outing you enjoyed.
- Write about or draw a picture of an outing you disliked.
- Make up a treasure trail. Write about the things you have hidden in different places.
- Plan an imaginary outing to one of the places marked on your map.
- Take a chance and visit Warrenend. List all the roads and avenues and find the quickest way out.

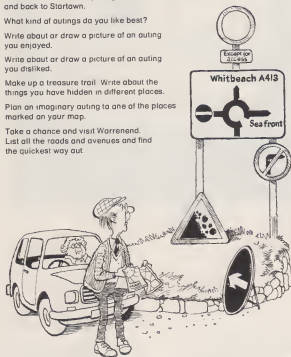


Figure 9 A Worksheet for Program 7

wide age/ability range. There were one or two niggles, where I thought the programmers could have been more friendly – the BREAK key taking the user right out of the program, not back to the MENU as one might hope in a suite of programs, and in Program 6, where "Route ends – Goodbye" leaves one up a cul-de-sac and the program has to be reloaded – but they were only niggles in an otherwise first class production.

STATISTICS AND MORE...

What about all those statistics that are collected about accidents? These can provide classes with a vast amount of information to create datafiles. I'm sure your Road Safety Officer will be able to let you have a printout of the latest accident figures for your area so that the children can make their own files, using a database suitable for their age, ability and experience.

If in doubt about how to go about it, it'll be worth having a look at ROSPA's Accident Datafile,

which contains records of 66 actual accidents to children in the 5 – 14 age group, and is designed to be used in conjunction with *Factfile* (every school has a copy of this!).

Those who wish to be more adventurous may like to explore *Investigator*, which is a dedicated database developed by ITMA and the Devon Traffic Unit. This allows more complex enquiries to be made on Devon road accident records for 1983. Teachers with a small amount of programming knowledge should be able to adapt this program to work with their own data if they want to use more Fieldnames (Headings) than available in *Factfile*, but feel they, or their youngsters, are not ready to move on to one of the more sophisticated database systems.

HAVE SOME FUN!

Children will find it enjoyable working with most of the programs mentioned above, and although this is a very serious subject, a "fun approach" can often be very effective. For young children, many of

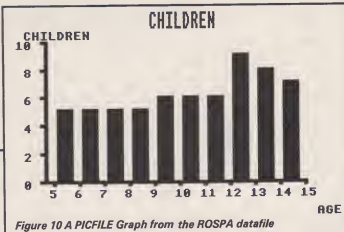


Figure 10 A PICFILE Graph from the ROSPA datafile

whom will be taken to school by mum, dad or older brother/sister, there's that delightful little program, *Roadcraft 1*, which was reviewed in the Edsoft pages of A&B in November 84. Roger Roadcraft has to be taken across three roads. The program offers five skill levels – the higher the skill level the slower Roger crosses the road and the greater the volume of traffic. Zebra and Pelican crossings, policemen and crossing patrols offer a variety of methods of crossing the roads safely. The graphics are pleasing and it is "fun" – and what if you kill off Roger a couple of times; at least he'll come back to life for a rerun!

If you really feel like allowing the children to let their hair down, try to get hold of a copy of *Midtown*, which was produced by the Telesoft Project at Brighton Polytechnic for CEEFAX. In this program the operators have to find the fastest and cheapest route in a town to direct a car from A to B. There are one way streets, other traffic and a ring road, where the traffic moves a lot faster. The program checks the time, the amount of petrol used and the cost of repairs! Who's the best driver in your establishment?

I began with a quotation from "Children and Traffic". Let me end with another from the same series of books: "Accident prevention is a method of equipping children for independence by creating within them a "safety consciousness" which will guide their behaviour in all circumstances, enabling them to identify and assess hazardous situations properly, to calculate risk responsibly and to widen the scope of their activities accordingly".

Using the micro can pay an important part in this training – but only a part. Most of the programs mentioned in this article make excellent use of the micro. I've deliberately not set out to provide a "best buy". While some of the programs have "overlap", they mostly fulfill different purposes. Hopefully, I've provided sufficient

information for you to decide which is/are most suitable for your project. At least none of them set a bad example, so they might prove useful with those thoughtless adults!

PROGRAM INFORMATION

The Road Safety Programs, David Seume, c/o Surrey CC, Road Safety Section, Highway House, 21 Chessington Road, West Ewell, Epsom, Surrey KT17 1TT, £14.50 (disc).

Bike, Clwyd Technics, Antelope Industrial Estate, Rhydymwyn, Mold, Clwyd £17.50 + £1.50 (p&p).

Road Safety Project, Fernleaf Educational Software, Fernleaf House, 31, Old Road West, Gravesend, Kent DA11 0LH, £18.95 (disc or cassette), £10.95 (individual programs).

Town, Cambridgeshire Software House, The Town Hall, St Ives, Huntingdon, Cambs PE17 4AL, £13.00 +£1.00 (p&p).

The Road Signs Project, Ward Lock Educational, 47, Marylebone Lane, London W1M 6AX, £29.95 (disc or cassette).

Investigator, Longmans Micro Educational, 33-35, Tanner Row, York £10.95 (disc).

Accident Datafile, ROSPA, Cannon House, The Priory, Queensway, Birmingham B4 6B3, £5.00.

Picfile (Includes enhanced Cambridge Micro Software, version of Factfile) Cambridge University Press, The Edinburgh Building, Shaftesbury Avenue, Cambridge.

Down to Business

Jan Vogler

Upgrade your BBC Micro to an IBM PC.

The Graduate is the ultimate in "add-on" hardware. It will convert your BBC Micro into the nearest one can get to an IBM PC (Personal Computer) without infringing the IBM copyright. "Why do I want an IBM PC?" you may ask. The answer is very simple: there is more good business software available for the IBM PC than for any other personal computer including: concurrent (holds several programs in memory at the same time), multi-tasking (does more than one activity at the same time) and windowing (presents more than one activity on the screen at one time) operating systems, and such trendy business packages as *Symphony*, *Framework*, *Lotus 1-2-3*, *Perfect II*, and *DBASE III*.

Acorn, Torch (who make the Graduate) and Upgrade all offer Z80 add-ons to run the "CP/M" operating system but this can have only 64K of memory, which cannot be increased. With an IBM PC or a "PC compatible" computer you can have up to 640K of memory.

NOTE FOR THE TECHNICALLY MINDED

Z80 memory is limited to 64K, because it is an 8-bit processor with a 16-bit "address bus", giving 16 address channels which can address 216 or just over 64,000 different memory addresses. The IBM PC on the other hand uses a 16-bit processor, the 8088, which uses a 20-bit address bus to address up to 220 or just over a million memory addresses. IBM, however, do not physically provide that many.

There are other powerful upgrades around: Torch also make the Unicorn, a "third processor" of enormous power (which this column will review shortly) which can have up to a megabyte of memory, but (and I apologise to

readers for the error on page 73 of the March issue which said it could) it cannot run the "MS-DOS" operating system. This is the widely available equivalent to "PC-DOS", which only the IBM PC uses and, at present, is the first choice of operating system for the best business software.

The Graduate has an 8088 processor, runs MS-DOS and has 256K of memory plus two "hardware expansion slots" so you can add memory until you have the full 640K; that is about three hundred pages of closely typed A4 text or the entire accounts for a fair sized company for a whole year! It can run virtually any program needed by the serious business user. I used it with *Lotus 1-2-3*; *Wordstar* and with the elegant new *Perfect Software II* (greatly improved and friendlier version of the software that is bundled with the Torch Z80) currently only available for the PC. I also, of course, used it with the *Pson Xchange* suite of integrated software, that is bundled with the Graduate and which is discussed below.

GRADUATE AND THE IBM PC

The Graduate is not a PC and those who buy it will want to know what shortfall they can expect. There are three main limitations.

Firstly, the modest restrictions imposed by using a BBC keyboard are overcome, by combinations of Shift and Control with character keys, and cause little problem.

Secondly, the BBC Micro provides only black and white in 80-column screen mode: far short of the IBM PC's impressive 16 colours. (Even though one can only use four of the sixteen on the screen at one time). This means that it is virtually useless to use business programs on a colour screen. This has not been a worry in the past and I maintain that colour is not appropriate to concentrated use, many hours a day, but times are changing. Colour screens have become better and

some of the best business software is now using selective colour. In graphics and 40 column text modes, the Graduate has normal BBC colours available.

Thirdly, and slightly more serious are limitations of the graphics. For rather complex reasons (for explanation see separate box) the Graduate does not perform cer-



1 Graduate and Xchange software

NOTE FOR THE TECHNICALLY MINDED

The 6845 "video-generator" chip in the BBC Micro still runs the screen. The IBM PC also uses a 6845, so what is the problem? Strangely, it is to do with the superb screen performance of the BBC. The 6845 chip uses no less than eighteen "internal registers" (fast, tiny memories actually inside the processor itself) which, in modes 1 to 6, save the user the trouble of handling most screen functions.

To further help the user, he or she is not expected to know which register to use: there is one single "post box" provided in the computer's main memory. Into it you post each instruction (which, like any letter, must bear both the message or instruction and the address.)

Now we come to the problem: the "post box" is in the BBC's memory, not in the Graduate's. Some PC programs, such as *Flight Simulator*, work very closely and rapidly between the 8088 central processor, its main memory and the screen, to achieve complex, exciting, rapidly changing graphics. But with a BBC/Graduate combination, the 8088 looks for the post box in its own memory and finds none there. Think of a centre-forward, trying to create a fast attack along the axis of the game. He swaps the ball rapidly with his inside forwards, always keeping the opposition on the wrong foot. But once his insides are not there in support he is foiled: to try and do the same with a winger or centre-half would slow the assault and lose its dynamic effect. The 8088 has not been taught to look for a screen post box in the BBC and, even if the program was rewritten to do this, the speed of that intimate screen/processor combination would have been lost.

tain kinds of graphic programs, such as the famous Microsoft *Flight Simulator*, in the same way as the PC does. So do not buy a Graduate if you want to run this kind of software.

HARDWARE

Graduate comes as a six-inch deep box, ten inches wide and sixteen inches from front to back, in the front of which are mounted dual disc drives. It is made of steel and pleasantly finished in two-tone grey. Remove the top cover (an easy task) and you will see: the two Cannon disc drives, each with a capacity of 320 KBytes after formatting (production models use Epson drives, which Torch say are quieter); a power supply and cooling fan; a single, large printed circuit board on which are mounted the 8088 processor, an impressive army of RAM chips and the two welcome expansion slots.

The good feature is that the unit will operate on one side, with the disc drives vertical. Although it looks rather silly, with its four rubber feet waving in the air, this is a most convenient arrangement as the 32-way ribbon cable that connects it to the "1MHz bus" connector underneath the BBC's keyboard, is lamentably short. The alternative would be to have the Graduate sit at the right hand side of the BBC and there would be ample space on it for a modem or document holder. The BBC needs no internal ROM (permanent memory chip) fitting, so connecting the Graduate to the Beeb is a matter of a few seconds: insert the ribbon cable and plug the Graduate into the mains. Switch on, and it "boots" (loads, automatically) MS-DOS from the "system disc". Now you are ready to load any application program. I have been used to a Z80, with the operating system held on a ROM, and found it rather tedious to have to load MS-DOS every time I switched on, but users will soon develop their own procedures.

MS-DOS uses a "batch-file" technique. You write a simple list of commands, which you save as a special file on your system disc. This can contain instructions to change screen colours, switch on the printer, load the applications

program and select the correct disc drive for the program files. It can be automatically executed when you boot MS-DOS.

THE BBC AND THE GRADUATE

How does the combination feel to the BBC user? The first thing I noticed was that my screen had lost seven whole lines! Now it only has 25 and I miss the extra seven, for reasons explained below.

On the review model the screen scrolled, rather jerkily (due to the screen memory all being held in the Graduate box and having to come across the 1MHz bus) but I soon found I could ignore this and Torch tell me it has been corrected on current production models. More frustrating was the loss of the BBC's split cursor, with which you can COPY lines higher up the screen. With MS-DOS, various function keys have been trained to copy previous instructions, but it seemed much less easy.

I also felt cheated that I could

you can "pipe" the results of one program back into another program, without having it appear on the screen at all. I used this on disc catalogues (called "directories" in MS-DOS), so as to arrange the files in a convenient alphabetical order. This overcomes the "hunt-the-file" problem that bedevils any user with more than half a dozen discs full.

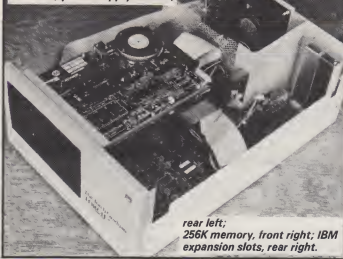
XCHANGE SOFTWARE

Whatever the virtues or vices of MS-DOS, Torch have chosen well to offer the Graduate with Psion's integrated software suite. It comprises four modules: word-processor *Quill*, spreadsheet *Abacus*, database *Archive* and a sublime business graphics program, *Easel*. No less than seven files, in any combination of these, can be held in memory at one time.

QUILL

The best thing about *Quill* is that it

2 Inside the Graduate. Clearly visible are: floppy disc drives, front left; power supply and fan,



rear left; 256K memory, front right; IBM expansion slots, rear right.

only store 320 KBytes on two sides of a standard 5 1/4" floppy, instead of over 400 with the BBC's DFS (and 800 if you use double-density).

On the credit side, MS-DOS is a much wider and more powerful operating system than the Beeb's MOS. Just to give one example,

is very simple to use. Otherwise I found it rather disappointing. Six lines at the top and three at the bottom of that already reduced screen are occupied by program "prompts", so you have only 16 lines to use for text. There is no windowing or split screen facility so you can only view one text at a

time, although there are various commands for making changes to texts held in memory but not on the screen.

But my main criticism is that *Quill* is very slow. If one has a part-written document saved as a disc file, this cannot be loaded direct onto the screen. Indeed, from switching on the machine, you have to:

Load MS-DOS
Change the default disc drive
Load Xchange, to give a menu
Select QULL:NEW TASK and type in the name of the task
Press function key F3 to get the command menu
Select "Load" on the command menu (single letter 'L')
And finally type in the file name and Return.

I timed this to take 1 minute 25 seconds compared with less than 30 seconds for comparable word processors but this could be speeded up by writing an MS-DOS batch file.

Cursor movement is also very slow. Using the arrow keys, with or without Shift, you can move one letter or one word in either direction and there is a "GO TO" command which takes you to the top or bottom of the text or to a specified page number. However, there are no commands to go to the start or end of a line, sentence or paragraph and the cursor on its own moves slowly and jerkily. I found that, in various situations, the screen could not keep up with even my tortoise-like typing speed, especially if I did short words on a series of new lines, like a shopping list.

However, what is lost in speed of execution is regained by reliability and ease of use. I found I made very few errors using *Quill*. Learners, or those who have found more sophisticated word processors difficult, will warm to it. It is a "wysi-wig" (what you see is what you get) word processor: it has a ruler at the top showing the 80 print positions and, at the bottom, a clear statement of which word, line, page, task and document you are on and whether you are in INSERT or OVERTYPE mode. You can set your page length and a neat dotted end-of-page line appears, so there

CONTINUED OVER

is no chance of printing a sub-heading and then having an embarrassing page break before the text appears. You can override the page breaks, if you want to leave space for a diagram or table, rather than begin it three quarters of the way down a page.

There is also provision for putting headers and footers (a standard line of text at the top or bottom of each printed page) and these can be at left, right or centre but there is no facility for alternating them, for documents printed on both sides of the paper. Variations in text presentation, such as double-spacing, are easy and a series of typefaces are offered: bold, underline and italic plus super- and sub-script but none of these are indicated on the screen text, so editing could be very difficult: you would not know what you had underlined. There is a full range of copying, merging, deleting, search and replace commands, all of them simple but slow. Finally there is a clever glossary facility: you can make any key on the keyboard memorize a sequence of characters or commands (up to a limit of 250 characters) which you can then call up with two key-strokes. Once again, retrieving is slow: each letter is printed out singly on the screen, at a rate of under four characters per second (much slower than a competent typist) which rather takes away the value of the facility.

Quill has its own "mail-merge" procedure. This can either:

Use a separate file that contains the various name, address and data lists, not unlike the MACRO facility in Acornsoft's *View*, or Accept variable data, typed in each time at the keyboard or Accept suitable files "exported" from the *Archive* database.

I shall not assess this in detail as I plan a complete article on mail-merging shortly.

ABACUS

As a businessman I liked Abacus immediately. Usually spread-

3 The unit will operate on one side, with the disc drives vertical.



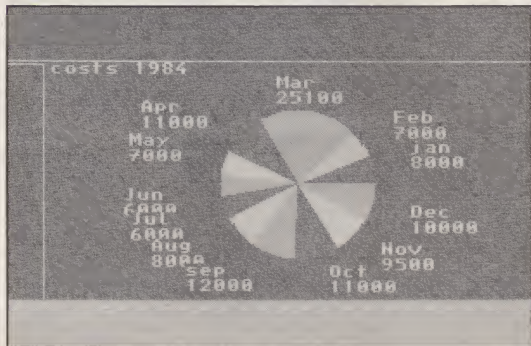
sheets are rather impersonal: every entry is referred to by a row number and a column letter and I

soon get confused. Friendly Abacus allows you to label a row or column and thereafter refer to it by

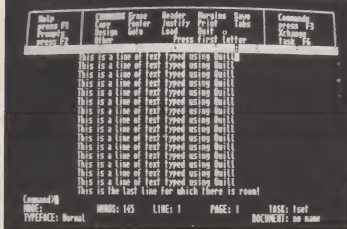
its label. So a furniture manufacturer can draw a production chart, label his rows: DESKS, TABLES and CABINETS and refer to them by those names when entering data. It will also write in the month at the head of each column, normally a tedious and repetitive task that just asks the computer to take it on. Best of all, if you insert the number of desks you are going to make in January, then decide to increase it by 2% each month, entry of a simple, single formula will calculate the figures for each succeeding month.

You can refer to a cell on one spreadsheet, that is not on the screen, from another that is dependent on it. So, when working on his SALES PLAN, our master joiner can decide that the price per desk will increase by 10% in June and see the result without having to bring his PRODUCTION SCHEDULE back on the screen at all. Also appealing to the business man is the security arrangement: any file can be protected by a password, without which it cannot be loaded. The most intimate details of company profits could safely be held on a computer in an open office.

The Abacus screen can be split



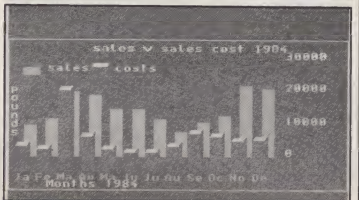
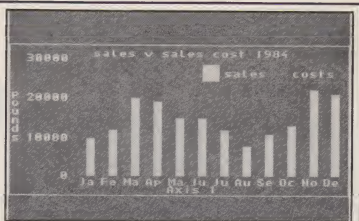
4 Quill: six lines at the top and three at the bottom of the 25-line screen are occupied by program "prompts", so you have only 16 lines to use for text.



into two windows and these can be either linked to scroll together or left operating separately. There is the normal range of commands for altering the way in which data is presented: the number of decimal places, whether it is justified to the left or right of a cell, whether printing is double-spaced and so on. Also, there is a most convenient sorting procedure. Suppose the spread sheet is used to calculate the "economical order quantity" for a number of items in the furniture warehouse. Each item would take up one row which would contain a catalogue number, the item name, the supplier's name, the price and so on. Perhaps the spread sheet was drawn up in numerical order of catalogue numbers but the buyer wants to collect together the items from each supplier. *Abacus* will sort it by supplier.

He then wants to arrange it in order of price, so that the senior buyer negotiates the most expensive and a junior clerk handles the cheap items. *Abacus* will re-order it using the price column. The only limitation concerns any part of the spreadsheet that contains formulae. This will be invalidated, so the feature has to be used with care. There is also a (much appreciated) facility to fix the vertical and horizontal titles of the spreadsheet — any of them, not just the topmost line and left-hand column.

Abacus offers a wide range of mathematics: all the common arithmetic functions, such as averages, exponentials, integers, logs, square, roots etc.: an adequate range of trig functions (although they require the angles to be presented in radians, whereas most people are used to working in



degrees; however there is a degree-to-radian conversion) and a couple of financial functions: net present value and internal rate of return. However, there is a shortage of statistical functions such as standard deviations and rather a surfeit of "computerish" ones, such as CODE, which returns the ASCII value of the first character of a word of text: of limited use to anyone outside the computer business.

ARCHIVE

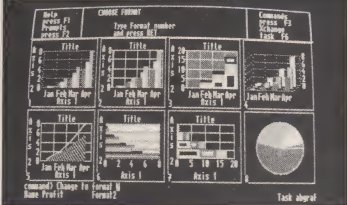
Archive is a database with a programming language and reminded me strongly of *DBASE II*. It offers the same three basic functions:

1 Create a database "card-index" structure. Each card, called a "record", can have up to 255 fields (far more than the miserable 32 allowed by *DBASE III*), each of which can hold numbers or alpha-numeric characters and can be up to

255 characters long.
2 Create screen presentations, both for inserting and displaying or altering the information.
3 Write programs to handle the data contained in the records. For example, if one has a database of names and addresses of customers, one can write a "command program" that will select all the customers who lived in a certain town and then print address labels. With a database of employees, one can write a program to calculate wages, tax, a complete payroll program in fact.

It is in the programming language that the greatest similarity to *DBASE II* is evident, with "IF/ENDIF" loops, APPEND commands to add a record to a file, and ORDER (to perform the same as *DBASE II*'s INDEX function). In addition to the language, there are

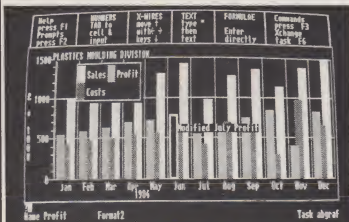
5 Easel's wide range of graphical formats.



CONTINUED OVER

a number of programming functions, many of them the same as those used by Abacus but also some familiar to users of BASIC, such as GETKEY and INKEY. Despite being integrated with Quill word processor, Archive also provides a special program editor for compiling its programs, although one can also write Archive programs using Quill, then EXPORT them.

- 1 Bar charts, line curves or pie charts
- 2 Vertical or horizontal
- 3 Side by side, overlapping or stacked (one on top of the other)
- 4 Use of the complete range of screen colours plus shading variations
- 5 Graph borders of variable thickness and colour
- 6 40 or 80 column display and printing



In a few seconds Easel changed from this vertical bar chart

A word of warning however. All the other Xchange programs are characterised by simplicity and ease of use. Writing database manipulation programs, which may use any from a vocabulary of some 80 programming commands, plus a further 40 function descriptions, is neither quick nor simple. Although the handbook and tutorial program provide a certain amount of help, I was rather surprised that Archive did not come with a number of standard programs for doing simple tasks. In my experience the average user will, unless he keeps his tasks short and simple, need to spend several late evenings to produce Archive manipulation programs that do what he wants. It will be well worth it.... but warn your spouse not to stay awake waiting!

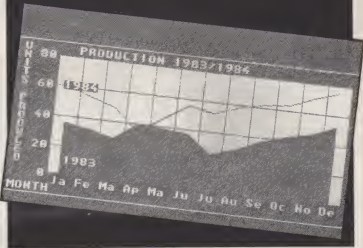
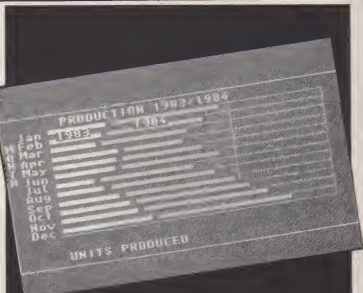
EASEL

Easel is a business graphics package with a wide range of choices:

- 7 Text labelling plus special arrangements for graph titles and axes.

HANDBOOKS

The Xchange Software handbook would be, but for one thing, excellent. It is split into two parts: a how-to-do-it section, for the complete suite and for each member, and a reference section that lists and defines the commands for each module. Wide use is made of screen diagrams and worked examples and there is a detailed and excellent contents list at the front. Its major shortcoming is the lack of an alphabetical index. I find it extraordinary that those, who present programs of such complexity and sophistication, do not realise how handbooks are used. Some users will read logically through once only; most will not have time. Thereafter a handbook is used like a dictionary: you look up what you need. With no index this is a nightmare! I discovered, only at the very end of



Printed on an Integrex printer, these show various graphics

produced on Easel with incredible ease!

two solid days spent exercising these programs, that it was possible to use Quill to edit the Archive programming language. This gem of information, lack of which might result in a user spending hours of work unnecessarily, is buried deep in the text. An alphabetic index in which one could look up the word

'EDITING' would have revealed this in a few seconds. From Torch, one of whose main products is Perfect Writer wordprocessor with an "indexing" facility, I find it incomprehensible! It is a great pity that superb documentation should be spoilt by this shortsighted omission of a vital feature.

ASSESSMENT

For the cost-conscious businessperson, who has been using a BBC Micro and discovered that it is not nearly powerful enough, there have in the past been two choices:

1 To fit a Z80 second processor, giving access to a range of CP/M software that can run with only 64K of memory.

All the suppliers of Z80 offer bundled software but it all has limitations, mostly associated with shortage of memory. Z To throw out his BBC micro and go to a professional business system, such as the IBM PC or Apricot XI but he will see little change out of £2000.

Graduate offers a third course and it will appeal to many: for another £1000, he gets a twin disc machine, with abundant memory, access to the whole huge range of IBM PC compatible software, and an excellent suite of integrated software which will handle his general administration needs. If he wants to expand thereafter, he can put in more memory or add an IBM-compatible hard disc costing around £1300.

I believe this is a choice many people are going to find very attractive. Despite some shortcomings, Graduate plus Xchange is excellent value.

I much preferred the 80-column graphs. The key box occupied less space: in 40 columns it seemed to obscure quite a lot of important data. (One would pay the penalty by loss of colour of course.) Graphs can be marked with symbols, which in turn can vary in colour and shading and line graphs can vary in thickness. Bar charts can be created with isometric (three dimensional) perspective and pie charts can have one segment removed sideways to focus attention. As well as using the wide calculating powers of Abacus, Easel has its own formulae, although these are rather more limited.

I found Easel brilliant: incredibly flexible and extremely easy to use. There is no fiddling about trying to work out the best axes scales: that is all done for you. The speed, with

which one can alter the presentation of data to display it to best advantage is breathtaking. The photographs show identical data, altered within seconds from vertical, three dimensional bar charts to horizontal bar chart and to pie chart.

INTEGRATION WITHIN XCHANGE

Thus far the Xchange programs are conventional. It is in its ability to swap data from one to the other that the true power of the Xchange Suite becomes apparent. You can extract information from the database and feed it into word-processed text or into a spreadsheet table; you can represent tabular spreadsheets in graphical form; you can incorporate tables within text reports.

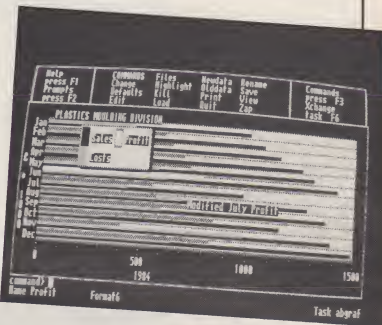
This transfer of data can be carried out in two ways: either you can create an intermediate data file or transfer directly. Data transfer files are nothing new. Innumerable people have used Multiplan data in a Wordstar report for example. Xchange scores because all the formats and codings used are compatible. Each program has an EXPORT command, to specify which data is to be transferred and an IMPORT command, to denote which file is to be received and where it is to be put.

Switching data between the modules is extremely easy. It took me a few seconds to export the contents of a spreadsheet budget to Easel and have it turned into lucid, helpful graphs. It was equally easy to transfer the same data into the body of a Quill report but, to my great disappointment, you cannot export Easel graphics straight into Quill. If you want to incorporate graphs in your report, you would have to print them out separately and modify page numbers accordingly.

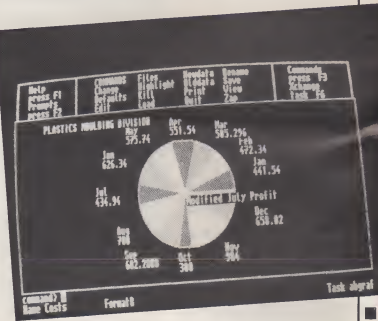
Abacus has joined the big league, of sexy, integrated software suites such as Symphony and Lotus, because it can transfer data without creating intermediate files. It is this ability which justifies

integration of all four programs within a single shell, the cause of my earlier complaints about slowness and the tedious loading sequence. The process of transfer is intricate and users would need to

gain experience but an excellent tutorial disc is very helpful. In painless, easy-to-run lessons it leads, step-by-step, through the IMPORTING and EXPORTING processes.

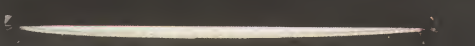


7 to this horizontal chart and 8 this pie chart



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

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Nine September 1985

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Hard disc breakthrough — Solidisk's amazing Winchester package.

Video graphics. The background to the most exciting Beeb visuals we've seen.

Top printers tested. 80 important criteria.

Accelerator. AMX edge detector utility, Valiant turtle, keying with Concept and computers in the classroom.

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COMPUTING

FOR USERS OF THE **BBC MICRO** AND **ELECTRON**

Programming in the Shadows
- BBC Plus

First with the firmware!
- Electron word, store and joy

Hard disc breakthrough
- Solidisk Winchester

Programming: Video graphics
- faster than the eye...

Business: Top printers tested

Education: COMAL, Valiant Turtle, Keying with Concept

Software: Accelerator, the edge on AMX

LogoTron Sprite Boards
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List processing, Logo, children and words.

Acornsoft's Home Education suite including ABC and Talkback.

Double Dutch — take a piece of Beatles Music or French text, have your BBC or Electron analyse it and then...

An £8 speech synthesiser for you to build + sophisticated software.

Notes on MIDI, the ergonomics of the electronic office, interactive printer character design, Printer Buffer, an Adventurescape text editor and BASIC utilities.

Software: Full-feature machine code wordprocessor for BBC and Electron. Amnesia — almost 100K of Adventure challenge.

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COMPUTING

FOR USERS OF THE **BBC MICRO AND ELECTRON**

In the Beginning was the Word

Habitual to person, accus-
d me with his wonted courtes-
d obstacles). (either f. wont¹
sion of wont¹ with -ED)
1. Ask in marriage.
); hence ~ER¹ n. 2. p.
ame, fortune, etc. (usu. f.
persuade, (person
). [OE wogian v.]

g. or pl.) Grow
sely a consider.
not see the ~ 1
general view; ou
danger etc.; don'
the ~ or *s, do
difficulties are over; hence
act fibrous sub
f trunks and
or cut for timber or fuel or
rafts; timber, fuel, etc., of this
(on) ~, put hand etc. against
(as superstition to avert ill
capture in children's game).
bottled storage of wine etc. (in,
1. (Bowls) = BOWL² 1; (Golf)
club. 5. ~ alcohol, methyl

Acornsoft's Talkback, ABC Reviewed
List Processing - Logo, children and language

Electronic Office - Ergonomics
Notes on MIDI - Powertran, Siel

en engraving made on wood;
n who cuts wood. (2) maker
● **BBC PLUS 128K INSIDE** ▶▶▶ of
bar holes in wood: ~fibre.

*warbler; ~-wasp, wasp that hangs nests in
tree or barrows in rotten wood; ~waxen,
candle-tremor [OE weaxe (as wax²); ~wind,
wind instruments made (orig. of
wood; ~wood, fine pine etc. shavings used as
surgical dressings or for packing; ~work, (1)
work done in making of things made of wood
esp. the wood-
wood-boring larva
(where wood is used
a. [OE wudu, wudu
*widuz]

making) print
ine film for
d. f. w.
y N.
rec
op² n. (s)
pean, esp.
unkn.)
Worcester
pungent sa
England]
Worces. abbr
English
word¹ (we
sounds
customarily
of it but n
element of
native ideas
of, the who
basic unit
in compute
have no
On offer-
pressing the same th
of it, no part whate
the ~ for it, not
as in thought; ~ for

er. See wool.
wool¹ n. = WEFT¹. [OE *owef*, alt. f. *owebb* (after
wefan WEAVE¹) f. as A- 1, WEB; w- f. assoc.
w. warp]
wool² n., & v.i. (Give) gruff bark of dog; hence
~ER¹ n., loudspeaker for accurately reproducing
low-frequency signals (cf. TWEETER). [imit.]
wool n. 1. Kind of hair distinguished by fineness,
softness, wavy structure, and scaly surface.
occurring mixed with ordinary hair in coat of

Software

Interactive Blanket Character Design

Adventurescape Text Editor

BASIC utilities

Wool

Woolmer

Woolly

Woolly

Woolly

Woolly

Woolly

Woolly

Woolly

Woolly

Woolly

Woolly

Woolly

Full feature machine code wordprocessor for BBC and Electron Annasie, 100K of Adventure challenge

On offer-

On offer-

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Competition 34

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Articles in the next month column are in an advanced state of preparation but cannot be guaranteed to appear.

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All submitted material must be in machine readable form. This applies both to programs (in any language) and to documentation, which should be prepared with a BBC or Electron wordprocessor. 5¼ inch disc (40/80) or cassette

equally acceptable. Please also include hardcopy and any suitable illustration, photographs and/or screen dumps.

If you are considering submitting material to A&B then please send a S.A.E. for a comprehensive style sheet. It's also sensible to give us a ring before going ahead with any major work.

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Adventurescape, the disc upgrade. A full text editor allows entering of messages and location descriptions. Also on offer: Amnesia, a massive Adventurescape production; a psychological thriller which should keep you glued to the keyboard.

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Alan Rowley follows up Programming Plus with routines to make full use of shadow RAM. This month it makes room for a multiple choice question marker program.

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Eleven November 1985

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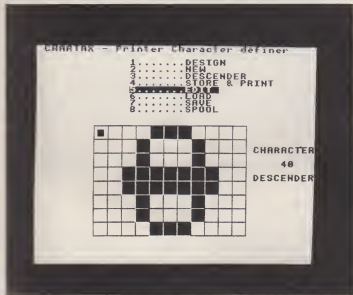
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Easyword 78

Our machine code wordprocessor for BBC Micro or Electron. Easy to use and easy on the pocket! Documented in full.

Keyboard Vultures 103

A typical tale of woe, recognisable in BBC Micro households throughout the country.



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Deathstar 22

Superior's marvellous new space fantasy. More than a touch of originality in the classic arcade style. BBC and Electron.

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Spellchecker Clive Grace feeds Watford's firmware with a word or two and it all comes out 100% Queen's English!

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A versatile character designer for dot-matrix printers.

BBC+ 128K

Gordon Taylor

What It Is and What It Does

The B Plus 128K provides an additional 64K of RAM (in just two 64 x 4 chips) on a small board which is mounted on the expansion connector on the right-hand edge of the main board.

With appropriate software, this can be used in any of three ways:
- As a Virtual Address Space of 4 banks (or two 32K) banks of Paged (or Sideways) RAM. This may be loaded with images of ROM software that then behave exactly as though the ROMs were plugged into the machine (until it is switched off!).
- As a RAM disc of 64K.

- As a Virtual Address Space of 64K above the 64K that is directly addressable by the 8-bit Central Processor Unit (CPU). (See Fig. 1).

It could also be shared (e.g. in 16K blocks) between these three uses, again with appropriate software.

Software to load and save Paged or Sideways RAM banks (but not to save ROMs directly), and to move data from main RAM

to Paged RAM, has been added to the B Plus DFS ROM - which thus becomes version 2.2. However, software to use the expansion RAM as a RAM disc (as in the Atari 130 XE, for example), is not planned by Acorn but is likely to be offered by others.

Indeed, the Paged or Sideways RAM and RAM disc uses may be compared with those of the Solid-disk Sideways Systems in a standard Beeb. (see A & B, November 1984, p 66).

In order to use the Virtual Address Space between &10000 and &1FFFF, the "language" must include code to translate this to a corresponding bank number and an address between &8000 and &BFFF. For example, addresses between &18000 and &1BFFFF are translated to bank C. This is provided in BAS128, which (like BASIC 1 and BASIC 2) can address only 64K, but (at some 19K) is larger than one bank, and is therefore loaded from disc into main user RAM.

Thus the figures for the Acorn machines are :

Computer	Size for BASIC - K	Average Time - Secs
B Plus with BASIC 2	25.5	14.55
B Plus with BAS128	64	29.43
B Plus + 6502 with BASIC 2	44	9.83
Electron with BASIC 2	20.5	20.44

While those for the main rivals are :

Amstrad 6128 (Amstrad 464)	41.3	N/A
Atari 130 XE	45.5	14.59
Commodore C 128	40	75.5
(Commodore C 64)	37.5	N/A
Sinclair Spectrum 48K	37.5	34.0
Sony (and other) MSX	40	58.5
	32 (26 with disc)	44.3

(The figures for the rival machines are taken from results published by Personal Computer World and Practical Computing).

MEASURES

Two measures of a computer are the size available to BASIC (and other) programs and the speed. One purpose of expanding the B Plus to 128K is to allow it to run larger programs, and it has 64K available to BASIC when using BAS128. Speed in BASIC is often expressed as the average time to carry out the eight Personal Computer World BASIC Benchmarks. While this is just twice as long as when running BASIC 2, it is still shorter than most of its rivals. A powerful combination of size and speed is still available by using a 6502 Co-Processor, running Hi-BASIC.

VALUE

The value of the expansion to 128K could be even greater for other "languages", including word processors etc. Regarding these, Acorn will only say that "versions of other software will be developed". One may however speculate that :

- this will include View, since with up to 25.5K in main memory and 64K in the Virtual Address Space, this could offer up to 89.5K - i.e. over 20 pages of A4 type in single spacing. (This compares with "only" 47K with Hi View running in a 6502 Co-Processor).

- this will not include ViewSheet, which uses 15-bit pointers for speed, and so is limited to a maximum sheet size of 32K (unless completely re-written). (It can of course handle much larger "models" by consolidating the results of multiple sheets).

The 64K RAM expansion is to be available both as an upgrade for existing B Plus machines, and already built-in to new machines. It includes the expansion RAM, the new DFS 2.2 ROM, BAS128 on disc and an explanatory leaflet. The price of the upgrade is likely to be only £30 plus fitting. This should be done by a dealer, since it involves soldering a multi-pin connector to the main board, and would still be excellent value at say £10. The price of the already-expanded B Plus 128K is £499, including VAT - the same as for the 64K model until recently. Taken together, these developments amount to a significant increase in price/performance, which - with the ever-improving software - will help to keep the Beeb competitive for a considerable time to come.

HOW THE B PLUS 128 K WORKS

MEMORY MAP (SIMPLIFIED) WITH BANK NUMBERS AND ADDRESSES IN HEX

										BANK D		V	81FFFF					
												I						
												R						
												T	81C000					
												U						
										BANK C		A						
												L						
												A	818000					
												D						
												R						
												D	814000					
												S						
												P						
												C	810000					
												MO:	8FFFF					
												ROM:						
													8C000					
EXP	EXP	F	OUR	32	K	ROM	SOC	KET	S	DFS	DFS	EXP	EXP	BAS	BAS			
RAM	RAM									ROM	ROM	RAM	RAM	ROM	ROM	RAM	RAM	
0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F		80	
																		8AFFF
																		88000
																	ISCR:	
																	USR:	EEN
																	RAM:	
																		83000
																		80000

Making the most of LOGO

John Henderson

Learn to live and live to learn. This motto must surely apply to the use of LOGO in schools. However many ideas users come up with, there are more possibilities around the corner. Using a full version of LOGO enables children of all ages to experiment with problems. Trying and testing solutions is a natural part of learning.

To date, most LOGO applications have concerned themselves with Turtle Graphics. A much wider application is to use the power of list processing to assist learning. This means much more than analysing the weekly shopping list as you will begin to see from this article. List processing enables the writing of procedures to explore the way words fit together. That is not to say that it follows on naturally from turtle graphics. List processing is very different as it does not build on concepts that are immediately familiar to children, nor does it provide instant solutions. A great deal of time and effort are required to solve problems.

LOGOTRON

All the procedures used in this article were developed using LOGOTRON. This was chosen for three reasons. First, it is a full implementation of LOGO, and thus provided the extension facilities that schools are looking for. Second, it seemed the most versatile and speedy package of the Big Four LOGOs for the job of list processing on the BBC computer. Third, it is contained on a single chip and eliminated the need for an expansion board.

The LOGOTRON package consists of a full manual of commands and sample programs, a command summary sheet and one 16K chip. Although there are several spelling mistakes within this manual, presentation is pleasing with actual program lists highlighted in red. The ring binder containing the file allows room for supplementary sheets to be added. The section on Logo Grammar is particularly clear and helpful. LOGOTRON was written by ACT/SOLI to LCSJ standard.

Starting list processing with Logotron.

LISTS GALORE

LOGOTRON takes lists of words, which are referred to as **OBJECTS**, and processes them. Easy isn't it! Well I hope it will be clearer by the time you reach the end. LOGO works through a series of commands called primitives.

FORWARD 200 LEFT 90

are commands used often in turtle graphic programs. Not all primitives are commands — some are actual outputs termed operations.

In list processing three types of data objects are handled. Objects can be a words, numbers or a list. They can then be used as input/output from procedures.

MAKE "1 [HELLO] PRINT :1 HELLO

MAKE "2 365 PRINT :2 365

This is an example of printing a word or a number from a single variable command. Square brackets can be eliminated from numbers. It is easy to join words together using the **SENTENCE** command.

MAKE "1 [ELEMENTARY MY] MAKE "2 [DEAR ...] PRINT SE :1 :2 ELEMENTARY MY DEAR ...

Notice the use of **SE** as an abbreviation and the use of a colon before each part (each element) of the list. If the sentence to be joined consists of more than two elements, brackets must be used as in the example below:

MAKE "3 [WHAT'S YOUR NAME ?] PRINT (SE :1 :2 :3) ELEMENTARY MY DEAR ... WHAT'S YOUR NAME ?

PRINT statements can be more powerful when combined with other commands. Look at the variable name **LABEL** given the object LOGOTRON:

MAKE "LABEL "LOGOTRON

By adding commands to this, different displays result.

PRINT FIRST :LABEL

prints the first element of the object that is LABEL, hence on screen appears:

L

Similarly, printing the last element of LABEL needs the command **LAST**:

PRINT LAST :LABEL

N

Commands **BF** (everything BUT LAST element) and **BF** (everything BUT FIRST element) yield more power with words:

PRINT BL :LABEL LOGOTRO

How can children use these commands? Well letter patterns are important to children learning to spell, so the

LOGO LISTING 1

shows how to strip a word a letter at a time and print out the result. Children can use these patterns to learn how to look at the shape of word strings.

MAKE "LIST [SQUARE TRI- ANGLE RECTANGLE] PRINT LAST :LIST RECTANGLE PRINT BL :LIST SQUARE TRIANGLE

Some other commands used by LOGOTRON make writing on the computer a painless activity. Printing to a certain part of the screen, for example, is made simple using the command **SETCURSOR** (SC):

SETCURSOR [15 15]

sets the printing position approximately in the middle of the screen.

Commands **READLIST (RL)** and **MEMBER?** are versatile and powerful. The list below shows a procedure to... well you look:

TYPE [WORD ?] MAKE "WORD RL

PROGRAM LISTING

LISTING 1 — WORD STRIP:

```
TO PAT :LETTER
PRINT :LETTER
PAT BF :LETTER
END
```

WORD :LOGOTRON

```
LOGOTRON
OGOTRON
GOTRON
OTRON
TRON
RON
ON
N
```

Compare this to the BASIC version of the same program:

```
10 XS=LOGOTRON
20 FOR loop =1 TO 8
30 PRINT LEFTS (XS,loop)
40 NEXT loop
```

Word? A & B
PRINT :WORD
A & B

The command **MEMBER?** does the important job of checking outputs to see if they are true. This is especially useful to check if an object is included on a list:

```
MAKE "LIST1 [A & B]
MAKE "LIST2 [computing]
IF MEMBER? "computing
:LIST2 [PRINT  
"Correct]
```

CONTINUED OVER

APPLICATIONS

Look at **LOGO LISTING 2**.

This forms the basis of a word puzzle created by children for use in the classroom. The advantages of this system are that words can be included that are **DIRECTLY** related to the work in a particular classroom and any redundant words can be removed, thus giving more relevance to the situation. The puzzle is based on three main procedures. First, a datafile containing the words required, second a program to ensure that the correct matches are made, and third a random choice element to the list. Creating a series of useful utilities such as this can free many teachers from the task of writing their own programs to be able to concentrate on constructing learning materials for children.

LISTS FOR CHILDREN

It may be that children will use the list processing facilities to learn how to program. Certainly there are some user-friendly aspects to list processing which are nearer to our native language than their BASIC equivalent. LOGO listing is not restricted in the same way as BASIC. Lists can be of varying lengths (up to 255 characters), may be completely empty or may contain sublists within them. However the vexed question of whether to teach children to program has not disappeared. Educationally, effort should be put into problem-solving rather than being able to write programs to overcome simpler problems.

Why LOGOTRON? It's list processing speed is the fastest of the Big Four LOGOs. In a test using a 10 element list printed out 100 times the clock averaged 4.2 seconds. Error messages try to be helpful, although inevitably the user guide is required at first to interpret some of these. There is also sufficient workspace, the amount of memory available to the user, to build procedures that

children are likely to want. Storing procedures in the Editor allows more space to the user, although the best policy is to train children to SAVE procedures onto disc as they work. LOGOTRON incorporates a garbage collection system to release workspace.

Table One indicates the size of workspaces available. Finally, the range of commands available is sufficient to allow schools access to the power of lists.

Table Two contains the most useful commands that children were introduced to when starting list processing with LOGOTRON.

THE FUTURE

Without a doubt the computer is here to stay. Without a doubt LOGO will be a powerful learning tool in the classrooms of the near and distant future. The question is what will be expected to happen? Many primary schools and some of the children in them, will be quite stretched to learn in a turtle graphics micro world. It is very difficult to use lists with confidence. There are, however, ways around the problem by using toolbox programs, written by teachers with particular children in mind.

Content-free applications that children can adapt to their own needs at that time without being driven to distraction trying to battle with the full power of list processing. To push children, and teachers, into microworlds where they lose control will be to tempt fate — even if it is high technology.

The most educationally beneficial situations in which children find themselves allow a degree of freedom, coupled with support from the teacher and time to achieve results, in an effort to solve problems. It is highly likely that schools will concentrate on a few of the many facilities available through LOGO. It is for individuals to choose according to their situation. Using LOGO in musical and control microworlds has yet to be explored. Today the emphasis is shifting to applications for the power of list processing e.g. creating a database facility using LOGO and enabling children to really explore the world of words where they are in control.

TABLE TWO: LOGOTRON LIST PRIMITIVES:

BUTFIRST (BF) print out all but the first element of object
BUTLAST (BL) print out all but last element of object
COUNT outputs the number of elements in an object
FIRST output first element of object
FIRSTPUT (FPUT) places object at start of a new list
ITEM outputs a specific item from a list
LAST output last element of object
LASTPUT (LPUT) places object at end of a new list
MAKE creates a variable
MEMBER? checks the TRUE value of an object
SENTENCE (SE) creates a list from two or more inputs

TABLE ONE: LOGOTRON WORKSPACE

This varies with the screen MODE being used, MODE 4 being default mode. Space is measured in NODES, each node being approx. 5 bytes.

MODE 0 755
 MODE 1 755
 MODE 2 755
 MODE 3 1571
 MODE 4 2795
 MODE 5 2795
 MODE 6 3203
 MODE 7 4631

PROGRAM LISTING

LISTING 2 — WORD LISTS

```
TO DATA
MAKE "LIST1 [computer
monitor disc]
MAKE "LIST2 [cassettes
discs lists]
END
```

```
TO MATCH
DATA
SETMODE 7
REPEAT 3 [PRINT ( SE
CHOOSE :LIST1 [is always
hardware whereas] CHOOSE
:LIST2 [is always software]
END
```

```
TO CHOOSE :LIST
OP ITEM 1 + RANDOM 1
:LIST
END
```

LOGOTRON LOGO
 Logotronics
 Regional Office:
 5 Granby Street
 LOUGHBOROUGH
 LEICS.
 LE 11 3DU

£59.95

Making the most of Assembler

Margaret Stanger

Sometimes machine code is so fast that a routine has to be written to slow it down while the rest of the world catches up!

The short program WAITING has a short BASIC delay routine, and the equivalent in machine code. The TIME is set to MINUS the chosen interval, and the computer does not continue the program until the TIME reaches zero.

The chosen interval (5 seconds in this case) was stored from location &80 to &84, with &80 containing the hundredths of a second.

ie. $16 \times 80 = 500 \times 84 = \&FF$.

LOCATION	VALUE	VALUE
&80	12	&0C
&81	254	&FE
&82	255	&FF
&83	255	&FF
&84	255	&FF

The time could then be written using the OSWORD 2 routine as described in the 'User Guide'. The accumulator is set to 2 and the X and Y registers point to a parameter block starting at &0080.

The TIME is read using the OSWORD 1 routine, but this time the parameter block starts at &0070. Time marches on and the changes are reflected in the following locations after 2.43 seconds and 5 seconds:-

LOCATION	value1	value2	value3
&70	12	0	0
&71	254	255	0
&72	255	255	0
&73	255	255	0
&74	255	255	0

The computer checks location &74 for the value zero, before the program continues with a return to BASIC. For a BBC machine, the interval timers could be written and read in a similar way using OSWORD 4 and OSWORD 3 (See Micro Eventing next month).

Taking time out in Assembler

```

10REM**WAITING BY M.STANGER
(5FBF)
20DELAY=500:REM 5 SECONDS
(068A)
30PROCAS (2536)
40!&80=-DELAY:?!&84=&FF:
CALL&A00 (B7B7)
50VDU7:END (54E0)
60: (0C0C)
70DEFPROCHEAT (5BD8)
80TIME=-DELAY (F528)
90REPEATUNTILTIME=0 (B96F)
100ENDPROC (8486)
110: (63DA)
120DEFPROCAS (7522)
130FORPASS=1TO2 (7933)
140P%=&A00 (9801)
150LOPT PASS (1516)
160LDX##&80 (2CC3)
170LDY#0 (7C8B)
180LDA#2 (398A)
190JSR &FFF1\OSWORD (BC1D)
200.STAY LDX##&70 (3C7B)
210LDY#0 (77EE)
220LDA#1 (92C2)
230JSR &FFF1\OSWORD (1B52)
240LDA#74 (D8BA)
250BNE STAY (2A1B)
260RTS (6270)
270] (C2D8)
280NEXT:ENDPROC (DC75)

```

VARIABLES

DELAY chosen interval
PASS loop variable for two pass assembly

MAIN PROGRAM

line
20 Sets DELAY to 5 seconds
30 Assembles machine code
40 Stores DELAY in parameter block, calls Machine Code routine.
50 Ends the program after sound signal

PROCEDURES

PROCHEAT

This procedure contains the equivalent of line 40 in BASIC.
90 Sets TIME to MINUS the delay
100 Waits until the TIME reaches zero

PROCAS

130 Two pass assembly
140 Sets the program pointer or start of the Machine Code to &A00, as this area is usually spare
150 Sets assembly options
160 Loads X register with Least Significant Byte of parameter block
170 Loads Y register with Most Significant Byte of parameter block
180 Loads the accumulator with 2
190 Jumps to OSWORD subroutine at &FFF1 to write the time
200 Loads X register with LSB of parameter block
210 Loads Y register with MSB of parameter block
220 Loads accumulator with 1
230 Jumps to OSWORD subroutine at &FFF1 to read the time
240 Loads the accumulator with &74
250 Continues program if accumulator is zero, otherwise repeats from LOOP
260 Returns to BASIC
270 End of machine code
280 Next pass of assembler

Notes on MIDI-

Clive Grace

In the first part of a series, some of the best music making hardware and software comes under scrutiny.

As there are more and more computer users and potentially more computer musicians, so the increasing importance of the computer is beginning to show in today's contemporary and popular music.

Look at Duran Duran's "Reflex" video, and you will see Nick Rhodes, their keyboard player at the controls of two £27,000 Fairlight sampling computers (more about that later). The Thompson Twins brought one on stage in the American Live Aid concerts, Johnny Fingers, from the Boomtown Rats had an Apple-based Greengate DS3 sampling unit on stage as his main keyboard.

In the April and May issues of A&B, I took the Acorn Music 500 synthesiser into a studio to try out its facilities. Music 500 is geared towards being a home synthesiser, and thus a lot of potential studio owners will not have heard of AMPLE, the best music composition language I have yet seen, but many studio engineers and computer musicians will want a great deal more. Sound sampling is all the rage at the moment. MIDI is an absolute must if you wish to use more than one synthesiser or computer together, and some sequencing software is necessary if you want to build up songs or patterns which hold together many of today's pop songs.

WHAT IS SOUND SAMPLING AND MIDI?

Sound sampling as opposed to Sound Synthesis, is a process by which a sound is stored digitally within a computer, it can then be re-calculated and the waveform altered to play at different pitches,

so the original sound can be played back in a musical score. The advantage that sampling has over synthesis is quite obvious. A synthesised sound will never be quite right as it is based upon parameters using a number of oscillators and filters to distort a pure wave form, like a sine wave or a square wave. A harpsichord will never sound quite right as the sound wave is so complicated. To the discerning ear, the resultant sound would be annoying to say the least.

The obvious alternative is to make an audio copy of the original instrument and, by a system of digitising the sound, (normally via a pulse code modulation process) storing the sound in the computer and eventually onto a disk. So if you wanted to play one of Purcell's Harpsichord suites on an original instrument, perhaps sampling a 1705 Cawton Aston spinet would do the job, unethical I suppose, but safer than shipping a priceless (and beautiful) instrument on tour.

The most famous sampling system is the CMI Fairlight, which has an awesome array of sound processing software and a friendly "human interface" via a lightpen. The Fairlight costs an absolute packet (as high as £32,000 for the top version) and boasts some of the most detailed software ever written on a computer.

MIDI is rapidly becoming a communications standard in the world of digital musical instruments, this can include anything from a Roland Synthesiser to a mixing desk controller unit. If an instrument does not support MIDI then it will not be able to synchronise itself with other MIDI instruments, nor would you be able to record a piece of music in the studio unless it was a live overdub. MIDI is an important step forward in that (grumbles from Bob Moog aside)

it allows the musician to effectively control the flow of data from one digital instrument to another and is in reality a communications standard.

POWERTRAN SOUND SAMPLING UNIT

One of the most outstanding pieces of hardware to come out from the BBC Micro this year is the Powertran MCS-1 sound sampling unit. It is a high quality digital sound sampling unit with a digital delay to boot. It is a professional unit which has found users in many fields of music. Midge Ure from Ultravox is a well known user of the MCS-1.

The inclusion of a digital delay unit is, in my opinion, a very good one. Many sounds can be "thickened up" by adding a small delay (of up to 200 Milliseconds) thus giving the impression that there is more than one sound source. Another useful trick is to have a shorter delay on parts of a waveform like a Fretless Electric Bass, to give the sound a rubbery String Bass sound. This process is called Flanging and can be heard in the bass guitar on Paul Young's albums (or even better, John Martyn's "Well Kept Secret" album).

The unit is quite heavy and is designed to be rack mounted into a travelling framework or in the studio. It has an alarming number of switches on the front and a healthy number of interface ports on the back.

FEATURES

The MCS-1 has an impressive array of features which are all addressed from the panel of switches to the right of the digital display. As the sampling unit is MIDI controllable the sampled sound is controllable from any MIDI equipped keyboard or by special modification, a 1 Volt per octave keyboard like ATPL's Symphony keyboard or the Music 500 keyboard.

Sampling is a very simple process by which the sound is fed into the MCS-1 via either a microphone input, or a pure sound

source, which is useful if you want to rip-off all of the best sounds on a synthesiser which you have borrowed for the weekend. The microphone or direct inject plugs into the socket on the far left of the unit marked "IN". Connection to a mixing desk or amplifier is made via the "OUT" socket, mid left of the display.

Pressing the button marked "RECORD" starts a pulsing LED on the button, this is to tell the user that it is ready to record a sound. The unit will store the sound, (up to approximately 4 seconds) upon a sound loud enough to trigger the record facility, or manually by pressing the record button again. The total length of time sampled can be reduced, so as to cut out any unwanted sections of a sample. Both the RAM size button and the sample speed controls are used to adjust the length of playback sample.

Thankfully, Powertran have included a "LEVEL" control with a "CLIP" LED below it, this is essential as you want a signal to be as loud as possible without distorting the incoming signal to sample or delay. Should you wish to protect the sound you are playing with (before dumping it down into the BBC software) you may wish to use the "FREEZE" option. This proved useful when I was sampling a Violin solo from Elgar's Violin Concerto, and had found the perfect sample of a Violin thanks to Itzhak Perlman. Pressing "FREEZE" saved the day as it avoided a near fatal mistake (to the sound) when I tried to sample another sound before committing the Violin to disk.

There is a noise reduction facility built into the MCS-1 which works via a de-quantization process. Normally when recording I trust the experience of the Engineer who is either a DBX or Dolbyophile. The NR button is set "on" at power up, and is invaluable when playing live, which is normally an appallingly noisy affair, if you fall foul of a bad PA system, or by trying to run 10 keyboards from three 4 gang sockets. The less noise that has to be clipped off at the mixing desk, the better and the NR facility goes a long way to curing this. Quantization noise from the sound being stored is sadly inevitable and

MIDI TEST

KEY STATUS

F1 ON
 F2 ON
 F3 ON
 F4 ON
 F5 ON
 F6 OFF
 F7 OFF
 F8 OFF

TX CHANNEL: 2

#0 MIDI CHANNEL
 #9 ALL NOTES OFF
 <X> TO EXIT

MIDI received
 Note
 Velocity

C Powertran 1984

Powertran have solved this problem. However should you require the additional brightness, then you can set this switch off, but it is not advisable.

The "PLAY" button is simply a means in which the sound can be recalled in its raw sampled form, connecting a microphone and adjusting the level control can, in a fit of self indulgence produce effects exactly the same as those found in Paul Harcastle's "19" or Eurythmic's "Sexcrime", ie the heavily sampled sounds, repeated over and over again, before the sample is actually finished.... fun for a while and proves that one of the most current effects in modern popular music requires no talent at all! Using the play button in this way is of no professional use. "PLAY" is used to examine the pure sample, and to modify it without the use of a MIDI keyboard, so sounds that require looping, especially the Violin which requires an extended delay or a Piano which needs an unnaturally extended decay, as the amount of sampling would render the MCS-1 too expensive in RAM chips.

"VOICE MODE" is an essential feature for playing the sound on a MIDI keyboard, whereby the pitch and duration of the sound (a maximum of 5 octaves) can be controlled, including the "bend" key to allow extra expression in keyboard solos. This is also a requirement when using "GATE" mode, the sound is only on for the set gate sound, this is useful for sounds which need to be clipped or, need a quicker decay. Pressing this button causes a "Lo" or a "Sh" prompt on the display which selects the long or short gate delay, the GATE mode allows for a great deal of control over loop effects.

DIGITAL DELAY EFFECTS

A special button for the delay line operation is set aside, and with the "SWEEP ON-OFF" buttons, a huge array of delay effects are possible, from 0.3 seconds delay (which is like singing into a tin can) to a maximum of 32 seconds (which is like singing in the Alps). Constant regeneration effects, such as the ones found in Reggae "Dub" music and, to more experimental effect by Robert Fripp, are possible, by making sure that the sound is re-echoed. Turning off the noise reduction leads to dynamic semi-distorted echo effects which is a similar sound to the echo effect on the guitar in Genesis' *Second Home By The Sea*.

The sweep buttons are used to affect the level of Phasing and Flanging, heavy sweeps are usually required on bass sounds, whereas string sounds are less demanding, pure vibrato is possible by setting the sweep range and sweep speed to maximum. Vibrato is a nice effect if used properly, and can add depth to a sound. The vibrato effects on the old Moog Prodigy and Rouge synthesizers are a case in point.

The rear panel is however a little easier to explain, as most of the connections are here. The connections are normally made and forgotten about. In the MCS-1's case there is only the provision for a MIDI IN and OUT socket, there is no MIDI THRU which is a shame as this means that the MCS-1 will have to be situated at the end of a particular MIDI node (if a satellite MIDI arrangement is employed) It is getting a little worrying how so

many synthesiser and drum unit producers are not fully implementing the MIDI THRU as this allows the MIDI information to be passed through the unit and onto another piece of equipment on another MIDI channel, of which there are eight in total.

There is a "FREEZE" socket which is used in conjunction with a short circuiting footswitch and is best reserved for freezing a sound, especially if you are working out an echo effect and have to have both hands on the MCS-1, the foot switch effectively keeps "PLAY" or a similar keyboard operation going.

The main link between the BBC and the MCS-1 is not through the MIDI interface, but by a special BBC IN-OUT socket, a parallel 180 degree DIN plug is all that is needed to connect the BBC to the MCS-1 and thus control the unit via the software supplied on disk.

BBC MIDI INTERFACE

Connecting the MCS-1 to the BBC Micro is very simple, the Powertran MIDI interface plugs into the 1MHz Bus underneath the BBC and the MCS-1 is connected to the interface by the BBC IN-OUT to the socket marked MCS1.

The MIDI interface is very simple to use and can be powered by the MCS-1's generous power supply or by an additional 9V (100mA) power supply. There are two LEDs on the unit, on the left is the power LED, which is to inform the user that the interface is connected and working properly. On the right is the data transfer LED which is only alight when data is being passed from the MCS-1

socket or the MIDI IN connector. The sound travels down the connectors at just over 31KHz to the BBC which is the accepted fast MIDI transfer mode, although the data is most definitely not MIDI information.

The unit is very small, just 150mm wide and 50mm high, the unit is unobtrusive and very utilitarian, all of the cables are easy to get at, which is necessary, especially as I have got into the habit of physically changing MIDI cables instead of re-allocating MIDI channels.

The Powertran MIDI interface differs from other MIDI interfaces in that it can control the MCS-1, no other MIDI interface is able to do this, so if you wish to store sounds on the BBC and use MIDI instruments as well, then you will have to use the Powertran interface.

CONTROL SOFTWARE

The controlling software is vital, if you want to do anything at all with the MCS-1 and the MIDI interface, and as the MCS-1 data is not a MIDI format it requires a separate transmission bus.

Each sound on the MCS-1 occupies 64K bytes of RAM and thus a complete sample of data will take about 21 seconds to transfer onto the BBC disc, not immediate, but fast enough for many practical purposes between songs. Unlike the Greengate DS3 with which you can store a number of samples in the machine at one time (providing they are short, like drums up to four decent samples can be squeezed in). The Powertran unit is only capable of storing one sound. No provision is made to store anything else which is a shame, but again, not too much of a limitation, and certainly no limitation at all if you are (like me) primarily a studio musician.

The MCS-1 disk program has a number of functions to perform which are: Upload and Download the sounds via BBC and MCS-1, to manage files, and perform all of the cursory BBC DFS operations such as rename and delete, to create special sound disks and test

CONTINUED OVER

MIDI information, to turn on or off codes and display the data it receives.

Simply BOOTing the disk file will load the program, including a pretty MODE 2 picture. It is advisable to backup the disk. I would also advise taking the picture out of the loading sequence as it takes a little while to load in the program and delays are annoying.

The program is menu operated and is addressed by the function keys, as soon as the main program is loaded, it would be advisable to put a sound disk in and use the "Create" option, should you have a double sided double disk option, then you can create a sound disk on any drive. Users of 100K 40 Track had better be careful not to press F1 to F3 as this will attempt to read from a disk which does not exist and thus call up a "Drive fault" error.

After the disk is CREATED, you should have files SOUND.1, SOUND.2 and SOUND.3, this is a special format disc and even though you can rename and delete files, you will have to do so through the program, as the disk is now unusable for storing anything else (BASIC programs for instance). You will find that as you experiment with more and more sounds, your disc requirements will treble at least, so get stocked up with good quality discs. Losing a program is bad enough, but I have found that losing a perfect sample of a vintage Stradivarius is almost as painful as watching a piano-wrecking contest.

Using the software, you can now accept MCS-1 data. In order to do this, you have to connect the MIDI interface to the MCS-1 by a length of cable connected to a 5 pin DIN plug. It is better if you either make the cables up (as I do myself for about 25p per meter) at considerable savings or buy a cassette to cassette copying lead from any Hi Fi shop. You would be mad to buy a Roland MIDI cable as the things are heat-sealed at the ends so as to make the cables impossible to repair in the event of an accident, and anyway, the ready-made and titled MIDI cables can be as much as £4.00 a pair, not at all value for money!

Supposing you have a sampled sound in the MCS-1 which you wish to commit to the BBC's discs. You simply press F8 and selecting the requested file number, either 1 2 or 3, you then press the BBC button on the MCS-1. There is a start-up message, if the connections are correct, telling you that the machines are in communication. **HELLO - MCS-1 VN1.1 HERE**. All this time there is a small graphics display of a "H" and a "+" symbol on the screen, to act as a prompt, telling you that the data is being passed, the DATA lamp on the MIDI interface will light up. Not only the sounds are stored though, thoughtfully all of the current VOICE parameters and LOOP parameters are loaded, so the digital delay and effects data are also available from a SAVE'd file.

The first file, initially SOUND.1 will be used, if this is already full, then it will try SOUND.2 and so on until it passes SOUND.3, at which point it will give a "Disc Full" error. The RENAME option is useful so that SOUND.1 can be anything you want, providing the filename is no more than seven characters long.

Delete merely changes the file back to a SOUND file, if you made a mistake, then you can simply use RENAME, to repair the damage.

A very useful piece of software, built into the disc control program, is a MIDI test display page, called up by pressing F9. The keys F1 to F8 are toggles to set the transmit tone ON/OFF codes for each MIDI channel. The MIDI receive section will likewise accept note on and off as well as display their binary value and position on the piano keyboard (great fun if you are using the Roland MIDI guitar controller).

This sort of software is very useful if you have a slight problem remembering where transmission codes are going to, coming from and passing through what instruments. It can be a nightmare knowing which plug is which and if one breaks down on you, then you would normally have to try each channel. With the MIDI test software, it is possible to completely reorganise the connections and flow of data in software alone, the test software is invaluable if you are

intending to go into MIDI in Poly mode, controlling 8 separate sound sources.

CONCLUSIONS

It is likely that the Powertran MCS-1 sound sampling unit is going to appeal to the studio engineer who has an existing MIDI arrangement. The advantages of housing sound sampling, digital delay and MIDI all under the same roof are obvious, the software is well implemented and is very flexible.

Sound sampling is however a two edged blade although it does allow the musician the creative ability to sample any sound they might want. The harsh samples a la Art of Noise and Frankie goes to Hollywood, are wearing a bit thin, but as sampling gets cheaper and more accessible (and with the MCS-1 how much more accessible can you get?) hopefully people with more inventive minds will put this process to better use. At the moment, all that sampling seems to be is a gimmick, a technological toy, which is a shame because sampling, is a branch of electronic music in itself, just as computer music is a branch of the wider world of contemporary music.

Sound samples are here to stay, the Powertran MCS-1 is a well designed, thorough piece of hardware. It is a little difficult to use in the beginning, because of the large number of switches, and the coarse, medium and fine control knob on the far right, but like any musical instrument, the more you use the MCS-1, the more you find out, and the more you want to use it.

For the professional user, I was pleasantly surprised how easily the MCS-1 fitted into the studio environment. Its rack mounting means that it can be fitted and tucked away permanently, but pulled out easily should the unit require additional cables in the back.

The unit was quite quiet in operation, although if it gets a little too close to high RF emitting pieces of equipment, then the unit can get a little noisy, so care must be taken when situating the unit in a studio.

The typical home computer musician is going to find the price

of the MCS-1 expensive, although I think that the price of £499 for the Kit including all the parts (only advisable if you are *au fait* with a soldering iron) and £699 plus VAT for the assembled unit is enough to tempt the computer musician or the studio Engineer who is looking for a flexible and low cost sampling system to add to their MIDI keyboard. For more information, contact:

Powertran Cybernetics Ltd, Portway Industrial Estate, Andover, Hants, SP10 3NN.

SIEL COMPOSING SOFTWARE

For many musicians the idea of using a computer for recording music and storing sounds is a tempting alternative to recording on conventional tape. Although tape has its advantages, the big disadvantage is that tape costs a lot of money, especially when it is in the form of a 24 Track recording studio, normally costing up to £30 an hour.

In a studio the emphasis is on time and sometimes mistakes have to be left in the final mix. Unless you wish to go well overboard on the budget, you might find it easier, and more convenient, to record the sections at home, getting them all perfect and then taking the recording into the studio to play back your masterpiece.

Of course, not everybody would want to go into a studio to record their music. Perhaps all the musician wants is a convenient means with which to compose and play back at his leisure. Whichever way you look at it, the advantages of storing and recording the music at home and playing back, either in or out of the studio, far outweigh the disadvantages.

About five years ago, the Roland corporation came out with a "Micro Composer", which was basically a glorified sequencer, built into a dedicated computer. It used the Roland synchronising codes (which have now at last, bowed down due to the popularity of MIDI). You were able to play or "write" notes into the composer

and you were able to play it back by plugging a Roland synthesiser into it.

Nowadays, the computer musician is demanding the same, if not more, features from a software package which can be loaded into a micro and, with the use of the software, control their equipment in much the same way that the old Micro Composers went about their business.

The Siel MIDI Composing software is the obvious step up from the typical one software package per computer rut. Their software is already implemented on the Spectrum and Commodore 64, and, at last on the BBC Micro. All of the software packages are hardware independent, hence the same interface and similar visual appearance of the software.

WHAT YOU GET

Both the software and hardware for the BBC micro are sold through Vince Hill Associates, who have a lot of experience with MIDI and computer music instruments. They act as consultants to the computer music world and we will

no doubt see more of them as more professional computer software is released.

The Siel "Multitrack Composer and Arranger" is designed to work with the SIEL MIDI interface. They cannot guarantee that the software will work with other people's MIDI interfaces, but it is likely that you will be buying the software package and MIDI interface as a bundle together.

As usual, you can connect up to eight MIDI equipped instruments to the interface by daisy chaining them using the MIDI THRU sockets on the back of the equipment you are composing with. The program is totally menu driven and takes a little while to get used to.

THE HARDWARE

The Siel MIDI interface is one of the most stylish looking MIDI units I have seen. Its smart black and light blue livery, with the green LED at the front to say whether the unit is working or not, is appealing and simple. As opposed to many other interfaces, which only plug

into the 1MHz bus, the Siel interface has to plug into the user port, probably to gain extra power for itself.

There are three MIDI OUT sockets, which is useful to say the least. There is also the usual MIDI IN and THRU sockets and the ubiquitous IN CONTROL bus. There is a decent length of cable at the end, so it can be situated a little way away from the computer, if you need it to be elsewhere other than hugging the side of the BBC's case.

Plugging the unit in, is a simple case of sticking the two cables, which cannot be mixed up, into the plugs on the underside, one into the 1MHz bus and the other into the user port, once they are fitted, the BBC should be switched on. The green spy light should be on.

USING THE SOFTWARE

The composing software is on disc, and is loaded by 'BOOTing the disk, (cassette based systems will be supported by the time you read

this as the finishing touches to the cassette tape be made). A short loading sequence and you are put into the primary menu, which gives you three options: Composer, MIDI Control and Disk Operation. Pressing C, M or D will enter each corresponding second menu.

Pressing 'M' will enter the MIDI control mode, this sets up the interface to transmit in one of the three MIDI '85 modes, OMNI, POLY or MONO.

OMNI mode is the very basic MIDI mode. When the synth receives this information it is instructed to play all of the notes sent by the computer, channel allocation (like calling one synth channel 1 and a drum unit 2,3 and 4 for instance) is ignored.

POLY mode is the more advanced form of transmit protocol which can send data down specific channels so a drum part can be sent down channels 2,3 and 4 to play a drum section. There is no conceivable reason why all 8 channels cannot be used on synths, or drum units!

MONO mode allows you to use each channel of a synthesiser to control different sounds. Synths that can use this facility are, for example the Yamaha DX-7 and the SCI Six Trax and T8. Very useful if you wish to make the composing software handle the bulk of the recording.

The "Disk Operations" menu performs the functions you will need to LOAD, SAVE, RENAME, DELETE and CLEAR files. Pressing LOAD, for instance clears the screen, and flashes the prompt: **Give Name of composition**. As it happens there is a demonstration file on the master disk, which is a section from Bach's Brandenburg Concerto, number 3.

COMPOSING WITH SIEL

The manual I received was only a provisional one but all of the necessary information is safely contained within the 10 pages of A4. The most vital section of the software (and thank God the

DISC CONTROL

STATUS

READY:

1 SLAP BS
2 STRADIV
3 SHEEP

DRIVE: 0

DRIVE
NUMBER

CREATE

RENAME

DELETE

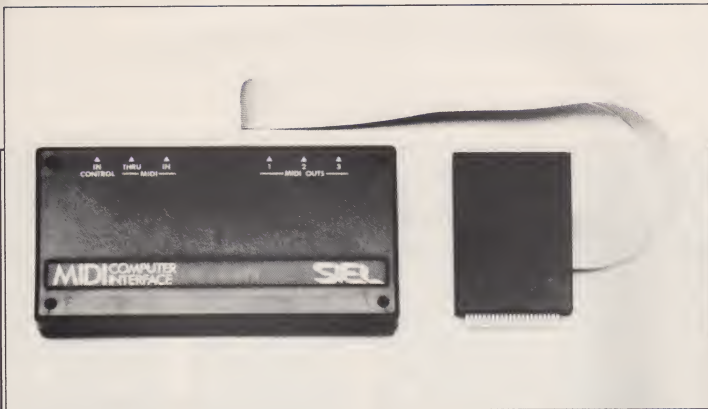
DSAVE

DLOAD

MIDI

C Powertran 1984

CONTINUED OVER



manual didn't skimp on this part) is the composing language. There's a comprehensive section which leads the user by the hand into the complex programming language.

There is no similarity between the SIEL music composition language and AMPLE, the only other MCL on the BBC micro, and for those who have been brought up on the "sticks and blobs" of conventional music notation, I am afraid that you will find the process rather tedious. The SIEL MCL is, I would gather, designed for the Computer Musician, who is, generally speaking, happier with numbers to build up structures in music, somewhat like the structures built up through repetition and transposition, similar in the way Bach wrote some of his pieces, especially his preludes for solo Piano.

When you enter the menu, you will be greeted with the "Indication of State" (why does that sound like a funeral?) which is simply the computer informing you the state of MIDI channels 1 to 6. Figure 1 shows the column arrangement, the channel allocation, and the values of all of the stops and pauses. If you are composing music, your aim is to get the values in the last column to add up, if not, and you are not trying to do strange things with rhythm like Phillip Glass often does, then you

have made an error. With care, the numbers should always add up.

The MCL has a surprisingly simple vocabulary but within the framework of the Siel composing software it is easy to build up quite a lot of music from surprisingly little code. All of the commands are single letters, for instance "C" is for COPY and "P" is for PLAY.

The syntax is very rigid and, in early days, your keying in music will be fraught with mistakes. Just don't keep making the same mistake that I do, and that is press the RETURN key at the end of a line, this is fatal as it erases the music you have typed in, unless you have terminated the music with a "@" character at the end. Figure 2 is a typical example of how music is listed and put in the computer.

Should you be lucky enough to have a velocity sensitive synthesiser (the faster/harder you hit the keys, the louder the synthesiser plays back), then you will no doubt want to program this feature in. Using the Velocity sensitive option takes up no more space in composer memory than normal.

In the version of the software I used, the cursor keys are not properly implemented, so editing an erroneous line is impossible. Only re-typing the sequence gets the music into the computer. This is an area for improvement in future releases. The commands are listed in full in figure 3 with a brief description as to what they do.

INSERT is a useful facility if you wish to write velocity sensitive

information. At a later date, should you wish to use velocity sensitive encoded data on an ordinary synth, then the code is ignored, (one of the beauties of MIDI is its ability to ignore things it doesn't understand). Using INSERT will re-number the other step numbers, in your current channel.

TRANSFER is useful if you wish to have another channel playing a certain instrument. For instance, if you had programmed a Bass section, and you wished to link the Kick drum of your MIDI equipped Drum unit (or computer!) with the Bass line of your score, then, it is a simple case of transferring the music laid down in the Bass section, to the channel allocated to the Kick Drum. Should you wish to transfer actual music scores but didn't want a different timbre, then it is a simple case of transposing the music up, say a third so the music will still fit and you can hear the effect of what you have done.

COPY is, again a very useful feature, allowing you to copy whole chunks of music. It is easy to write whole songs with the minimum of effort this way. You could write a "Song", using an introductory section, and a verse followed by a chorus, with a slightly changing Bass pattern every time.

NEW is used only when you want to start on a new composition, or you want to try afresh on a new channel, (N)4 will clear channel four, but (N) will clear the whole lot, very drastic, so SAVE the music file first.

AT WORK AND PLAY

It is wise to consider what kind of person is going to use this sort of hardware/software package. Certainly the computer musician will be happy with the facilities, especially for the price. The software boasts a true composition language dedicated to serving MIDI and works very well. I would imagine the greatest difficulties would arise for those who are used to actually playing an instrument to input their scores into the computer.

The Siel philosophy and approach to their software is novel to say the least. Their aim is, I think, to have all the peripheral instruments controlled from the computer. The software for the Commodore 64 to drive the Siel Expander 80 is clever, having an imaginary synthesiser front panel on the screen, to control an otherwise entirely digital synthesiser, with the addition of a MIDI keyboard a fully polyphonic synthesiser is built up at a fraction of the normal cost!

Siel's entry into computer music on the BBC Micro is most welcome. The Composing Software package and Midi Interface are an excellent start. I look forward to seeing what more Siel have in store.

Oxford Pascal

D.B. Stiles

BBC Pascal from the compiler factory of Oxford Computer Systems.

PASCAL has been extensively advertised recently as the panacea for programmers who are tired of BASIC. As a professional user of PASCAL on IBM machines I can vouch for the fact that it is more convenient in many ways, and fewer errors are encountered at run time than with BASIC. I chose the Oxford Computer Systems version of PASCAL for the BBC computer with a view to creating a much needed data-base for photographic slides.

The reasons for the choice of PASCAL over BASIC were two-fold: the compiled code would (in theory) run faster on string searches, and PASCAL is more convenient and efficient in handling data-base records due to the inherent record structure of PASCAL. Whilst the former may or may not be true, the latter fell far short of expectations in this instance.

POSTAGE AND PACKING

Oxford PASCAL arrived in a plastic 'book', containing the manual, a ROM and a floppy disk. A cassette version is also available, but this is a rather more limited version which requires the ROM to always be present and permits only small programs to be compiled.

The disk version, on the other hand, has a disk-based compiler which allows large programs to be compiled directly onto disk. It also has a linker which allows very large programs to be compiled in separate smaller modules. These are generally tested separately as far as possible, and then linked into one complete working whole. It is also possible to include procedures and functions from previous programs by keeping them separately on disk as library files, then INCLUDING them in the compilation.

A 'locate' facility is provided for either converting compiled code into stand-alone programs or for placing them at any memory location you may choose. Note the either/or! It is apparently not possible

to relocate a program to run without the Oxford PASCAL ROM; thus a program could not be run, for example, on a cassette machine if it had been compiled on a disk-based machine, unless the ROM was in residence.

DOCUMENTATION

The Oxford manual is adequate if one is familiar with the language; however, it is not suitable as a beginners guide to the PASCAL language. More and better examples would be beneficial, even to the experienced PASCAL user. I would suggest something like Programming In Pascal by Peter Grogono as a tutorial for the tyro and a reference book for the experienced programmer.

The Oxford manual contains several errors, although most can be puzzled out with a bit of thought. The practice of using the underline character to separate words in a procedure name is supported, says the book. No it's not, says the compiler. The example showing a packed array of 15 characters being assigned. However nine characters will not even compile. The provision for simulating BASIC's OSCLI command line interpreter is also shown incorrectly, since it requires a writeln and the string in quotes.

Unlike my normal practice of 'try it first, then read the book', I actually read most of the manual before even plugging the ROM in. The first alarming thing I read in the manual was 'BASIC 2', since I only have BASIC 1. And the manual meant it too! I don't know why PASCAL should require BASIC at all, but the resident editor refused to work, and the sample programs, with one exception, refused to compile. The compiler seemed to fail them on real numbers at compile time, but the program then crashed at run time if the reals were replaced by integers.

The resident editor as supplied I can do without in any case, since it is a line editor similar to the BASIC

one; although with the addition of find and replace facilities. As far as I am concerned one of the big attractions of PASCAL is that I can use a text editor with its facility for scrolling up and down through the program, and get away from the restrictions of a line editor. Even a word processor such as WORDWISE is preferable, and this is what I am currently using on PASCAL. Of course, life is never smooth, and the Oxford PASCAL ROM does not live well with WORDWISE. In particular WORDWISE will no longer include a print file from disk in its presence.

FILING FAILING

On the whole these faults are mainly in the category of teething bugs, and seem to indicate too early a release of the product. If these were its only failings I could use it for several programs I have in mind. Indeed, I have written four smallish ones with it already. Its major faults are in not supplying adequate string handling, and providing only the basic file handling necessities.

There is no provision at all for random access files, and this means that my data-base ideas are just not on, as this type of application uses almost nothing else. A good random access filing system coupled with the record structure inherent in PASCAL makes it a language ideally suited to database management.

The Oxford implementation of PASCAL contains access points to the computer's operating system at several points, giving control over move, draw, sound etc. It does not, however, provide a direct equivalent of INKEY and the only way to check on the shift and control keys is by braving the wrath of Acorn and 'peeking' a memory location. There is no apparent way of defining constants for ASCII characters; allowing CONST chr(130) to define a function key constant would be very useful. Nor is it possible to do a SET on the full range of 0 to 255 for key checking, which in turn is necessary because CASE is lacking the ELSE function. Although non-standard, the ELSE or OTHERWISE option for CASE is almost universal in mod-

ern PASCAL implementations.

Now I know that string handling, OTHERWISE/ELSE and random access are not defined in the PASCAL standards, but any language which ignores them is doomed at birth for serious programming. Couple this with the fact that the I/O error trapping does not work on disk files and that ends its usefulness for general user-friendly applications. So much for the clause in the manual permitting the user of Oxford PASCAL to sell programs written in it.

After using Oxford PASCAL for a week I had compiled a short list of faults and comments. Not being able, for some reason, to raise them on the phone I wrote to Oxford enclosing my list. Apart from one abortive phone call from them which failed to reach me, I heard nothing from them for six weeks. When they did write, it was a brief note enclosed with a new (free) copy of version 2.1 disk and ROM, with a note to the effect that as far as they knew all the bugs had been removed, and that a new manual was in preparation.

My copy now seems to work with BASIC 1 quite happily, as evidenced by the fact that I can use the editor (admittedly useful for five-liners), and the sample programs now compile and run; but none of the other complaints seem to have been dealt with.

OXFORD SUMMARY

The Oxford implementation of PASCAL is a very good try on a machine with limited memory, although with disk machines this is not quite such a limitation as with cassette ones.


As a strict version of standard PASCAL the Oxford implementation is very reasonable, except for a few bugs (some of which may still be caused by BASIC 1). Thus it is a good introduction to higher level languages for students, providing they have a good teaching manual to aid them. As a serious working language, however, standard PASCAL itself is of little use. It is only when extensions such as disk and string handling are added to the language that it becomes the powerful tool with which real programs are written.

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All submitted material must be in machine readable form. This applies both to programs (in any language) and to documentation, which should be prepared with a BBC or Electron wordprocessor. 5 1/4 inch disc (40/80) or cassette

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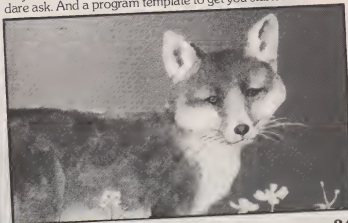
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Doubling Up

Tony Self

Simplified volume handling from UDM plus part 1 of the official upgrade from Acorn

UDM UPDATE

In the October issue of A&B, Clive Grace commented in Feedback that the UDM DDFS was one of the best around, but couldn't they do something to clear up some of the gremlins which existed in the version 2.00. Well Clive must be psychic, as UDM have recently released a version 3.1 which should put matters right.

UDM have made some very nice improvements to this version, which certainly makes their system one of the easiest to use for a novice.

All the major changes centre around the expanded volume facility in double density mode — unfortunately, they have done nothing to improve on the maximum number of files available in single density, which still remains at the standard 31.

Version 2.00 gave you the facility to "EXPAND" the disc catalogue in double density mode, increasing the maximum number of files to 120, by adding three extra volumes. Each volume was capable of holding 30 files. These could be selected by "VOLUME drive/vol" (where vol was a letter in the range A—D). Version 3.1 uses the same system, but makes the volumes easier to access. In fact the user need not know how the volumes are organised at all.

The "EXPAND" command has been removed and replaced by an

option available after formatting. The formatting command itself has been improved upon, as it now displays the track being formatted during the operation. I think it is always reassuring to know a program is actually doing something. After the formatting has been completed you are asked whether you require expanded catalogues and then whether you wish to format another disc — again a useful addition.

TRANSPARENT VOLUMES

The best improvements, however, are to the way the system manages the volumes for you. In version 2.00, if you knew a file was on a disc, but were unsure about which volume, you could invoke the "FIND" command to search all the volumes for you. On finding the file, that volume would be selected in preparation for a load command. Well version 3.1 does not have this command, instead you just load the file. If the file can not be found on the current volume it automatically selects the next volume and tries again. It does this for all four volumes, before issuing a file not found error. Similarly, when saving files, if the current catalogue is full, it will select the next volume and so on until it finds free space or issues a catalogue full error. In both situations the volume actually loaded from or

saved to becomes the current volume. Of course you still have the option of manually selecting the volume with "VOLUME, which now accepts lower case as well as upper, but I suspect that this command will become more or less redundant to most users.

Finally a new command has been added — "CATALL, which, as you might imagine, will list all the catalogues on an expanded disc. This command works in a very neat way. It starts by cataloguing the current volume. Pressing the space bar will then display the next volume's catalogue and so on. However, pressing any other key will exit the routine and leave you in the last volume displayed.

The key pressed is also put into the keyboard buffer, so it can form part of the next command you are going to enter (i.e. "C" if you are going to CHAIN a program).

UDM have obviously gone to some trouble to listen to their customers and the comments made in the press, and have come up with a very worthwhile upgraded DDFS Rom. The package now also includes a disc sector editor which operates in either density, an essential tool for the serious disc user.

I would certainly recommend that all existing UDM users upgrade their system and that readers contemplating purchasing disc systems should seriously consider this option.

ENTER ACORN

A little late in the day, but nevertheless welcome, Acorn have brought out their official 1770 upgrade. Although this kit does not provide for double density operation in itself, it is the first step to take if you wish to avail yourself of the Acorn ADFS. Basically the kit replaces

the old 8271 and with a disc controller board holding a WD1770 as used in the BBC B+ and many of the independent double density boards around, such as Opus and Solidisk. The kit is very similar as well, comprising the board of two TTL chips, a couple of links (if you are lucky) and a 16K EPROM.

If you read my review in the May issue, you might remember my comments about Solidisk's ingenuity in using shorted polyester capacitors as links. Well Acorn have to take the biscuit. I quote from their covering letter which came with the kit which only included one wire link — "these are in short supply, please make another up using a staple of other suitable material".

Fitting the kit is very straightforward, helped immensely by the excellent fitting instruction booklet. The DFS EPROM supplied was the version 2.20, which is an update on the EPROM originally supplied with the B+. The documentation supplied with the kit is excellent. The 93 page DFS user guide is the one which has been issued for sometime now, but addendum sheets are included covering the new commands available on the 1770 system.

There is little point in me covering the facilities of this DFS as they have already been covered in articles on the B+. Suffice it to say that buying this upgrade on its own would be pointless if you already have an Acorn DFS, as you will undoubtedly find that some of your existing protected software will not run on the 1770 system. However for new users and those who wish to take advantage of Acorn's ADFS this is probably the right way to go. Also new software becoming available on disc should be written taking into account Acorn's new standard.

I hope that in the next issue I will be able to report on the ADFS itself. Although I have already received a copy of the ROM I am still awaiting a copy of the utilities disc and the user guide.

As a final note I have included in Table 1 benchmarks covering these products, plus the figures for the Kenda DMFS, kindly supplied by Allen Hardy, and some mystery figures. Make sure you get next month's issue to see how these figures are obtained.

Table 1 Benchmarks

Benchmark	TABLE 1 — Benchmark timings					
	Acorn single	UDM DDFS single	3.10 double	KENDA single	DMFS double	????
1	5.59	4.42	4.13	7.17	6.01	0.19
2	5.39	3.79	3.92	5.56	4.34	0.17
3	1.87	0.88	0.81	60.58	60.59	0.49
4	6.95	5.77	5.47	10.96	8.89	4.59
5	6.63	5.47	5.34	5.78	5.52	2.34
6	10.57	9.43	8.76	14.82	12.02	6.15
7	9.97	8.65	8.36	8.93	8.54	2.85
8	3.58	2.79	2.47	5.41	4.71	1.59
9	3.23	2.26	2.33	2.60	2.68	1.05

View From The Top

Mike Kent

Micros in our primary schools. Are we making the most of them?

Four years ago, throughout England and Wales, a survey of computing in primary schools was carried out. Thirty two schools owned a computer. By January this year the figure had risen to 26,000 machines, a quite staggering increase by any standards.

This doesn't mean to say, of course, that all the computers are actually being used. How many, I wonder, have ended up in stock cupboards after a few teachers have given the proliferation of connecting wires a cursory glance and decided that computing wasn't for them...and thus, the children they teach? Some, I suspect, may still be lying dormant in their cardboard boxes...

Like many thousands of other schools in the early eighties who had decided to take advantage of the Department of Education scheme for purchasing a computer, we approached the idea with a mixture of excitement and apprehension. As a staff, our combined experience and knowledge of computing was minimal, and reaction to the idea of even buying a computer was decidedly mixed, with several teachers suggesting that the money could more profitably be spent in other ways. However, after much discussion, it was decided that our children should indeed become computerate, and that we should learn alongside them.

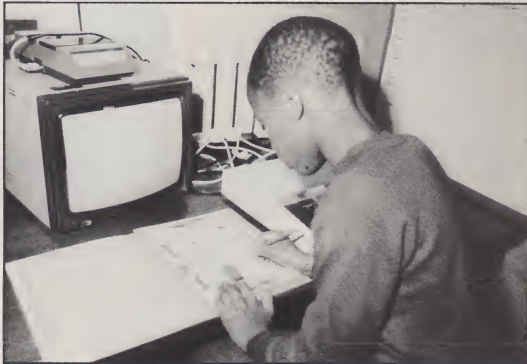
The first problem came in deciding which machine to buy. The choice under the DoE scheme narrowed it down to three; the Spectrum, the RML 480z, or the BBC. Since the BBC had received outstanding reviews and had been selected by nearly all the authorities as the ideal machine for Primary use, we tended to favour it. However, on learning that ILEA had put its weight behind the 480z, it seemed sensible to take the advice offered, and opt for this machine instead.

The afternoon our Link arrived was an exciting one, as we unpacked the boxes watched by children who no doubt wondered if their teachers were capable of handling this new technology. No technofear for them, of course. Most of them were already cracking up enormous scores with arcade games on their home Spectrums.

were astonished to find that it all worked!

Although computers were supposed to be reliant on human input, ours quickly proved it had a mind of its own. It soon refused to load programs reliably (usually just at the last byte!), and loading a program of any length seemed to take forever. It also produced strange messages on the monitor, and in general gave the staff the impression of being as user friendly as a stick of dynamite! The starter pack of software supplied with the machine was another cause for concern. One of the programs was excellent, two were interesting, and the remainder were unbelievably

to the classroom, set it up, choose a program from the narrow range of passable material and then load it, assuming, of course, that the equipment wasn't having one of its temperamental days. And what of the classrooms not on the same floor as the computer? How would we get the trolley up or down the stairs? How many children would miss out on computing in the course of a week because we only had one machine to share between them all? (I know you want a go on the computer, Simon, but we only have one for all two hundred of you. Never mind, you'll definitely have three minutes on April 3rd 2010...



Since the hefty instruction manual made as much sense as a quick lesson in brain surgery to us raw beginners, it was some time before we were in a position to actually connect up, let alone compute, and by five o'clock the less faithful had shrewdly departed for home. Undaunted, we put a program into the cassette recorder (discs weren't available to us then), gave the leads a final check...and

banal...mere fourth rate text book material given the gloss of modern technology.

DOUBTS

Even those of us who were keen to promote computers began to have serious doubts. In order to use the computer, a teacher would have to wheel the trolleyful of equipment

For half a term we struggled with our one computer, though it tended to be based in the library and was used mostly by small groups of Juniors. Certainly, some worthwhile work was done, mainly by fourth years with LOGO. Though interest amongst the staff was sustained it was obvious that most children hardly saw the

CONTINUED OVER

machine at all, mainly due to its weight and immobility.

We could have left it at that, but the interest aroused had given us a determination to succeed, and after more discussion we decided to adopt a different strategy altogether, though it meant virtually starting all over again. Since the most successful home computer was the Spectrum, why shouldn't we capitalise on that, and use the computer most children would be using at home? The Spectrum was small, inexpensive, very light to move about, and had an excellent specification. It had been criticised, in terms of use by children, for its multi-function keys which might prove confusing, and the small rubber keys which could be awkward to use. But then, we reasoned, we often under-estimate children's ability anyway, and it was likely that our children could actually handle multi-function keys better than many adults. The small keyboard problem was rapidly discounted. Children tend to have small fingers!

Since the cost of a Spectrum was relatively small, we then had an exciting idea. Why not equip every classroom with a Spectrum, from Reception upwards? Ambitious, certainly, but if we could trade back our expensive LINK 480Z.....

We approached the Computing Inspectorate rather bashfully to put forward our idea, but it was rejected with a firmness that surprised us. The Spectrum, we were told, was an unreliable machine. It would break down frequently or overheat, it wouldn't stand up to a heavy workload, and it wasn't suitable for 'serious computing'. Since reports from friends and colleagues who owned Spectrums differed from this view (including our Chair of Governors, himself a keen Spectrum enthusiast) I became convinced that we were on the right track. My philosophy was essentially a simple one: by giving a computer to each class, the children would not only have much hands-on experience, but also see the computer as an extremely useful and versatile tool in their learning.

We began to see the acquisition

of our computers as a goal to be aimed at over the period of one year. Each class would need a TV/monitor, a cassette recorder or microdrive for loading, somewhere safe to lock the equipment away at night, and a method of keeping it plugged together on a semi-permanent basis. No teacher would delight in spending an hour before school sorting out a mass of tangled wires before plugging in! We would also need a good basic software library organised on a class-loan basis.

The theory seemed fine, and now we had to fund the project. Every penny was important. Tins rattled conspicuously at concerts, raffles were abundant, and our parents were marvellous, helping us to raise over six hundred pounds on a sponsored walk alone. The total crept upwards, and together with a generous cheque from a friend of the school, we were in a position to equip all our classrooms after just seven months. I disappeared into our craft room for a day with several children, and together we constructed eight wooden trays to hold the sets of equipment. The trays were divided into small compartments to hold each item firmly in place, and channels were built to contain the wiring. A 4-way 13 amp block was then screwed to each tray.

As the kits arrived, each tray was fitted with a Spectrum, transformer, thermal printer (given free by the distributor), cassette recorder, and demonstration tape, together with the necessary linking leads.

The beauty of this system was that the tray and its contents were very light to carry, even for a child. The equipment, apart from the TV, stayed permanently connected together, and the time taken by the teacher to 'set up' was absolutely minimal. She had only two things to do; connect the mains lead from the 4-way socket to the wall, and plug the Spectrum's aerial lead into the classroom TV, which, of course, could also be used for watching educational broadcasts.

Security for all this equipment might have presented a major headache, but the help and advice given by the security officer soon ensured that each floor of the school had a large safe. A teacher



now had only a few yards to walk in order to store her tray and TV at hometime. This, and the ease of setting up, has made certain the equipment is used regularly.

The software library began to expand quickly. Much of the early commercial material for the Spectrum was as dismal as our initial starter pack, but our experience and knowledge were growing, and so was our ability to select a suitable range of programs across the curriculum for both Infants and Juniors. Currently, software has improved significantly in quality, and the best tapes come complete with a workpack of ideas that can occupy children for some weeks. There were, of course, some

teething problems with our equipment, partly due to the very heavy use the computers were receiving from a multitude of tiny fingers! During the first year, three of our Spectrums had to be returned, though they were back within three weeks. We couldn't grumble at that!

So far, then, the children were using commercial software for exploring adventure games, stimulating writing, creating pleasing patterns with a strong maths content via Logo Challenge, learning about a variety of subjects from road safety to ballooning via simulations, and for practising basic skills. There is still much contention about isolating skills acquisi-

tion from the modern 'broad based' primary curriculum, but it seems logical to assume that children can hardly have an autonomous approach unless they have a healthy 'tool kit' of basic skills with which to explore their environment, and the better 'skills' software tapes can make this a very enjoyable experience.

Naturally, care needs to be taken in selecting software. I recently saw a program which gave the child a couple of minutes to do his tens and units before plunging the world into nuclear war.....

NEXT STAGE, FIRST STEP

Since the revised computer project had taken off so well, in a shorter time than expected, we decided to move a step further. A short while before our project had been initiated, I had bought a BBC Micro for home use, and a colleague had bought a Spectrum. We tended to arrive for school

rather fired in the mornings, having spent long nights delving into the fascination of BASIC and making the first hesitant steps towards writing our own educational software. It felt rather like learning a foreign language; tortuous at times but worth it when you got there! From discussing the relative merits of Spectrum versus Beeb, it became obvious that the BBC machine had a lot to offer. It was expensive, and prohibitively so in any quantity, but since the bulk of the quality educational markey was aimed at the BBC, we wished to take advantage of it.

During the course of the next year, we spent part of our school allowance on three BBC's, and after fitting them with Wordwise chips, we were in a position to introduce the children to word processing.

Wordwise is a thoroughly comprehensive word processor, but simplicity itself for children to use as well. After learning a handful of commands, the child can type out his writing, edit it, correct spellings quickly, and experiment with moving sequences of text around. With

poetry writing, for example, the word processor really comes into its own. Anyone who has watched a child's face as his or her piece of writing emerges from a printer for the very first time will understand the importance of word processing and the skills it encourages. It is not, of course, a substitute for calligraphy, but an important and exciting extension of it. Since the BBC has such a user-friendly and robust keyboard, children take to typing quickly and easily on it.

It is important to remember that the staff were experimenting and learning, alongside the children. Though my own fascination with computing had begun to fill many of my leisure hours, a project of this kind has to be nurtured slowly. Many teachers are still wary of anything more technical than a tape recorder, though at our own school help is always at hand, and nobody talks in machine code rhetoric. We feel computing must be seen as an activity for all, rather than a technical elite who are able to jargonise skilfully but say very little.

What, then, of the future, for we mustn't simply be content with putting computers within easy reach of our children. There are, I feel, many exciting avenues to be explored.

At present, a group of Juniors spend a morning with me, learning how to write their own programs. BBC BASIC is a very structured dialect, and pleasantly logical to use, but even so I was surprised at how quickly the children began to absorb it. They have experimented with colour and sound, graph work and number crunching, design and animation, and written lots of little routines just for fun...like finding out how much pocket money they are likely to earn over the next decade! It won't be long before they are able to write useful little learning programs for the Infants to try. Certainly, the logic and reasoning power developed by program writing is powerful and readily apparent, stimulating a whole range of new skills.

We must move steadily into the realm of data basing, with its opportunities for classifying, sorting and comparing. We must bring the children to a further understanding of how influential computers are on their lives, and how useful a tool they can be. We must investigate the growing range of peripherals for the computer, which can be helpful to both teacher and child, and we must look to the time when children will not only build models of towns, traffic lights, bridges and light-houses, but hook a computer up to them and make them work.

We can even extend computer learning into the Nursery, too. At the age of three, my youngest learned most of her alphabet, and how to spell her name, by playing on the computer.

As we have discovered, it is important to make the computer an item of everyday classroom equipment. This, however, is merely the first step.



Mike Kent, Headmaster of Comber Grove Primary School in London, argues that regular hands-on experience is essential for young children, and describes how this was achieved in his own school.

Down to Business

Jon Vogler

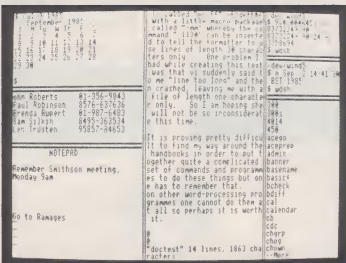
INTRODUCTION

"I shan't get a car; it's far too difficult to learn to drive." Ever heard that from a businessperson? Under the age of sixty I mean? Perhaps from the bicycle wobblers you pass on your way to work. For most people however, the first few nervous lessons behind the driving wheel, the complexities of gears and clutch, handbrake and hill starts and the tedium of the highway code are worth learning because of the increased speed and capacity and power that a car provides. Trouble is, even cars are not all that fast, especially in traffic jams and by the end of a long trip you are fit for nothing.

You can go by train, relax, stop thinking too hard. There is just as much speed, capacity and power but something else is lost: flexibility. The rails are fixed and someone else plans the timetable without considering your particular needs. All too often, this means you cannot get to exactly where you wish at the time you want, even if you get up at four o'clock in the morning. What is the answer then? Some tycoons are so impressed at the improvements which technology can make to their personal convenience and efficiency that they buy and learn to pilot a personal airplane or helicopter. These people arrive for meetings ontime, fresh, confident. We are no longer surprised that business people should invest thousands of pounds and hundreds of man hours learning time to achieve one ultimate goal: high personal productivity. Why then do these same sultans of business say "I shan't get a UNIX system; it's far too difficult to learn"?

Of course many business folk are still at the bicycle stage: their offices use typewriters, filing cabinets, even slide rules or adding machines and those telephones that wear a groove round your index finger. Many who decide they needed the power and flexibility of the micro computer (the office equivalent to the motor car), use CP/M 80 or MS-DOS operating systems and a generation of business programs such as *Wordstar*, *Visicalc*, *Dbase II* and *Perfect*

UNIX is the most powerful operating system ever to run on a micro. Torch offer it on the ultimate BBC add-on — but not for the faint-hearted.



1. The Unicorn's window facility: seven live tasks all running concurrently and many can run in the background.

Software I.

They are powerful and flexible but have one problem, you must learn to drive them just as you had to learn to drive a car. Those who persevere find it rewarding, but many funk the effort. They want more speed and power but are unwilling to do the learning and this has provoked the birth of very user friendly operating systems such as *Gem* or *Lis* which soak up spare memory to create pictures and a clickety mouse to drag them around the screen. Like the train, this approach has one huge disadvantage: although you still get the power and speed and can run everyone's favourite, business program (you know, the ones with trendy names like *Symphony*, *Framework* or *Jazz*), what is missing is flexibility. If what you want to do is that little bit different; if your business doesn't quite fit the pattern or if you are more adventurous and want to go where others have laid no rails, you find yourself

at a dead end.

The other alternative is UNIX, which is the equivalent of the personal helicopter. UNIX is not a program, or a computer; it is an "operating system", just like CP/M or *Gem* or the BBC's own. The difference is that UNIX is the most powerful one ever to run on a micro. Not only will it do anything that you wish and go anywhere that you like but taking your employees or business partners along for the ride costs little extra. There is almost total flexibility and huge amounts of power and capacity but both the helicopter's disadvantages: it is expensive and learning to use it needs confidence and a lot of time.

To see whether it was worth the money, and whether its difficulties and complexity had been exaggerated, I wanted to try it myself. Impossible for the owner of a modest 32K Beeb? Not at all, because Torch offer the ultimate in BBC add-ons: the Unicorn which hangs

a Motorola 68000 32-bit chip (don't worry about the numbers that just means "very powerful indeed!") and a megabyte of memory (that just means 30 times as much as the normal Beeb!) and a 20 mega byte hard disc unit (40 times as much as an average floppy disc drive). The advertisements were most persuasive: a system that would run half a dozen different operations at the same time; would display them in separate windows on the screen; could be networked to ten other people who need each have no more than a BBC B with an *Econet* fitted and a monitor. All this at around the price of a (20 megabyte) hard disc *ACT Apricot XI* with half as much random memory and no real multitasking capability.

My especial interest was that UNIX seemed to solve so many of my current problems. How to look up someone's telephone number on my database when in the middle of word processing this article? How to extract information from the database and put it directly into a report without tedious and elaborate programming beforehand? How to look up my floppy disc catalogue or my bibliography or the calendar for 1988 while compiling a budget spreadsheet? How to insert a couple of tables of data into the text of a technical report? Fantastic if these can be achieved without what that notorious "unfriendly" UNIX is huge. The Torch version comes with 1000 different files and programs (not bad value, around £4 inclusive of hardware) and the hand books are about the size of the London telephone directory. So readers will forgive me if my article is split. This month I shall describe the standard UNIX system and next month discuss its use in business and running some applications packages on it.

SOME ENCOURAGEMENT

In case it proves difficult to describe this highly technical system, let us start with some management. Fig 1 shows what

tasking windows can really offer a business person. The central window contains the text of an article for A&B.

To the left, starting from the top, this month's calendar, so I do not miss your editor's merciless deadline. As well as this year it seems to cope very amply with the year 2010. Then a window on the database giving one or two phone numbers (I needed them in a hurry for someone who just telephoned). At the bottom, my "jotting pad" notes made during the phone call, for later reference.

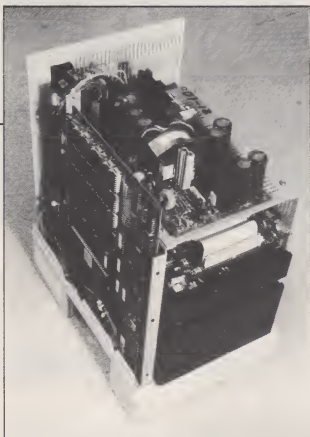
On the right of the screen: at the top the calculator, on which I could work out my income tax or how long it will take the probe to reach Haley's Comet. The calculator program seems quite comfortable working to twenty six decimal places!

Below is today's date and time and, at the bottom a list of disc files, so I can check the name of a file I wish to insert in the article. These are not just dead information on the screen: each is a live program or process currently running.

As well as the seven windows I could have other tasks grinding away in the background; for example calculating a complicated formula that needs to reiterate many times or formatting a document for printing or counting the number of words in an article. You don't have to stop and wait until these processes have finished. Your printer can be printing away in the background and another program could be transmitting data over the telephone or interrogating a data base in California. Think how long it would take, on a normal BBC, to gather all this information and perform all these tasks. That's the high personal productivity that UNIX offers.

SOME FEATURES OF UNIX

I shall not try and describe how UNIX works. That needs a whole book and some people get quite nutty about it. UNIX is full of expressions like the "shell" and the "kernel" which we don't need to go into. Rather let's describe the hard-



2. Inside the cabinet of the Torch Unicorn.

ware you get if you buy Torch UNIX. You need the 20 megabyte fixed disc (reviewed in A&B Computing July 1985); UNIX will gobble between half and two thirds of it. That still leaves plenty of capacity for your CPN files and programs (CPN is the CP/M look-alike operating system under which the Torch Z80 runs Wordstar, dBase II, Perfect Writer or whatever); you don't lose access to these because you have UNIX.

Contained inside the hard disc cabinet is the Atlas printed circuit board which contains both the 68000 chip and also the Z80 chip (Fig 2). Also within the same box is the huge random access memory: you have the options of half a megabyte (sufficient for a single user) or a full megabyte (Fig 3), necessary to run an efficient multi-user system. One of the reasons why UNIX can run so many processes simultaneously is that all this vast brain is used for the actual processes that are running. UNIX loads them from the disc and dumps them again when they are finished so you don't have memory cluttered up with processes which are not actually running. Finally you need a UNIX ROM to be fitted in your BEEB and, if you want a multi user system, an ECONET network. The various

costs are shown in the inset box Fig 4.

It is the terminals which are so remarkably economical. They don't even need a second processor: a straight Beeb fitted with Econet and a special ROM is quite sufficient. Once UNIX is running on the host machine, any terminal can link in quickly and easily. Nor incidentally do you lose access to those beloved BBC games programs. Keys B and Break will still get you back to the BBC operating system. However, although you can multitask (run several tasks simultaneously) from the terminal, under the Torch system the terminal will not work with separate windows; this facility is only available on the host machine. However, this might even be a good thing, you don't want your secretary writing out his (or her!) weekend shopping list while typing your monthly production report nor the warehouse clerk making changes in the sales ledger. In fact there are no problems of this kind, because UNIX offers a sophisticated protection system. Each file can have three different sorts of protection, read, write or execute for three different groups of people: the owner, a defined group to which the owner belongs or anybody else (Fig 5).

UNIX AND THE USER

UNIX is most often criticized for being unfriendly. People miss the neat displays and helpful error messages so familiar from the BBC. Partly this is because UNIX, from within the system, does many of the things for which, with just a BBC, you would need to buy a special program. There is nothing that prevents extravagant displays (except prudent economies of disc and memory space, sometimes ignored in the face of such abundance!) However the lack of error messages is definite. UNIX is very terse. If it can't find a file, it doesn't say "FILE NOT FOUND" it just returns to the prompt - rather like those travelling companions abroad who, as you pass some majestic scene or fascinating old building merely draw on their pipes and grunt!

The unfriendly feeling is emphasized because UNIX does every thing in lower case letters and uses extremely concise commands. However this too has merit: it saves one finger constantly hovering over the shift key and reduces the number of key strokes. It is only slightly quicker to run a game by typing in small letters "aliens" than by the familiar BBC: CHAIN "BALIENS" but when such commands are repeated hundreds of times the difference becomes significant. In fact many of the commands are helpfully mnemonic. If you want to count the number of words in a file called "fred", you simply type in *wc fred*. Likewise the massive handbooks actually look less friendly than they are. They are looseleaf, extremely well subdivided, comprising both separate sheets on each command plus explanatory articles (mostly written by the men who invented UNIX at the Bell laboratories in America in the late seventies) and although some are highly technical, there are others designed for the nontechnical and the new user.

Just like using a motor car service handbook, you don't need to understand all the technicalities of the engine to find the bit that tells you how to top up the battery. But

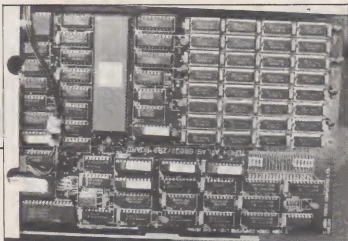
CONTINUED OVER

if you are a motor mechanic, then you want all the engine detail you can get. However many users will find, as I did, it is helpful to buy one of the many "Teach yourself" books. Torch list eight of them and my local bookseller offered a further five!

THE UNIX FILE SYSTEM

Another feature that many people find difficult at first is the concept of "path names". This is also used (but is less essential) by computers (such as the IBM PC) that use MS-DOS. Instead of dividing the hard disc into a number of surfaces (B:, C:, etc. just like floppy discs) UNIX treats the whole huge area as one. That brings the immediate, enormous advantage that you don't have to remember (or care) on which surface your program or file is located. Hundreds of files are all equally accessible. But, as always, there is a penalty to be paid. How do you locate the exact one of a thousand files you need? Imagine you have just arrived in Britain and want to find someone called Jon Vogler. You could go to some central government office and look up all the records of all the people who have ever been born in Britain and you might, with difficulty, track him down. Much easier however if you have been given an address. In fact we address letters the wrong way up: to find Jon Vogler, the post-office starts at the bottom and progresses upwards. The first information, that he lives in West Yorkshire, narrows the search; Leeds, as the town in West Yorkshire, narrows it further and so on. In fact we could write his address more logically as West Yorkshire/Leeds/Roundhay/The Avenue/40/Vogler/Jon. If there was another Jon: Jon Smith, living at 18, The Beeches, Ruislip, he would be clearly distinguished as Middlesex/Ruislip/The Beeches/18/Smith/Jon.

Unix path names work exactly the same way. The place you start from (Britain in our example) is known as *root* — like the root of a tree. Then you follow a path name through various branches to get to



3. The Unicorn's main board: the thirty two memory chips (top left) give a megabyte of RAM; the huge Motorola 68000 chip (lower centre left) has 64 pins to handle 32 bit words.

the file you need. Each of the files can be regarded as a fruit hanging on the tree and various limbs, branches and twigs, from which the fruit hangs, are called "directories". One directory may have several files hanging from it or may have some files and also some sub-directories. A typically UNIX path name is */usr/bin/wc*. The first slash indicates the root. *usr* is like a branch and *bin* a twig (they stand for user and binary and are directories that are present in the UNIX structure when you buy it. *wc* is the wordcount program. You can also create your own directories and files.

Supposing in your business the UNIX system is going to be used by Tom and Betty. You might create a new directory, called *new*, which would contain all the files added

betty/data. That is all there is to a pathname, it is simply a file with a rather complete address which enables the computer or its user to find any program or file without difficulty. And of course Betty could lock her data file in such a way that perhaps either she or Tom could both read it but only she could write to it to make alterations.

Every UNIX system has also one "super user" who can read or alter every file. And of course UNIX offers the normal range of commands to move files from one directory to another, copy them, rename them and alter them in various ways and has a powerful series of "wildcards" that, for example, specifying the pathname */new/betty/* can refer to every file in the directory */new/betty* if you wish to list or protect them all.

you have a file containing a list of names of employees, arranged in order of the date they joined the company and you want to sort it into alphabetical order. The *input* is the list of names, the *process* is to sort but what about the *output*: do you just want it to appear on the screen? Not much you can do with it there. UNIX gives you complete freedom to redirect it as you wish: either to the screen or to a printer or to another file or down the telephone wires to a computer in your head office a hundred miles away.

Have you ever tried to make an alphabetical listing of all your BBC disc files? If so you will know how frustrating it is. You can display a catalogue of one disc on the screen and you can print it but you cannot merge it with the contents of twenty other discs or sort them alphabetically without buying a special program (a program which incidentally I have yet to see produced: anyone got one?) UNIX makes this easy, without any special program. I was able to type in one single line: *find / -print/ user/jon/filelist* This listed all the 1250 files and directories on the system by name and wrote them into a file (called *filelist* in my personal directory */user/jon*. Alternatively I could have routed

FIG 4 - TORCH UNICORN PRICE LIST		
Item	Memory	Price (excl VAT)
Unicorn	1 Mb RAM	3995.00
Unicorn	Half Mb RAM	3495.00
Multi-user licence	Host ROM	850.00
Terminal pack	Terminal ROM	99.00

4. Prices of the Unicorn

since UNIX was received from the supplier. Then in *new* you might create three more directories: one called *common* that anybody could use, one called *tom* and one called *betty* for their sole use. Now suppose both Tom and Betty create a file called *data*, how does the computer know which one to use? Why, because one has the pathname */new/tom/data* and the other has the pathname */new/*

PROCESSING PROGRAMS AND FILES

One reason why UNIX is so flexible is that you can do so many things with programs and files. I have already mentioned running them in the background while you do other tasks on the screen. You can also redirect them. Suppose

them to the printer or put a tee (UNIX is full of plumbing words) in the system so they went both to the printer and to the file at the same time.

However, suppose I did not want to list them but only to count them. UNIX will pipe processes: the output from one process flows into another. The command *wc* pipe is the simple vertical bar *|* and I could have piped the output from the file listing *describe*

This is an attempt to produce unformatted text that will be printed on the screen as two and three column widths. The problem I have been having is that output that has already been formatted loses its page starts and finishes when set to multiple columns.

The solution seems to be to format the text using the UNIX formatter programme which is called "nroff", together with a little macro package called "me" whereby the command "lisp" can be inserted to tell the formatter to use lines of length 38 characters only. One problem I had while creating this text was that it suddenly said to me "line too long" and then crashed, leaving me with a file of length one character only. So I am hoping she will not be so inconsiderate this time.

It is proving pretty difficult to find my way around the handbooks in order to do it together with a complicated set of commands and programmes to do these things but one has to remember that, on other word-processing programmes one cannot do them at all so perhaps it is worth it.

One other problem I have is in remembering to quit the "append" mode of vi before I make a command so I keep on having to delete commands that find their way into my text. It is so easy to type "append mode" it pushes text ahead of you, while the insert mode it inserts whatever text is ahead of you and this also takes some getting used to. Anyway that is enough chat; let us see about columns.

So, by typing continuously across the screen in "vi" I am hoping to produce unformatted text that will not be truncated by the programme with the argument "lisp" which stands for two columns. Let's go and see what happens now.

Bye! bye! See you in two columns.
Doctest: 14 lines, 1053 characters

7. The screen editor "vi" uses the entire screen for text.

memory. List it on the screen and the compiled program appears as a confused jumble of codes, so it is far harder to pirate. The disadvantage is that it is tedious to correct the code because, for every alteration, you have to recompile. It is before testing whether it runs correctly. That, of course, is where the Torch Unicorn's multitasking windows facility really comes into its own: you can write the code in one window, compile it in the next, and run it in a third, as near simultaneously as you, the user, can manage. For any business that cannot find, or cannot afford, tailor-made software, the ability to write in C is an enormous asset: but only for those with the time and ability to exploit it.

TEXT PROCESSING FACILITIES

Because UNIX was originally written to help the engineers at Bell Telephone Labs produce their technical reports, it is particularly strong on text processing facilities. However, these are not like the accustomed wordprocessing packages, such as *Wordstar* or *View*, with all the facilities rolled up behind one single menu.

Instead there are many different components: a variety of editors, two different formatters and several subsidiary programs with special uses. Some of the editors deal with only one line at a time and are virtually obsolescent in these days when we have all

become used to full-screen editors. However UNIX offers an excellent one called *vi*. To format for a line printer there is a program called *nroff* (pronounced "enroff") and there is a program for formatting photo-typesetting called *troff* ("tee-roff"). Any reader who has discovered how difficult it is to get your friendly neighbourhood printer to accept text produced on less powerful word processors should be especially interested in the latter. Both *nroff* and *troff* are difficult programs to use so UNIX provides a set of "macros" which tailor them for the average user. In addition there are "pre-processors" for tables of data and for mathematical formulae. Again, anyone who has experienced the problems of incorporating these simply and fluently in word processing text will heartily rejoice. The table program is elegant: Fig 6 shows the text I typed in to produce the price list table, Fig 4.

vi

vi has everything you could ask for from a screen editor except one: familiarity. It seems to work quite differently from most programs and it is tempting for the new user to reject it because of this. Typing in is done in a quite separate mode from other activities, although only a single keystroke is needed to switch between the modes. For example if you are in *text mode* and enter the simple command to save your text "*w*" without first touching the escape key to go into *command mode*, then you find you have written "*w*" into the middle of your text and, only after some days of practice is it trouble-

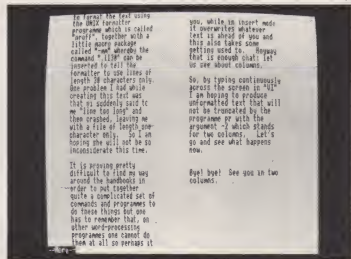
free to remove it again!

However, once these teething troubles are past, it is a delight. First of all there is a complete range of cursor movements: forwards or backwards by the next letter, word, line, sentence, paragraph, half-screen, screen, section (a section is a portion of text begun with a subheading) and the whole file. You can specify whether your move is to the start or end of the word and can include punctuation or skip over "white space": the net result is that one keystroke serves where other word processors need two or even several and this, as readers will now know, is Vogler's acid test of good editors. One can also move to a specified letter or word or line number. (Lines can be numbered automatically without interfering with the editing). In addition, by prefixing the command with a number, you can move by 5 words, 3 lines, 7 screens etc. There is plenty of screen to move around, because, in contrast

change a word rather than simply delete it, prefix the movement command with small "c" and you find yourself typing over the unwanted words or sections, marked at the end with a dollar sign to indicate the extent of the deletion, which is completed when you press escape, even if the text you are adding is much shorter than that you are taking out.

The arrangements for copying and moving text are particularly powerful because, unlike so many programs which offer only one or at best two or three markers, *vi* gives you 26 markers: an "m" followed by any small letter of the alphabet. To home on a marker you can either prefix the letter with a "E" sign; or with a single inverted comma sign "" to return to the start of the line on which it is contained.

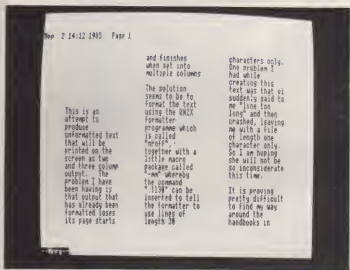
To complement the 26 markers there are 27 buffers: one buffer into which any deletion is saved (without you needing to do any-



8. The text from Fig 7 converted to two columns by "nroff", the formatter.

to many word processors, particularly those designed for the IBM PC) it uses the whole screen depth of 32 lines and the whole width (Fig 7). There is no "wordwrap" but don't worry: *nroff* supplies the necessary justification, filling and hyphenation if required. By prefixing with a "d" any of the movement commands you can delete the text across which the cursor moves. If you want to

thing) and the others which need to be specified by a letter of the alphabet. The joy of the unnamed buffer is that, if you carry out deletions and then regret them, the command small "u" restores you to the condition before you started deleting. Of course if you forget what text is in which buffer you would simply open a small window and list them all to jog your memory. Having deleted or copied text



9. The same text in three columns.

into a buffer, you can replace it wherever the cursor is and there is also a facility to replace it several times: very useful when writing legal or contractual documents, all of which begin "the contractor shall....."

Most word processors have a facility that enables you to centre the work area (eg the cursor) in the centre of the screen; *vi* goes one better (or two actually) and allows you to position it either at the centre or at the top or bottom of the screen. Searching and replacing are also easy, with the facility of doing them in reverse and for continuing the search after the first find with a single key stroke. Searches can be instructed to ignore the case (ie treat "happy", "Happy", "HAPPY" as the same). One very useful facility enables you to match braces, ("{" "}" "[]"). When your cursor is on the opening bracket, typing the command "%}" will move the cursor to the matching bracket, particularly useful when writing programs.

Working with multiple files also has undreamed of power. If you want to insert part of one text into another, you just display line numbers and specify the range of line numbers to include. Likewise you can save part of a text or edit only part. If you are really chopping and changing texts about, you could run them in two or three windows with all the line numbers showing

in order to carry out a rapid mosaic operation.

vi makes it easy to set out text on the screen: a double sideways arrow will move the complete line of text in either direction and there is a setting command to change the "shift width" distance by which it moves and also to auto indent the following lines if required.

However to me the greatest of all joys with *vi* was that, while still remaining in the word processor, one can still do those useful things which are normally denied. You can set the function keys and this enables you to make full use of them for writing repetitive phrases. However, *vi* has an additional feature, of mapping not only the red function keys, but any key on the keyboard, to contain any phrase or command that you may wish. This gives terrific economy with commonly used phrases or commands. Finally while still leaving the text on the screen you can leap out of word processing, perform a calculation, check on a filename, interrogate a data base, or do anything else you like and then leap back into your word-processing text without losing so much as a character.

If *vi* is powerful, *nroff* and *troff*, when combined with their various macros, are even more so. They can be summarised in one phrase: anything you can do with words on paper, the *roffs* can do it. The fac-

ilities I particularly valued are of adjusting the environments for headings. You can set your own combinations of underlining, bold type, number of lines before or after, indentation etc., and the facility to print text in as many columns as you wish (Figs 8 and 9). It is simple to view the text on the screen before printing: there is none of that nightmare of trying to preview text on the screen, one hand firmly fixed on the shift and control keys, and then being unable to go backwards to see what it said on the previous page. Moreover the underlining and italics can also be viewed on the screen (Fig 10).

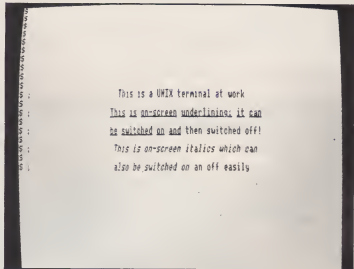
One serious deficiency with the text processing facilities is the lack of an adequate manual index. The main part of the *UNIX* hand book, the part that explains the various *UNIX* commands, has an excellent index but there is none for *vi* and, although the hand book sections are detailed and fairly easy to understand, it is very difficult to find the particular activity you want to perform. There is however a useful detachable prompt card which covers the common commands and manoeuvres.

CONCLUSION

I have only glimpsed the full depth of capabilities of the text processing packages and indeed of the

rest of *UNIX*. I anticipate it will take years to really get their full power at my fingertips; but what exciting years! In next month's article I shall discuss some of the applications programs you can run on *UNIX*. Many have been designed to take the complexity and anxiety out of using this operating system.

It took me four or five days of intermittent use to learn as much about *UNIX* as is revealed in this article, and after the first day, I cannot say I found it too terrifying. As with all computer applications, learning your way around the hand book makes life much easier. If you find computers difficult, and have taken a long time to master the programs you are using at present, *UNIX* is not for you. However if you feel at home with present packages but are frustrated by their lack of power and limited capabilities, then you can buy *UNIX* with no hesitation. Finally if your personal productivity is of vital importance and you are prepared to devote money and the necessary time to mastering it (and remember that there are many books, tutorials and courses, as well as *Torch's* extremely helpful customer support unit to help in this) then you should have no hesitation. Like learning to fly a helicopter, it will mean that your ability to do what you want, quickly, efficiently, where you want and how you want, is revolutionized.



10. Underlining and italics can be shown on the screen.

Cheaper RAM

Mike Harrison

Sideways RAM on the BBC can be implemented in one of two ways: You can fit two RAM chips into a ROM board, if you have one, or you can buy a RAM-only unit. The first is fine if you already have a ROM board, as the chips are only about £5 each (Sept.). This article shows how these same chips can be used without a ROM board, i.e. in place of a RAM only board. The total cost is about £10 for the RAM chips, plus about 50p for the other chip used.

This cheap solution gives the same facilities as most ROM board based RAM, i.e. Auto-write (any write to memory in the ROM area goes to RAM, so data can be 'LOADed into it directly, and machine code (e.g.ROM software) can be assembled directly to the RAM.), and the option to put on a 'Write protect' switch, to protect data stored in the RAM.

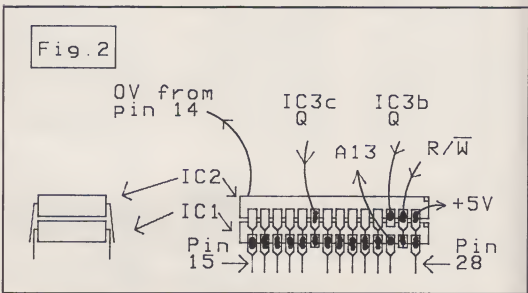
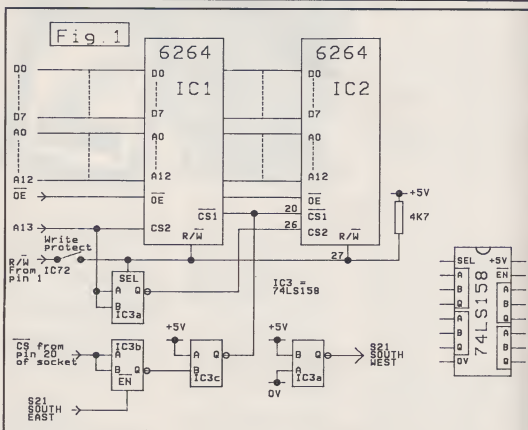
The key to the low cost, and ease of construction is the way that it is built: by 'piggy-backing' the two RAM chips, and plugging the bottom one into one of the BBC's ROM sockets.

GETTING TECHNICAL

Each of the RAM chips can hold 8K bytes of data, so two are needed to fill the 16K ROM area. External circuitry is needed to control which RAM chip is active, and to handle the writing of data to the RAM (and disabling of other ROMs when the RAM is written to). These functions are performed by a 74LS158 chip, which is a quad 2-input inverting multiplexer (don't worry if you don't know what that means, this isn't a tutorial on logic design, so just take it from me that it works!).

The circuit is shown in fig.1. IC3a selects which of the 2 RAM chips is accessed. IC1 is active from &A000 to &BFFF, and IC2 from &8000 to &9FFF. IC3b,c determine when the RAM is active - when the 'Chip Select' line from the socket is low, or the Read/Write line is low AND the 'Area Select' line from S21 is low. IC3d disables the ROMs when a Write occurs. The 'Read/Write' line is taken from pin 1 of IC72, as this is right next to the ROM.

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