Personal Computer World

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ON COURSE FOR ATARI
Exclusive UK test of the new generation of home computers

ATARI 400 & 800

Once again PCW brings you an exclusive Benchtest — this time it's of two exciting computers to be be launched early next year. By offering TV games and audio-visual education capabilities as well as normal computing, Atari says it has created the first machine to be aimed at the true home market. The easy-to-use computers plug into the domestic TV and through it provide a wide range of graphics, colours and sounds; David Tebbutt reports.

Atari claims its 400 and 800 series computers are the first of a new generation of home/personal computers. They are primarily aimed at the home user who will be able to play pre-packaged games, learn all manner of things with audio-visual educational packages, sort out his finances or simply compute. No doubt people running small businesses will be interested in this machine and many of them will find it suitable but at the moment it does have some limitations — all Atari printers use paper rolls as opposed to sprocket fed fanfold paper and few business packages are available. It's quite possible that this will change so don't rule it out completely.

We've all been scratching around for years now wondering if and when the home market will ever exist — I think that Atari will create the market with the home education packages on this machine. One thing is very clear — as the rate of change in our society increases, so we shall have to learn new skills to cope with this change. It is well known that enjoyment goes hand-in-hand with learning — people learn more when they're having fun — so Atari has quite sensibly latched on to this and, bearing in mind the social climate, sees its educational packages being used by children and adults alike. The consumer education market is a big one; the Atari machine is well suited to it and it has the potential to do extremely well.

Both machines are well made and look quite pretty — a glance at this month's cover will tell you far more than any words I write. The 400 differs from the 800 in that it has a flat touch-sensitive keyboard and limited expansion capabilities. It is capable of doing everything that an 800 of the same memory size can do and anyone buying a 400 and then wishing to upgrade to an 800 will be able to run all their existing programs on their new computer.

Both machines plug into the domestic TV (colour or black and white) and are very easy to use. Programs can be loaded from a cassette recorder (Atari), disk or they can be run from a plug-in cartridge. It's interesting to note that the cassette recorder is used for audio as well as digital information which means that the audio channel can be played back through the television speaker under program control — no doubt this feature forms the basis of the audio-visual packages mentioned earlier. The 800 contains a socket for a video cassette recorder — imagine the potential for this machine when video disks come along — it will be possible to access about 12,500 Mbytes of digital information on just one such disk.

Other peripherals available are disk drives, printers, an RS232 interface — necessary for talking to non-Atari devices (other printers perhaps) — games paddles (three types) and a light pen. Given the right marketing, the right price and right level of support Atari could do very well.

Hardware

I was supplied with a 16k model 400, a 48k model 800, a 90k single disk drive, a 40-column impact printer, two joystick controllers, a cassette recorder and a selection of disks and cartridges. The only problems encountered were with the TV display and the cassette recorder. The television display problem was caused by interference from one of the power supplies — a prototype made up for the review. This was quickly cured with the addition of a few smoothing capacitors which will now be incorporated in production models. A more serious problem occurred with the cassette recorder which would only

work properly about five percent of the time. We tried three different recorders, all of which worked before leaving Atari but none of which worked properly on arrival. My own mains power is the main suspect but at the time of writing the cause has not been found. Once it is, then I am quite confident that Atari will modify the equipment design to overcome similar problems in the future. Atari itself has had no problems with the recorders and a software house I know has been using the recorders (eight of them) for nine months now without any problems.

The model 400 measures 13½" x 11½" x 4½" and weights 5¾ lbs. It has a flat keypad with each 'key' having raised edges, which makes for a much better feel than the more common totally flat keyboards. Having spent a week switching backwards and forwards between this and a conventional keyboard with real keys I definitely prefer the latter. In theory the 400 should only be connected to a printer and a cassette recorder but, in view of my cassette problems, I hooked up a disk drive and it worked. The disk operating system gobbled up rather a lot of memory with the result that I was left with just 4238 bytes for program storage. It is possible to reduce the DOS requirement by about 5 kbytes leaving just the bare minimum of routines to keep the disks running. Really, the 400 isn't a disk machine but you could probably get away with it — just.

Finally the 400 has one slot for exchangeable cartridges. I was supplied with a Basic cartridge and three games: Basketball, Star Raiders and Alien Invaders. It was very tempting to spend the week playing Star Raiders rather than preparing this review.
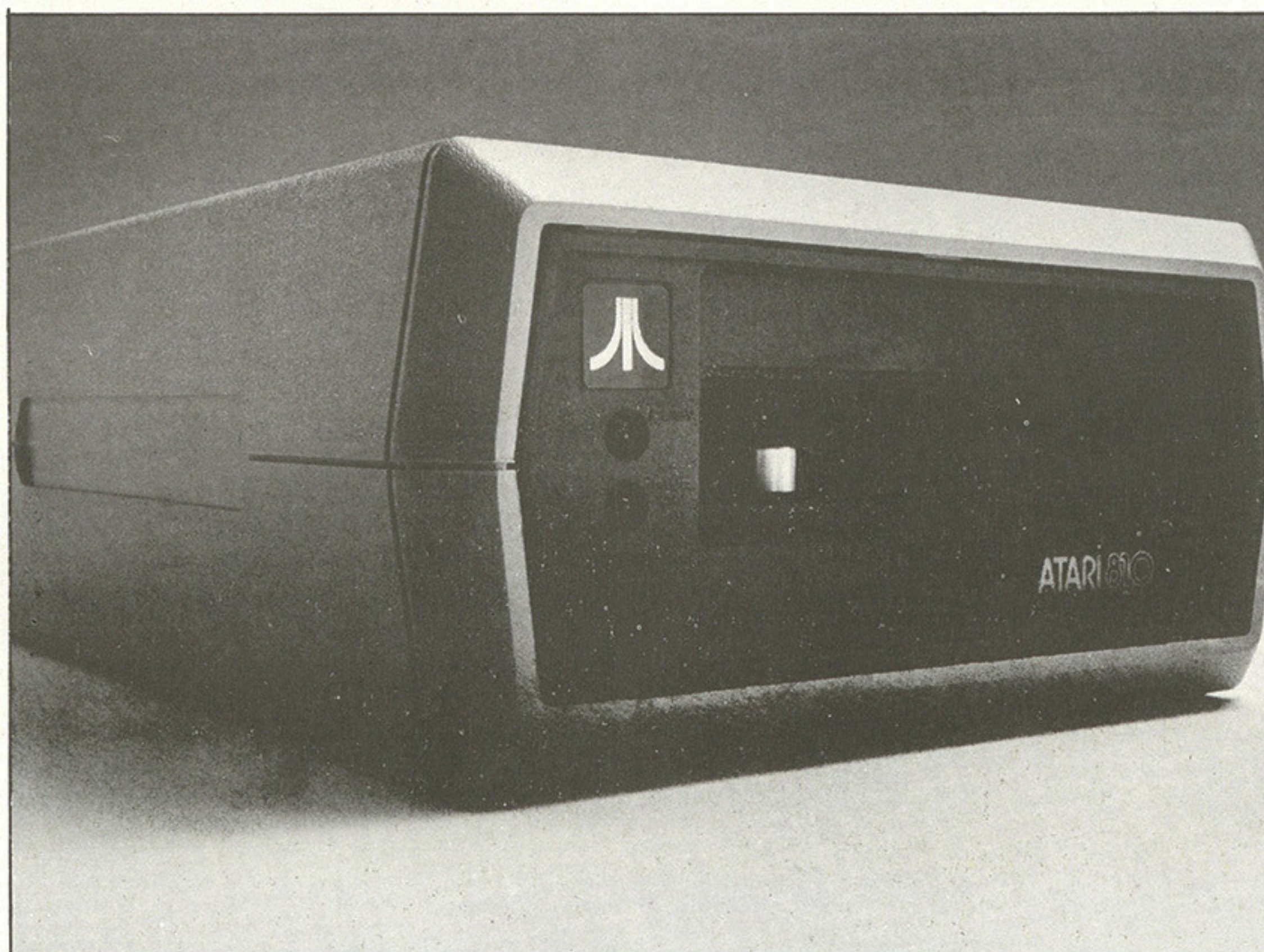
The 800 is clearly a more grown-up machine. It has a normal keyboard which came as a great relief after stubbing my
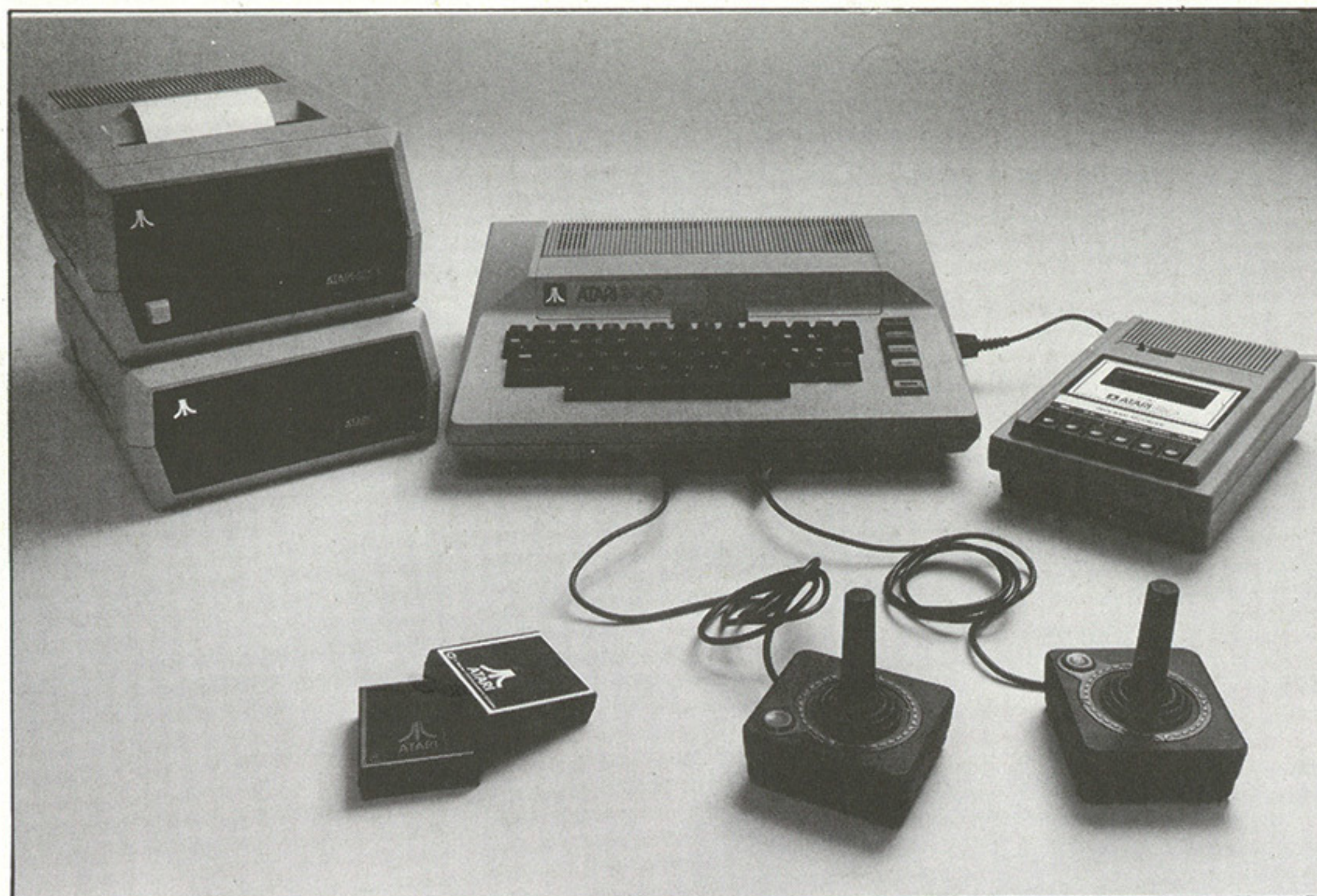
A useful configuration comprising an Atari 800 with disk drive, forty column printer, cassette recorder and a couple of joysticks.
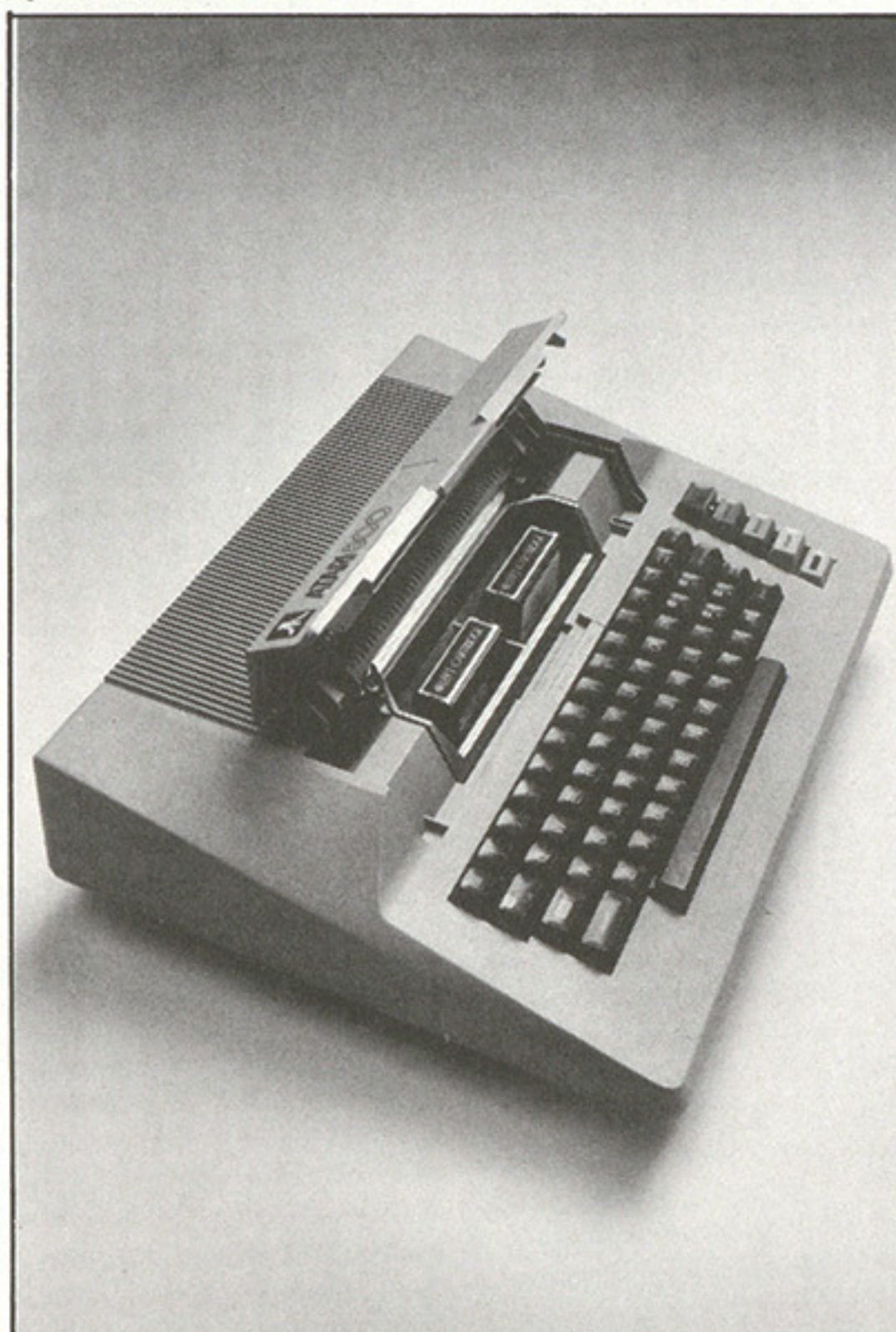
Two views of the 800 showing the locations of the various plug in modules.

A close up of the 90k disk drive.

fingers on the 400 for a few days. The reset button is protected by a plastic surround which stops you pressing it inadvertently. For those buying a 400, don't worry — the reset doesn't clear your program. Two cartridge slots are provided: the left one is the equivalent of the one in the 400 while the other's a bit of a mystery. Somebody did mutter something about bubble memory but I think it was speculation rather than a fact. It seems to me that some cartridge programs will exceed the 8k limit and the second slot will enable them to overflow. The 800 has a DIN socket for connecting a VCR or an external monitor — see my earlier notes about video disks.

The 800 can be expanded using either 8k or 16k expansion memory modules. (Rumour has it that the 8k will be dropped and that a 32k is on its way.) Three slots are available giving a maximum of 48k if you use 16k modules. A fourth slot contains the 10k operating system. The fact that this occupies a plug-in slot must mean that the operating system can be easily upgraded. All these modules may be installed by the home user in about 30 seconds flat.

The cartridge slots occupy memory locations from 32k to 48k so if you have a 48k system you will lose 8k if slot A is in use and 16k if both are being used.

Like the 400 the 800 is compact measuring 16" x 12½" x 4½" and it weighs in at 9¾ lbs.

I have now covered all the main differences and the rest of the review relates to both machines. For convenience I shall call the machine the Atari.

The keyboard is arranged in the standard qwerty format with the addition of a number of control and special function keys. Each key may be used in three or four different modes: control, upper case, lower case and graphic character. With 57 keys this means that over 170 different characters can be generated. In addition to this, each character may be displayed in normal or inverse video giving a true range of over 340 choices. Each time a key is pressed the keyboard (not the television) 'peeps', very useful on the 400 when you can't always be sure you've made contact.

Cursor movement is as flexible as you're likely to need with up, down, left, right, clear screen and tab controls provided. It is possible to set and unset tabs anywhere along a single line on the screen. The manual suggested that tabs could be set anywhere in a logical line (up to 120 characters); if it's true I'd like someone to explain how. All keys repeat after they have been held down for about a second, which is especially useful when screen editing. All character modes — upper case, lower case, inverse video and graphics — may be 'locked' until changed. When the machine is in lower case mode, upper case characters can still be obtained by pressing the shift key just like a normal typewriter.

The screen format can be any resolution from 12 x 20 to 320 x 192 with up to five colours. In normal text mode it is 24 lines of 38 characters although the line may be altered to any length between one and 40 columns. A logical line is three times the physical line length and when nearing the end of a logical line the keyboard 'peeps' a warning. Character insertion and deletion is

RED ALERT

RED ALERT
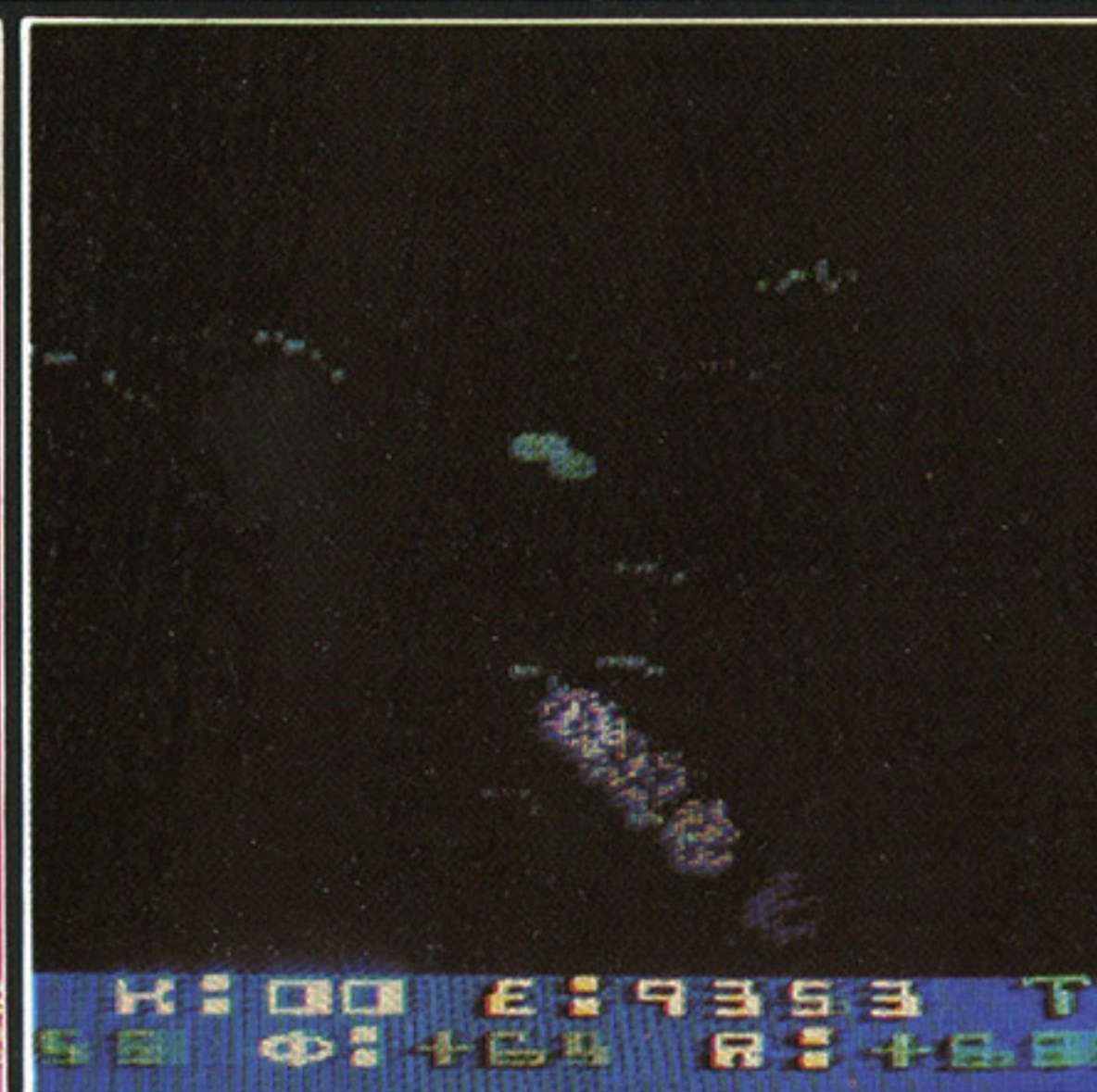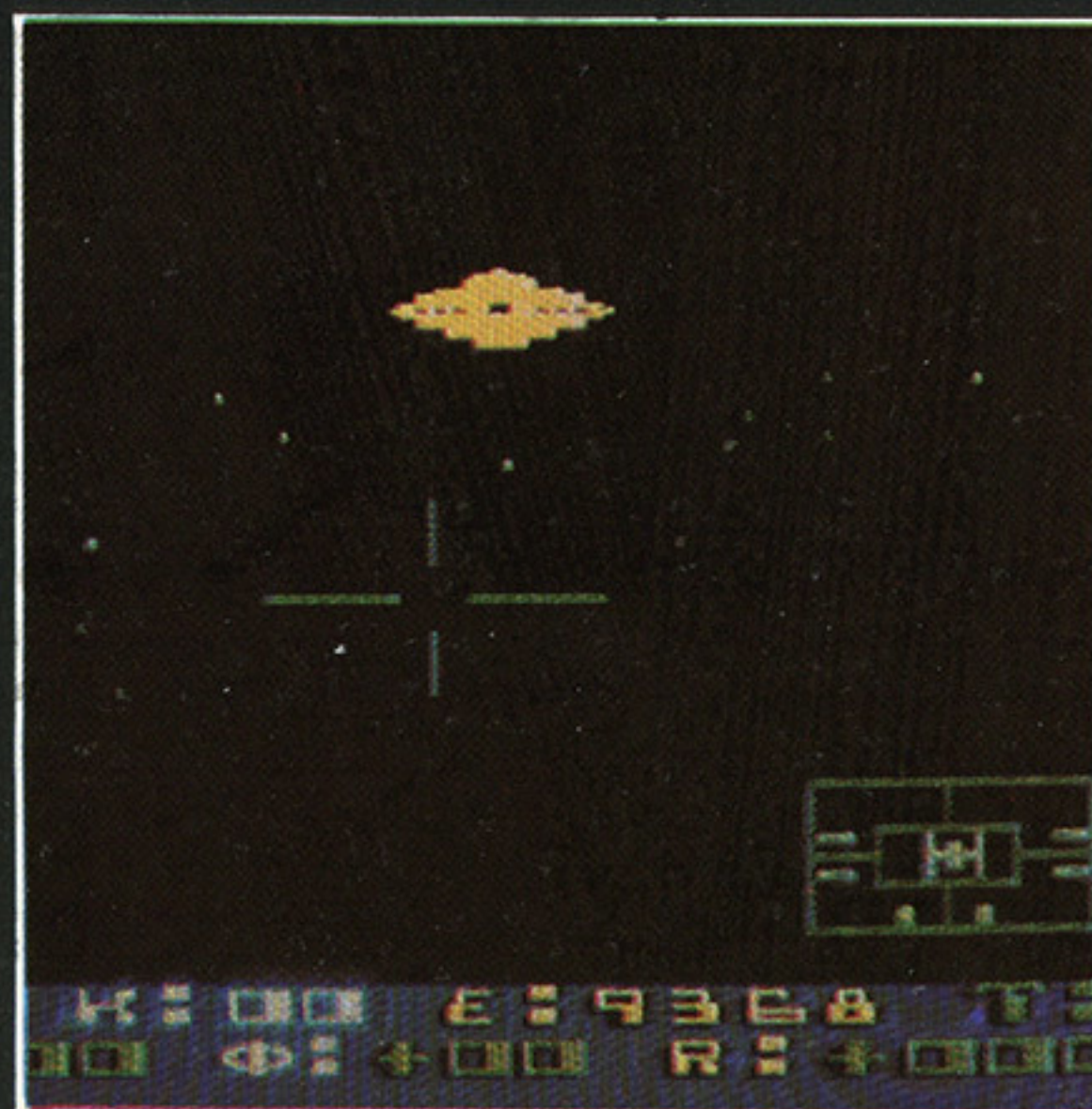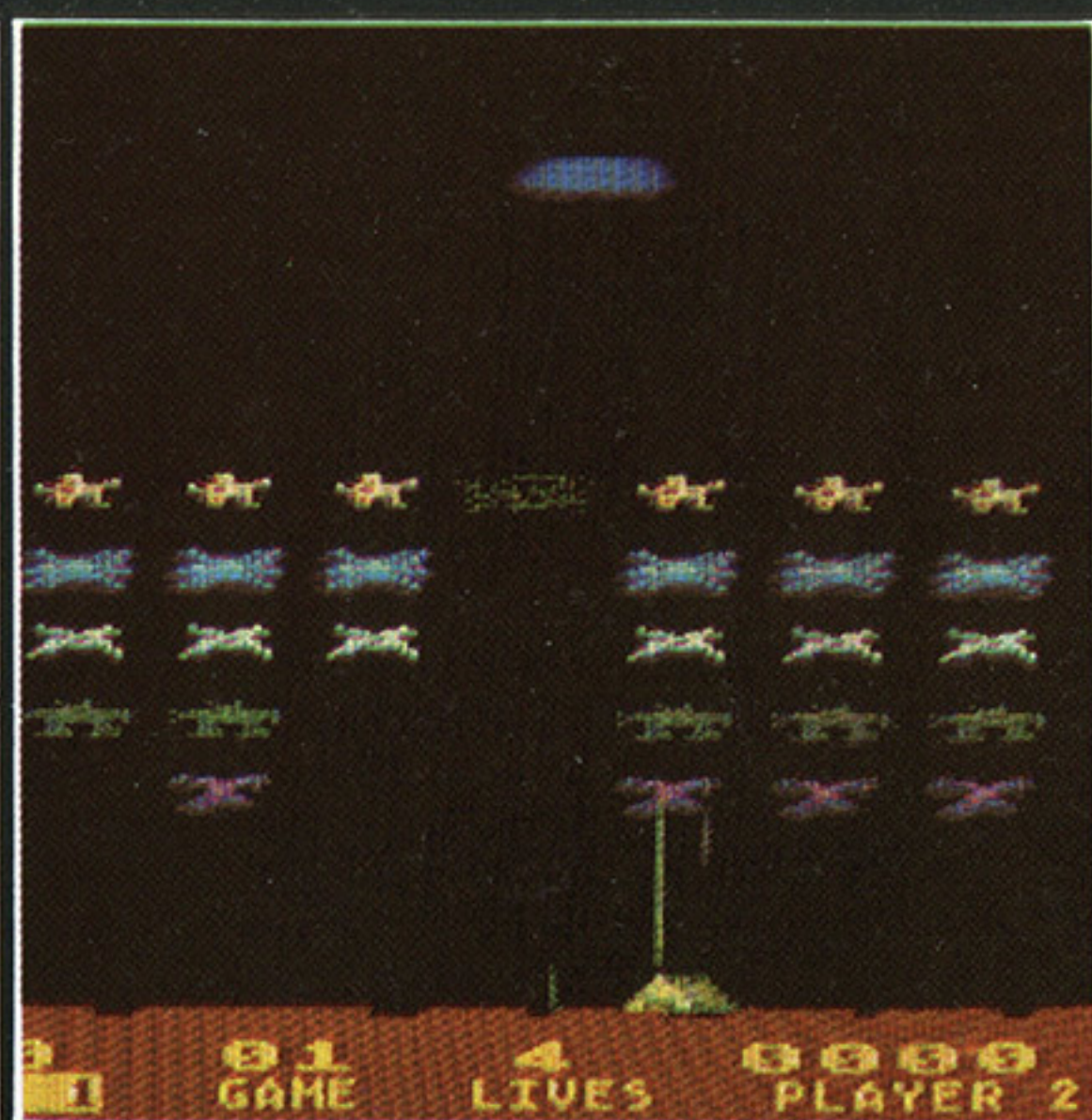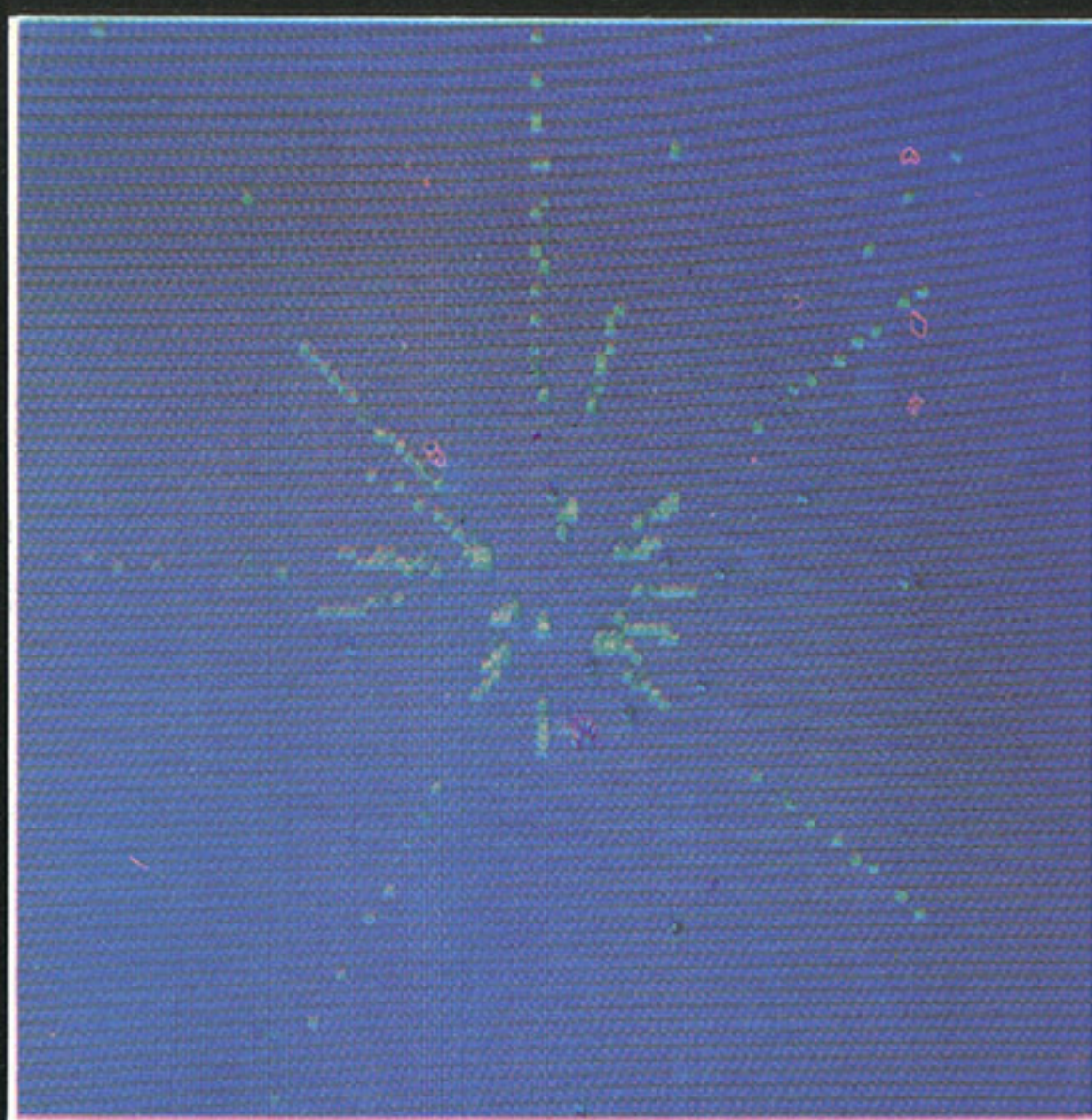
provided as well as line insertion and deletion. Line delete removes a whole logical line from the display but not from memory (if you're keying a program) whereas line insert makes space for a single physical line.

Four remaining keys on the right of the keyboard allow for system reset, select, option and start. Apart from reset these keys relate to the selection and initiation of functions in a cartridge.

The processor used is the 6502, the same as that in the PET, Apple and others. It runs at 1.8 MHz and gives benchmark timings which are a little slower than PET or Apple. The real time clock runs at 50 Hz, unlike the American version which runs at 60Hz so some US packages will run a little slow in the UK.

Four ports are provided at the front of the machine for attaching controllers — either knobs, joysticks or keypads. Up to eight controller knobs may be attached (in pairs) each returning a value from one to 228 depending on the knob's position. The joystick is a nine-position controller and up to four may be attached. As well as the positional controls, each device contains a trigger button. Up to four keypads may be attached, each containing keys 0 to 9, * and #.

One input/output port is provided on the side of the machine. Each device which can be attached has two sockets to enable others to be 'daisy chained'. The printer, disk drives, cassette recorder and RS232C expansion unit may all be connected in this fashion. A light pen plugs into one of the front controller ports.

The cassette recorder can be used with any high quality audio tape and reads from two channels — one audio, the other digital. It transfers digital information at 600 baud and is very sensitive to speed fluctuations. Sound is output through the television. The recorder has a tape counter to give the approximate position of a program and, as each recording has an 18 second leader, the precise location of the program start is not too critical.

The printer supplied was a 40-column impact machine with 5 x 7 matrix. With its on-board 6502, I reckon it could do more than I could find out. I managed to get the standard character set but no graphics. The documentation gives tantalising hints of more features, mainly to do with the ability to print horizontally and vertically but I couldn't get it to work.

Two other printers are available, a thermal 40-column device and an 80-column machine. All three printers use a paper roll which limits the scope of the machine a little.

The disk drive supplied was a 5¼" 90k single sided device whose origin appears to be Atari. I had a little peek inside and could find no manufacturer's references other than Atari itself. Up to four drives may be attached or, if you need more storage, a double density dual drive is available, giving about 160 kbytes per disk. Again, up to four of these drives may be attached, giving a total over 1.2 MBytes.
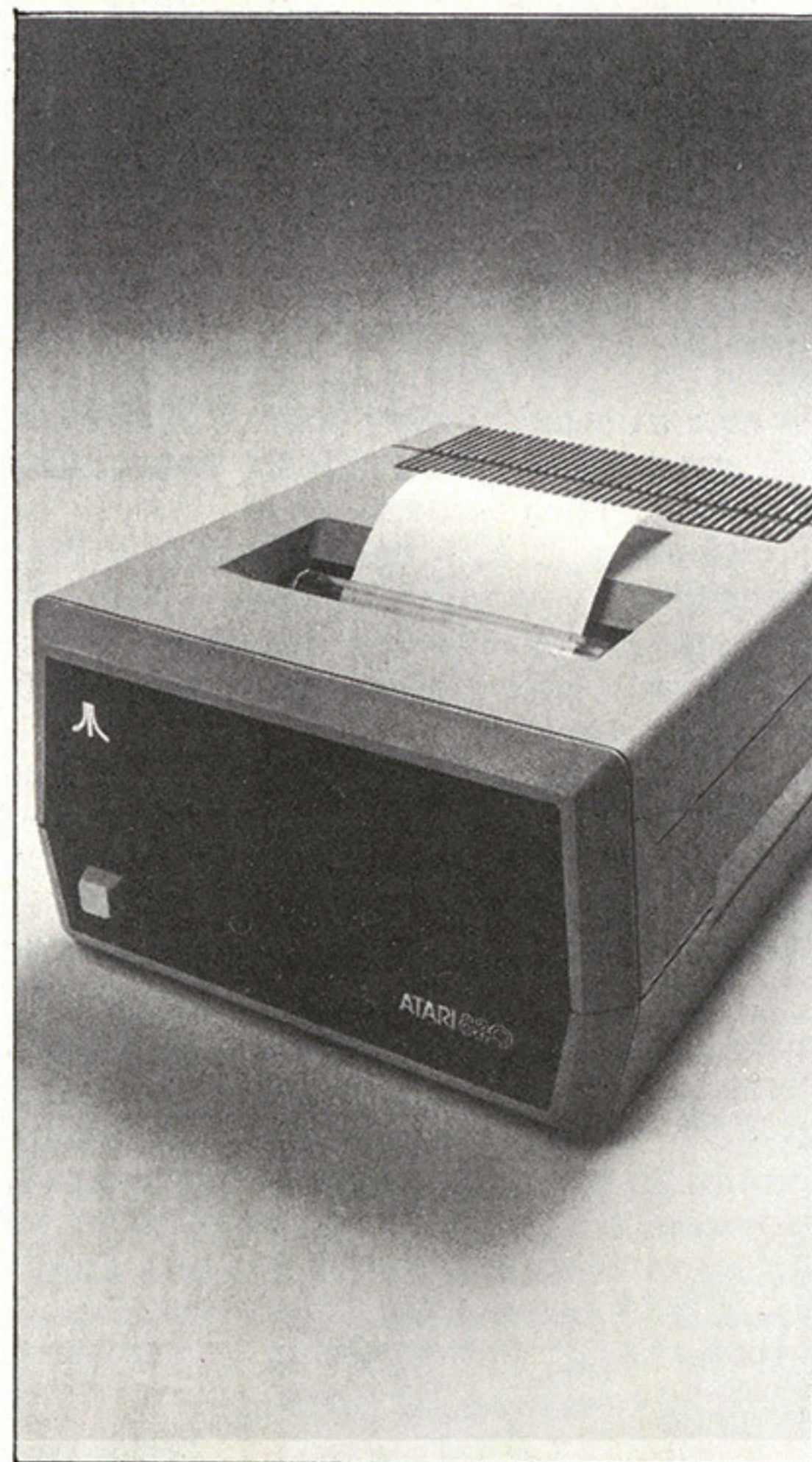
I consider the hardware to be very well made and certainly attractive enough to have in the home.

Software

The main operating system occupies a
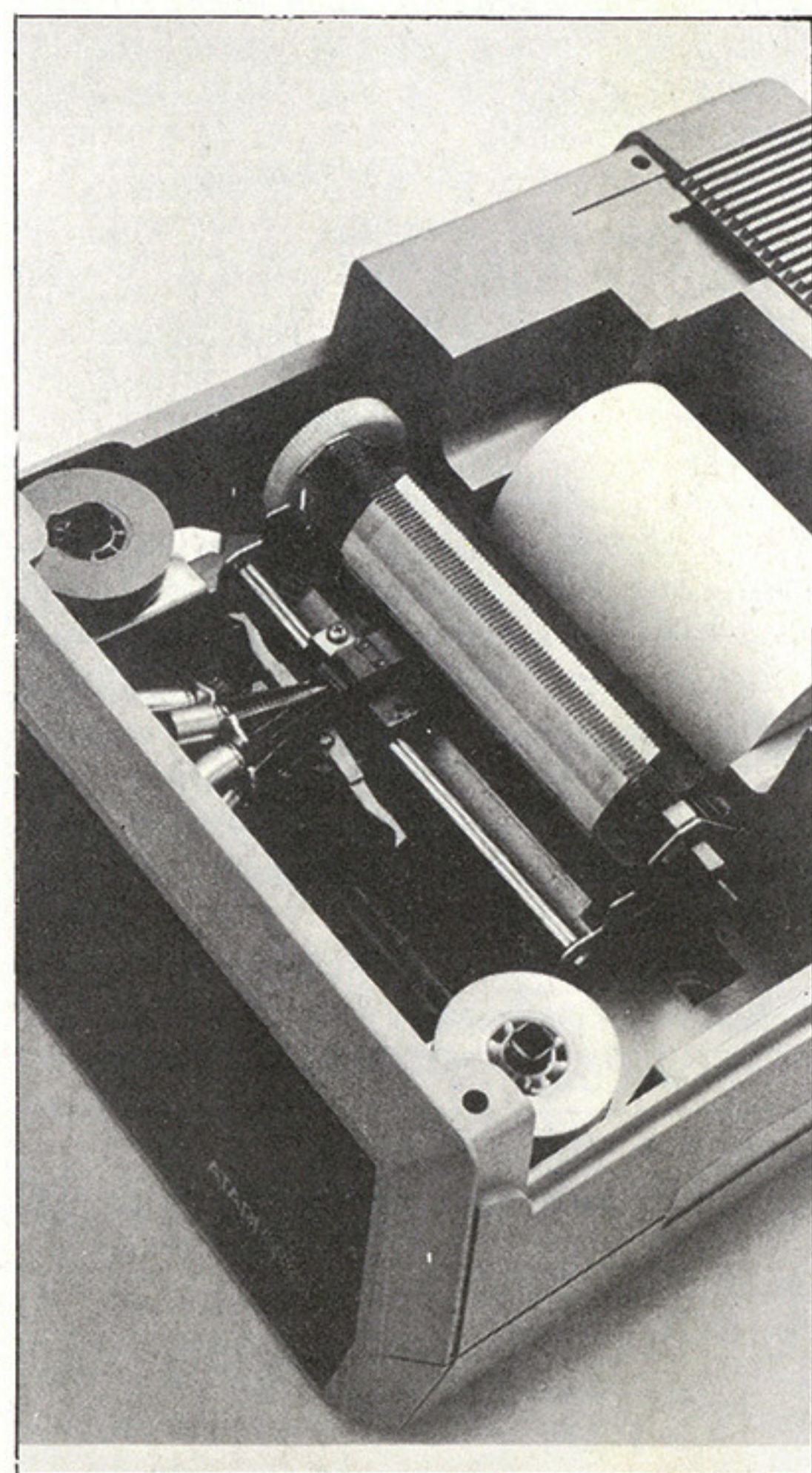

A close look at the 400 keyboard and cartridge slot.

The special Atari recorder.

Outside and...

... inside the 40-column impact printer.

10k ROM slot, the disk operating system is loaded from disk and takes up almost 9k of user RAM and the Basic cartridge occupies the RAM from 40 to 48k. At the moment games and other package modules occupy the same slot as the Basic cartridge.

Every package comes with an instruction booklet which can be quite substantial: a 12-page booklet explains the Star Raiders game for example. To digress for a moment, the Star Raiders game is similar to many of the Star Trek type games *except* the television screen gives what appears to be a three-dimensional view of space. In fact it creates

the illusion of being the window of your spaceship. Believe me it's quite addictive and there are several levels of play, each rewarding you with a whole series of grades depending on your performance in your mission. It could take weeks, months even, to reach the highest rank of star commander.

I've been told by someone who knows about these things that the programs available now are nothing compared with what's coming along.

Two program libraries exist, one for 8k programs and the other for 16k. The latter contains this new generation of games as well as new programming lan-

guages and business information processing packages. An enormous amount of Talk and Teach courseware is being prepared, such as Basic Psychology, Basic Sociology, Effective Writing, Counselling Procedures, Supervisory Skills, Principles of Accounting, Principles of Economics, Spelling, History and so on...

A terminal emulator and an assembler/editor look like interesting cartridges to get hold of as well.

Basic

It would be impossible to give a full description of Atari Basic in this review. Instead I shall restrict my comments mainly to those aspects of the language which are different to the Basics normally encountered.

First of all a couple of points relating to program input and editing. Atari Basic checks command syntax quite carefully at the time of input and, if it detects an error, highlights it with a marker at the part of the line at fault. Unfortunately this admirable approach stops when programs are run. The user is presented with an error code number which has to be looked up in the manual. It's possible to use a reserved word as a variable name although Atari doesn't recommend it; I tried LET LET=10: GOTO LET, yes, you can GOTO a variable name. Finally CTL 1 allows you to freeze the screen (and program) and unfreeze it at will. This is great if the doorbell rings while you're in the middle of a fast moving game for example.

Saving and loading programs on cassette is quite neat; the keyboard 'peeps' once if you're to press PLAY and twice if PLAY and RECORD are to be pressed. A number of commands are available for these functions, LIST, CLOAD, LOAD, ENTER, CSAVE and SAVE. SAVE or LIST can record programs for later merging by the LOAD and ENTER commands. CSAVE saves a more compact version of the program.

Memory map

Operating system	FFFFH
Floating point routines	DFFFH
Hardware registers	D7FFH
Not used	CFFFH
Slot A or RAM	BFFFH
Slot B or RAM	9FFFH
Basic & RAM	7FFFH
DOS & RAM	2A7FH
System controls & RAM	12FFH
	0000H

The string functions are adequate but hardly exciting. For a start all strings must be defined using a DIM statement, thus turning each string into a single dimension array, as in Cromemco's 16k Basic. No string arrays (in the normal meaning of the term) are allowed, which can be a bit of a nuisance. On the bright side, there's no limit on the length of a string although substrings are limited to a maximum of 99 characters. Substrings may be concatenated but not with the usual '+'; on the Atari it is necessary to devise an expression such as Z$(LEN(Z$)+1)=A$; this adds A$ to the end of Z$. All string variables can be subscripted either with a single number or with two separated by a comma. A single character means 'from this character position to the end of the string', while two characters define the start and end positions within the string.

The INPUT instruction will accept commas as part of the string, unlike so many other Basics. Unfortunately the machine gives no warning if the string is too long for the space available to accept it — the poor thing is simply truncated. Another oddity about Atari Basic is that you can't include a prompt in the INPUT statement and it's necessary to precede it with a PRINT.

ADR returns the memory address in decimal of the start of any given string.

A matrix has a maximum of two dimensions as opposed to the more usual three. Unlike the ZX80 which can only work with integers, it is impossible to define integer variables on the Atari machine.

A nice feature is TRAP; this allows you to define an address to which program control must pass when an error is encountered — very useful. This must be reset with a new TRAP instruction following each error trapped.

Sensibly, Atari has included a POP instruction which enables you to remove the top entry from the stack, essential if you decide not to RETURN from a subroutine.

Disk handling is somewhat crude but nevertheless effective. It comprises three useful commands — NOTE, POINT and OPEN. I only mention OPEN because a file may be opened in append mode which is quite useful. The other two commands give direct control over where the disk is to be accessed. NOTE saves the current sector/byte combination while POINT sets internal pointers to the next sector/byte to be accessed. Think about it. Sadly I didn't see a DOS manual but I have been led to believe that file handling software is fairly non existent at present.

GET and PUT read or send one character to a specified device and the location pointer is then incremented by one.

Many instructions are quite lengthy so an XIO command has been provided to give a sort of shorthand. The required function is accessed by issuing an XIO with a command number selected from a table. It has one extra function not provided by any other command and that is to FILL a previously defined graphics area.

Surprisingly, user defined fuctions are not allowed in Atari Basic. There are, however, a number of functions, among which are RAD, DEG and CLOG. RAD or DEG selects whether results are to be in radians or degrees — the mode won't change until another RAD or DEG instruction is encountered. CLOG gives logarithms to base 10. Mathematics are to nine-place accuracy except for EXP which will be at least six.

The graphics on this machine more than make up for any minor deficiencies in the other departments. It is possible to select from 128 colour/luminance combinations and 17 different screen arrangements. Up to five colours may be displayed, depending on the particular graphics mode in operation. Table 1 gives the range of options together with their RAM requirements.

Two of the more useful commands are DRAWTO which draws a line from the last location plotted to the coordinates defined and SETCOLOR which is used to set each of the five possible colours. Mixed text and graphics are allowed, so it's necessary to move an 'invisible cursor' around the screen. This is done using the POSITION command; text sent to the graphics area will then appear at that position.

The graphics commands take a lot of effort to master but they are definitely worth it. You may even find a few modes that are not in the manual, as I did.

One look at the Basketball or Star Raiders games tells me that there are far more graphics facilities locked away inside the machine. Atari isn't telling though, so it will be left to some bright programmers to get inside the software and then to spill the beans. (To PCW perhaps?) For now I would suggest you go to a pub or an arcade where Atari machines are installed to get some idea of their potential. One of the interesting features is the 'simultaneous' movement in different directions of large graphic figures (people, spaceships etc).

Up to four sounds may be played simultaneously; the pitch of each may be varied from one octave below middle C to two octaves about it. Special

Basic Reserved Words							
+	—	*	/	∧	NOT		
BYE	CONT	END	LET	LIST	NEW	REM	RUN
FOR...TO...STEP...NEXT			GOSUB...RETURN		GOTO	IF...THEN	STOP
ON...GOSUB	ON...GOTO			POP	RESTORE	TRAP	
CLOAD	CSAVE	DOS	ENTER	INPUT	LOAD	LPRINT	NOTE
OPEN	CLOSE	POINT	PRINT	PUT	GET	READ/DATA	SAVE
STATUS	XIO						
ABS	CLOG	EXP	INT	LOG	RND	SGN SQR	USR
ATN	COS	SIN	DEG	RAD	ADR	FRE	POKE
ASC	CHR$	LEN	STR$	VAL		PEEK	SQR
DIM	CLR						
GRAPHICS	COLOR	DRAWTO	LOCATE	PLOT	POSITION		
SETCOLOR							
SOUND	PADDLE	PTRIG	STICK	STRIG			

distortion effects and separate volume controls may be applied to each voice, using the SOUND command, and once a sound is initiated it will continue until stopped by a reset, END or another SOUND instruction for the same channel.

You will see from the Basic reserved words table that there are many commands not even hinted at here. In my view it's a good Basic with just the one or two limitations mentioned above.

The disk operating system (DOS) must be booted in before programming starts, which is very important, not least because the machine has to be switched off before DOS can be loaded. It was difficult for me to evaluate the DOS properly as I didn't have the DOS manual; all I can say is that it worked for me — I had no disk problems at all and I was saving and loading both programs and files. A menu can be displayed which shows that DOS offers the usual functions such as file copy, delete, rename, lock, unlock as well as disk level commands such as copy, write DOS to disk, format disk and duplicate disk. I was disappointed not to find mention of any file handling procedures as this would save each user reinventing this particular wheel.

Benchmark timings (all times in seconds)	
BM1	2.35
BM2	7.41
BM3	19.89
BM4	23.16
BM5	26.78
BM6	40.75
BM7	61.51
BM8	43.08

TECHNICAL SPECIFICATION

CPU:	6502, 1.8 MHz
Memory:	8-48k (16k limit on 400), 8k ROM Basic (40-48k RAM location) 10k ROM operating system.
Keyboard:	Full qwerty + special keys. (61 keys including controls).
Screen:	Domestic television. 12x20 to 320x192 resolution. Up to five selected from 128 colour/luminance combinations, 4-channel sound.
Cassette:	Digital, 600 baud. Audio channel. Tape counter.
Disk drives:	5¼" 90k. 5¼" twin 160k drive. Up to 4 drives per system.
Printers:	40 col impact or thermal, 80 col impact.
Ports:	Interface module gives RS232C. VCR socket on 800 (can be used for a monitor). 4 games controller/light pen sockets.
System S/W:	10k operating system. 9k (almost) DOS in RAM.
Language:	8k Basic (others coming)

			Rows			
	Graphics mode	Columns	Full	Split	No. of colours	RAM required
Text	0	40	24	—	2*	993
	1	20	24	20	5	513
	2	20	12	10	5	261
mixed text/ graphics	3	40	24	20	4	273
	4	80	48	40	2	537
	5	80	48	40	4	1017
	6	160	96	80	2	2025
	7	160	96	80	4	3945
	8	320	192	160	1*	7900

* 2 luminances may be defined for one colour

4 text lines are provided at the foot of each split screen.

Table 1 Graphics options

Potential use

Without doubt this machine is aimed at the home user and education in its widest sense. The audio visual facilities will find a place in the home, in commercial training establishments as well as in the school. The games will be an attraction to those already interested in computing while at the same time involving those who wouldn't normally touch a computer with a barge pole. The home computeer will have a whale of a time while the more serious may reconcile their household accounts and taxes on it. The businessman may use it but probably only the smallest, the architect or engineer perhaps. The 400 should be ruled out for serious computing although it is ideal for games/computing/education. The 800 offers a more grown-up option with plenty of growth capability; disks and the RS232C interface will ensure that some quite serious users will buy.

Both machines are friendly, they have the solid backing of Atari and, behind it, Warner Brothers Communications.

This machine is probably the strongest contender for the home computer market in Britain today.

Documention

A lot of effort has gone into the preparation of the documentation. It has been well produced although there is still some room for improvement. The operator's manuals are very clear as are the instructions for operating the various cartridges. A Basic manual written by Albrecht, Finkel and Brown was also quite excellent.

Aimed at the absolute novice, this book takes you through most of the various features and functions of Atari Basic. All except our friends the I/O commands, that is. Experienced programmers will probably dip into this book but I would recommend a beginner to work through it carefully. The Atari Basic reference manual is quite good for the experienced programmer but not a lot of use to the beginner except for the appendices which give all sorts of interesting information such as the derivation of mathematical functions in terms of Atari Basic, memory maps, useful POKE & PEEK locations, error codes and the various graphics modes.

I'd like to have seen more in Atari's own manual; I did feel that they skimped a bit on explanations, especially with regard to printer and disk operation.

Prices

Prices in the UK have not been finalised so I shall give Atari's "approximate anticipated retail" figures which include VAT.

16k 400	£395
16k 800	£695
Cassette Recorder	£55
90k Disk Drive	£525
80 column printer	£500
16k RAM	£145

My guess (not Atari's) is that the cartridges will range from £20 to £50.

Conclusion

I've said it all earlier in the review but for the benefit of those busy people who only read the introduction and conclusion, I think that Atari is doing a very professional job. The machines are clearly aimed at the home market where, as well as satisfying a demand for sophisticated games and Basic computing, they might spawn a completely new 'consumer education' boom. Self improvement is rapidly becoming a necessity and Atari seems set fair to help/capitalise depending on your viewpoint. Some small business owners may buy but they are unlikely to form a major part of the installed base. The official UK launch isn't until early next year so Atari has time to fix the odd hardware problems encountered during the review.

At a glance

***** excellent, **** V. good, *** good, ** fair, * poor.

FIRST IMPRESSIONS	
Looks	*****
Setting up	*****
Ease of use	*****

LANGUAGES	
Basic	****
System software	**

PACKAGES	
Business	not reviewed
Education	not reviewed
Home	****

PERFORMANCE	
Processor	**
Cassette	see text
Disk	**

COMPATIBILITY	
Hardware	**
Software	*

DOCUMENTATION	****

VALUE FOR MONEY	****