A Database Publication

apple user

Vol. 6 No. 10 October 1986 £1.25

Enter the GS: A dramatic breakthrough for the Apple II range

How to go mousekeeping with Pascal

Apple IIe: Enhancement plus compatability

Simple date-stamping for DOS 3.3 files

Using ProDOS to print out error messages

Cash flow budget analysis made easy

REVIEWS: Keystroke memory with MacroWorks ● Digital circuits with LogiMac

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Volume 6
Number 10
October 1986

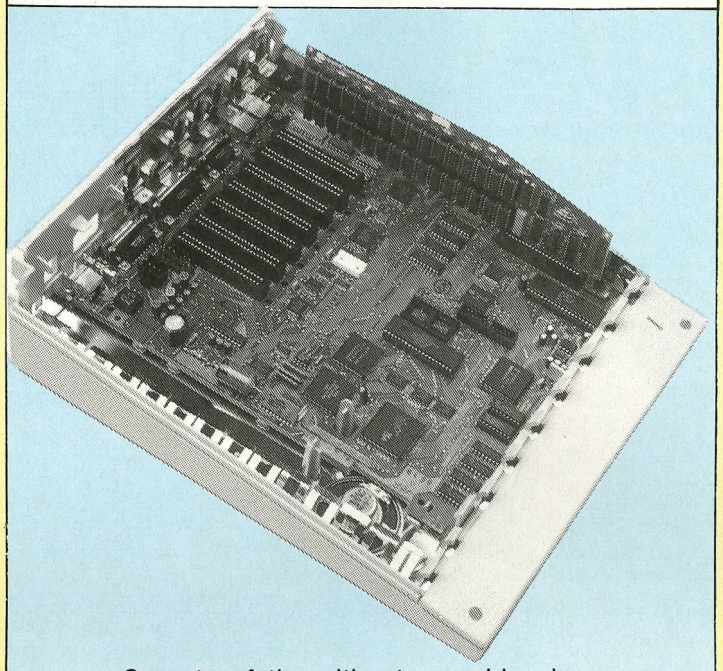
News

Reviews

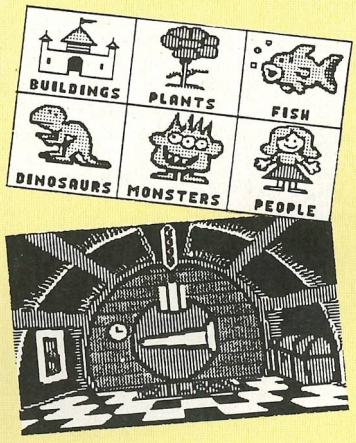
Utility

MicroLink

Debut



Fun & Games



Hardware

Classifieds

Game

Business

Feedback

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Published by Database Publications Ltd, Europa House, 68 Chester Road, Hazel Grove, Stockport SK7 5NY.

News trade distribution:
Europress Sales and Distribution Limited, Unit 1, Burgess Road, Ivyhouse Lane, Hastings, East Sussex TN35 4NR. Tel: 0424 430422.

ABC 11,780 January-June 1986

Subscription rates for 12 issues, post free:

£15 UK & Eire (sterling)
£23 Europe
£38 Overseas (airmail)

The GS is a giant step forward for Apple II

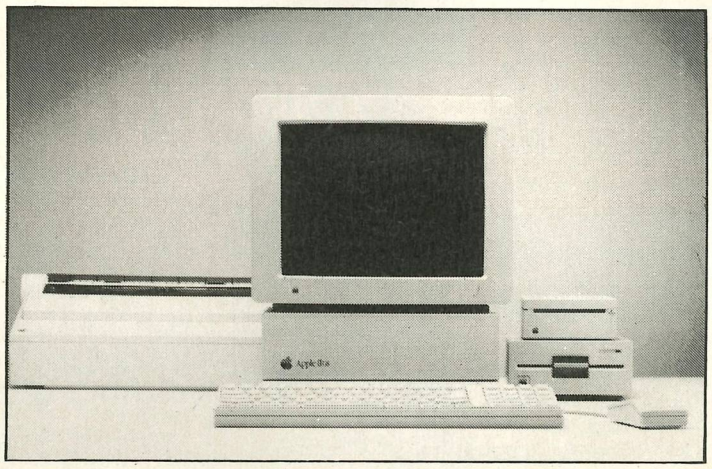
APPLE has launched the ultimate machine in its bestselling II range with sophisticated graphics and built-in sound – the IIGS.

Running on a new 16 bit processor, the computer which goes on sale in the UK in December is being aimed at small and medium sized businesses.

In particular, the company sees a potentially vast market among the current three million existing Apple II users world wide.

The Apple development team has kept many of the features that has won the II range a legion of fans but has added numerous others.

"There are a lot of people out there who prefer the Apple II to the Macintosh," pointed out an Apple spokeswoman.



"So much so they might well opt for an enhanced machine from another company rather than a Macintosh. We are certain the IIGS is going to appeal to them."

The new Apple II is based on the 65C816 microprocessor with 256K ram, expandable by 1 megabyte, and 128K rom. It has one dedicated ram/rom memory slot and seven additional input-output slots and comes complete with an Apple Desktop Bus mouse as standard.

In line with Apple's move towards generic peripherals for both the Apple II range and the Macintosh, the IIGS is the first Apple II to incorporate the AppleTalk network.

Running AppleTalk, the IIGS can link up to Apple's LaserWriter which can be shared by up to 31 micros. It can also be used with the Apple ImageWriter II dot matrix printer.

The IIGS is being launched along with the Apple Hard Disc 20SC, a 20Mb hard disc with SCSI interface, the SCSI allowing IIGS users to access files up to six times faster than on a floppy disc drive.

A range of new peripherals for the IIGS includes a high resolution RGB colour monitor and a monochrome monitor, a 3.5in disc drive and a 5.25in disc drive.

The company claims that the IIGS will run "the majority of existing Apple II software packages". And that they will run "approximately three times faster" on the new machine.

New applications are currently under development specifically for the IIGS and the first of these are expected to be ready in January, 1987.

David Hancock, Apple UK's managing director, says: "The launch of the Apple IIGS is a very important step in the evolution of the Apple II.

"What we have done is put the Apple II on a chip to combine the best features of the original design with significant enhancements and new features".

THE Apple IIGS is to be offered in three bundled packages starting at less than £1,000.

A monochrome system provides basic entry which includes the CPU, monochrome monitor and 3.5 in disc drive for £995.

Bundle two offers a colour monitor, 3.5 in disc drive and 256k ram expansion card for £1,395.

Top of the range is the 20Mb hard disc system with SCSI interface, monochrome monitor, 3.5 in disc drive and ram expansion card for £2,195.

"The bundles are not just introductory – they are part of the overall IIGS concept",. says a company spokeswoman.

Apple will also be offering both the machine and peripherals for sale as separate items. The price list is: CPU, £795; monochrome monitor, £110; RGB colour monitor, £410; 3.5in disc drive, £295; RAM expansion card, £95; 20Mb hard disc, £1,250; and 5.25in disc drive, £195.

R&D budget up 50 per cent

APPLE has boosted its research and development budget by 50 per cent in the States this year.

It has done this in order to ensure that the next 12 months witnesses the introduction of more new products than during the whole of the previous history of the company.

"Right now the pipeline is full," Apple supremo John Sculley admitted.

Although the company is playing things close to its chest for the time being, *Apple User* has learned that the boffins are working on:

- A way in which the Apple II and the Macintosh can understand each other's files.
- MS-DOS as a co-processor option for a future product.
- A role for Unix in workstations – but not as a replacement for Macintosh.
- More commercial applications for both the Apple II range and the Macintosh.
- Special software products of its own in order to stimulate new markets.

What Apple won't be doing is providing an architecture – as arch rival IBM has done – which allows for low-cost clones from the Far East to flood the market.

Instead it will stick to throwing its weight behind its research and development to provide the key for its continuing success.

"I firmly believe that Apple's future will ride on the innovative things we do in fully commercialising Macintosh and giving a long term commitment to the Apple II with technology enhancements as this becomes feasible," commented John Sculley.

Inside the Apple IIGS

MAX PARROTT and MALCOLM WHAPSHOTT have been testing the new 16 bit Apple IIGS. Here is their report.

APPLE has unveiled the next stage in the evolution of its world-beating II range – the IIGS.

The development team has effectively placed the Apple II on a chip, allowing the best features of the original design to be combined with such significant enhancements as almost complete compatibility with the IIe and the IIc.

THE HARDWARE

The four layer motherboard has the same physical dimensions as those of the IIe but fits in a smaller, redesigned case and is, of course, a completely new design. The socketed microprocessor is a 65SC816 which is a full 16 bit machine that on power up emulates the 65C02 of the IIc and later IIes. The other onboard chips are mainly surface-soldered custom designed together with eight D41464s giving two lots of 256k of ram.

The motherboard has seven of the traditional slots along the back and one other shorter slot in the front right-hand corner. The board sits in a platinum-grey plastic box 28cm wide, 30cm deep and 12cm high which has a small extension of 4cm at the front.

These dimensions are such that the computer, keyboard, mouse and two slim-line disc drives easily fit in a shoulder bag.

The power supply is supported above the left-hand side of the board. The top of the box is released by pressing two plastic buttons at the rear and can then be swung up and pulled clear of retaining hooks along the front lip of the main box.

These hooks form part of a metallic interference shield which also overlaps with the metal box of the power supply which can similarly be unhooked, swung away from its supports and completely removed.

The platinum-grey keyboard which measures 38cm x 12cm x 3cm is connected to the rear of the main box by a coiled cable. The connection is via a 4-pin sub-miniature DIN plug at one rear corner of the board.

A similiar connector at the other corner may be used for the mouse which now comes in a re-designed case, and which is easier to handle because of it.

The connections are made via the new Apple desktop bus which is a versatile, simple, serial system having a data line, a return line and a 5V power line. There is one reserved line. Peripheral devices other than the keyboard and mouse can be connected in any order to the desktop bus. Interestingly the motherboard had an old style keyboard socket and space for a keypad socket.

I did not try these out; it looks as if the board could be designed to fit into an existing IIe case using the old power supply and keyboard as an upgrade path. Whether this is true or not, and, if it is, whether new firmware is needed, I do not know.

The keyboard has all the keys of the IIe including Open-and Closed-Apple although these have both translated to the left of the spacebar and are known as Open-Apple/Command key (with the propeller symbol familiar to Mac users) and Option key respectively. The spacebar is shorter, in common with most modern keyboards.

To the right of the main keys is a numerical keypad together with *, /, +, –, =, Enter (Return), and a Clear key. The Clear key returns Control-X. Several of us used the keyboard and found it pleasant to the touch, with the right amount of tactile and audio feedback.

The keys are auto-repeat with variable repeat and delay times. The keyboard layout is adjustable, to conform to nine different country standards or the Dvorak system (Figure 1); the key tops however, were English/USA on our machine and not easily, if at all changeable. Possibly key overlays will be used.

An onboard control panel program which we will describe later allows the keyboard input to be buffered or not buffered as on the IIe.

The back of the main box has casing slots corresponding to the motherboard's slots, somewhat similar to those of the IIe, but these have plastic covers held in place by an internal key with a twist action for easy removal and replacement.

Under the slots are the Apple desktop bus connector (subminiature DIN) for the keyboard or direct mouse connection if wanted, a composite video phono socket, a 15-pin D type connector for analogue RGB, a 19-pin D type disc port, a 9-pin D type connector for games paddles – does anyone still use them? – or joystick (as on the IIe the full 16-pin DIL socket is also on the motherboard), two 8-pin sub-miniature DIN serial connectors and a stereo headphone jack.

The power plug and on/off switch are on the left of the rear above the keyboard connector.

The disc port is described as a smart port. In fact it's a very smart port, being able to daisychain up to two 3.5in drives and two 5.25in drives. The 3.5in drives appear to be in slot 5 as drives 1 and 2 and the 5.25s appear to be in slot 6. The review machine was sent with one of each size and these, when daisychained together, both appeared as drive 1 on slots 5 and 6.

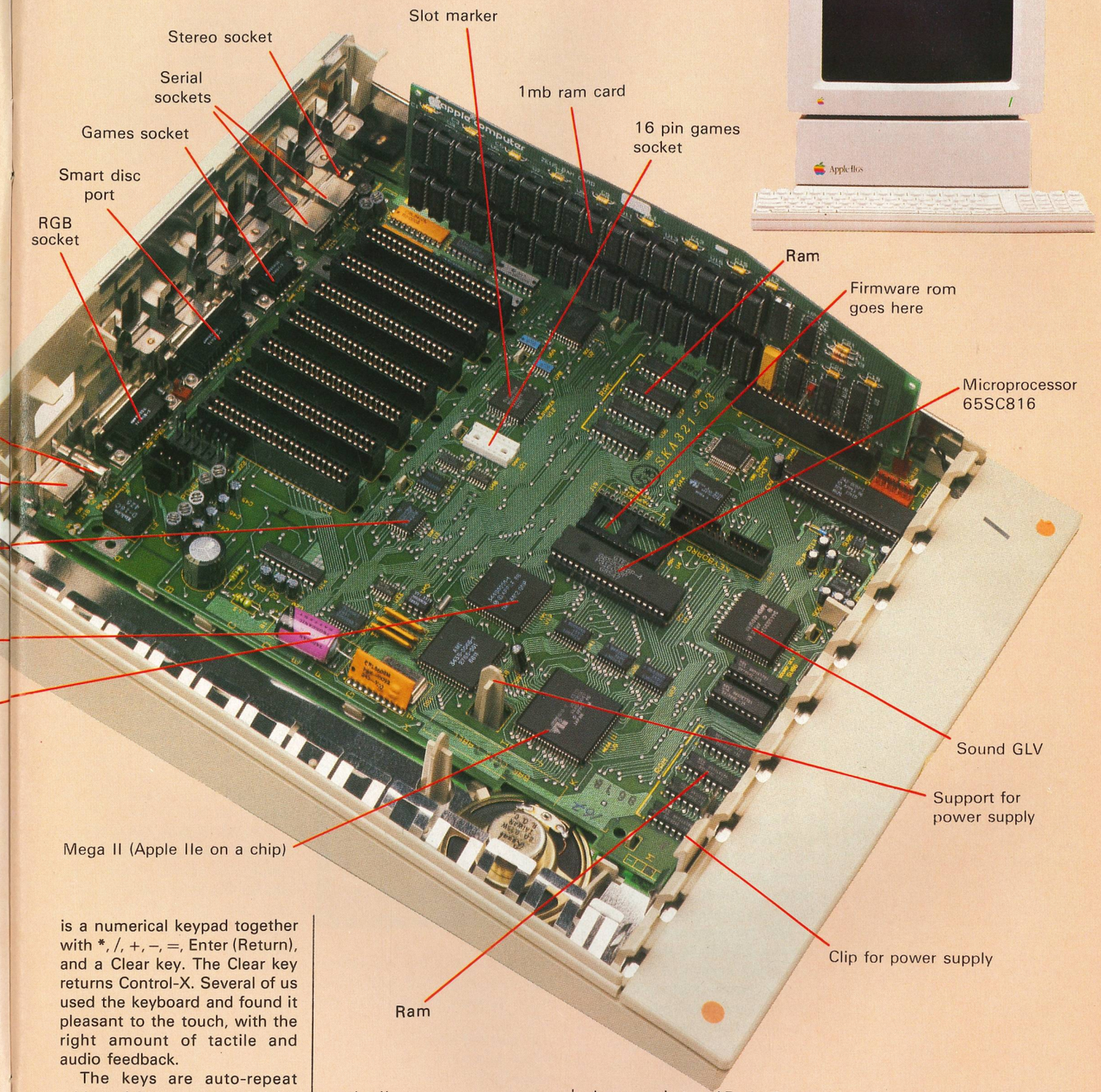
The 3.5in Sony drive was

The main features at a glance:

Almost complete compatibility with IIe and IIc.
Can run IIe software at 2.8 times the speed.
7 slots, plus one other.
Two built-in serial ports.
Built-in 80 column display.
Built-in mouse port.
Built-in AppleTalk.
Redesigned case and motherboard using custom chips and the 65SC816 microprocessor, separate keyboard, and redesigned mouse.
Minimum 256k of ram, expandable up to 4mb.
128k of rom with Basic, new monitor program, a Mac-like finder and a machine control panel program.
Composite video and analogue RGB output.
A possible palette of 4096 colours.
Two new graphics modes:
– 320 by 200 with 16 colours.
– 640 by 200 using 4 colours.
New sound capabilities using a dedicated chip with its own 64k of ram.

USA
UK
French
Danish
Spanish
Italian
German
Swedish
Dvorak
French Canadian

Figure I: Keyboard options



double-sided and gave under ProDOS a total storage space of 800k. The 5.25in was a half-height, external IIc drive which gave the traditional 143k of storage. In 8 bit IIe emulation mode, that is when powered up under the standard conditions, the machine acts as if an extended 80 column card were in slot 3. This appears to ProDOS as /RAM with the expected 127 blocks.

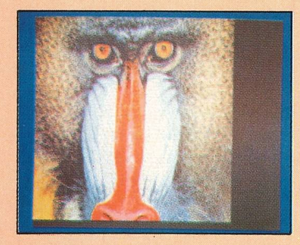
The review machine was also sent with a memory extension board which fitted in the shorter 44 line slot at the front of the motherboard. This had on board a further 1mb of ram as 32 D41256s arranged as two banks of 16. A jumper controlled whether one or both banks was mapped in.

In 16 bit native mode this memory is seen as contiguous 64k banks of memory. As the larger capacity memory chips become available in cheaper quantities these will probably be replaced to give an expected 4mb.

In 8 bit mode under standard conditions this memory is not seen by the system. However, the control panel program is able to set some or all of this memory, in steps of 32k, as a ram disc from 0k up to the maximum on board (Figure II). At least, I assume it is up to the capacity of the expansion board, as the control panel program told me the most I could have was 512k until I fitted the jumper on the board.

In 8 bit mode this memory appeared to ProDOS as /RAM5 with 1024 blocks and is obviously "mapped-in" to slot 5 – the smart port. While working in IIe mode with ProDOS 1.1.1 I happened to invoke the control panel program and was told that I had differing amounts of free ram available depending on how much of /RAM5 I was using.

Clearly the system has some form of dynamic ram allocation



Minimum ram disc size: (0-max in steps of 32k)
Maximum ram disc size: (0-max in steps of 32k)
Largest selectable: (Max of memory card)
Ram status:
Ram disc size:
Total ram in use:
Total free ram:

Figure II: Ram disc control panel

which does not essentially affect the 8 bit mode but may be important in 16 bit mode (although in 16 bit mode this memory is not seen as a solid disc but as main board memory).

Incidentally, the control program can map out the ports and thus map in the corresponding internal slots in their place. When this happens with the smart port the use of /RAM5 and the 3.5in drive is lost but the 5.25in drive daisychained to the 3.5in still appears as if in slot 6.

We were told that the motherboard's slots, while being compatible with standard Apple II slots, are also compatible with the 16 bit mode. This is transparent to current 8 bit cards, but new cards will require more chips to demultiplex the address from the data lines.

As on the IIe, slots each have 256 bytes of space for prom allotted in the $C100 to $C700 area with expansion rom space for all from $C800 to $CFFF. Also each slot has its I/O locations in the space from $C090 to $C0FF and the holes in the screen memory area. Memory is shadowed, a term new to many Apple users – we'll return to this later.

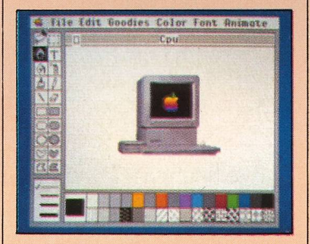
The microprocessor on the GS is a 65SC816 which is a 16 bit CMOS version of the 65C02 from Western Digital with many extra commands and addressing modes to take advantage of more memory. It in fact starts up in 65C02 emulation mode and has to be switched to its 16 bit mode.

Its internal address bus is 24 bits wide and so it can address 16mb of memory; the GS however, has ram memory mapped from $0 to $3F in banks of 64k which is 4mb in total. The first two banks (0 and 1) correspond to the 128k of a IIe and these and the banks 2 to 63 (2 to $3F) can all run at the microprocessor clock speed of 2.8MHz. Rom is mapped in to banks $FE and $FF and is also read at 2.8MHz.

The addressing and memory refreshing for all these locations is handled by a custom built chip known as the FPI (Fast Processor Interface). Some more ram maps in to banks $E0 and $E1 and runs at 1MHz so that the I/O slots and video displays act as on the IIe. This ram shadows the zero bank ram so that the whole looks like a traditional Apple II, writing takes place in banks 0 and $E0 and for the I/O areas writing and reading are both slowed down.

The control panel has an option of running applications (games?) at the old 1MHz speed for compatibility. With this option the program still actually operates in the fast ram area but the FPI works at the slow speed.

The accumulator and index (X and Y) registers are 16 bits wide but can operate as 8 bit



registers in 65C02 emulation. The data bus is 8 bits wide, much as with the 8088 of the IBM PC.

There are also 8 bit data and 8 bit program address bank registers, new addressing modes and fast block move instructions together with relocatable zero page and stack.

The processor is said to be a fast one; Steve Wozniak says that it is about twice as fast as the 68000 at the same clock speed.

The custom designed chips have some interesting names; the smart disc port is controlled by the IWM (Integrated Woz Machine), basic Apple II stuff by the Mega II (that is an Apple IIe in a chip), the slots by the Slotmaker and sound by the sound GLU (General Logic Unit) which works with DOC (Digital Oscillator Chip).

Other VLS ICs on board besides the FPI are the Video Graphics Controller (VGC), the Keyboard General Logic Unit (KeyGLU) and the keyboard microprocessor (a 50740A).

All the illustrations on these pages were photographed from an Apple IIGS monitor screen.

DISPLAY

On boot-up with DOS 3.3 or ProDOS 1.1.1 the demonstration machine, which was connected to an analogue RGB monitor, gave white text on a mid-blue background which looked pleasing but is alterable from the control panel program. The options are shown in Figure III.

The review machine was connected to a green-screen, monochrome, video monitor which caused the standard boot up display to appear as light green on a dark green background. We also connected it to a Microvitec low resolution monitor converted to accept analogue input rather than TTL. The startup display may be in 40 or 80 columns but generally software soon takes over and selects which.

The composite video display output switches to monochrome for text-only displays to enable the best resolution. The text and graphics modes act exactly as expected from Basic on a IIe.

The built-in 80 column display also acts exactly like an Apple extended 80 column card for the IIe. For example in 40 column mode pressing Esc 8 selects 80 columns and Esc 4 reverts to 40 columns. Issuing a PR 3 (or pr 3) also switches to 80 columns.

HGR and HGR2 (or hgr and hgr2, for all Basic commands may now be given in lowercase) creates a black screen surrounded by a colour border which is selectable via the control panel. With hgr on monochrome the text area at the bottom appeared as fine, alternate green and black lines with bright green text on it if the colour display is chosen as standard but as a dark green background if monochrome is chosen. Low resolution graphics behaved as on a IIe.

The two new graphics modes have screen resolutions of 320 by 200 pixels with 16 colours per line (256 on the screen) and 640 by 200 with 4 colours per line. Basic does not have plot and draw commands to use these screens but they are accessible from it.

The 320 by 200 mode is true colour resolution, that is any colour dot (out of the 16) can be next to any other colour. This takes 4 bits per pixel or 32k per screen. Moreover, the memory mapping is linear and contiguous and entire bytes from $4000 to $BFFF of bank $E1

map on to the screen.

This memory is not normally shadowed and is not normally used from Basic. However it can be shadowed if desired by bank 01 (the auxiliary memory bank of the IIe).

The colours may be chosen from a palette of 4096 different colours and shades, but a good quality, high resolution, analogue RGB monitor is required to get the best results, especially for text.

The 640 by 200 mode is more complicated where colour control is concerned, although memory mapping still seems straightforward. Apparently the effect is that any one pixel may only take one of four colours selected from the palette but elsewhere on the line other colours are possible with a maximum of 16 for the line.

We have not seen any examples but this scheme apparently allows 80 column text to be shown on the same screen as the graphics by a technique known as dithering.

We had been sent some digitised colour pictures and a drawing program which gave remarkably good results on our colour monitor. On monochrome the super hi-res pictures appeared in shades of green but were still most impressive.

The full technical details of how colours are manipulated from Basic are not presently available, but a quick scan of some of the programs suggests that different values poked into the $C000 area of memory are involved as might be expected.

These new graphics modes are similar to but surpass those of the Atari ST, which has a two colour selected from 512 colours mode, and of the IBM colour adapter card which has the same dot but not the colour resolution.

The Mac's screen has a pixel resolution of 512 by 342 and the pixels are square but without colour; the technical information says that the 320 by 200 mode of the GS has pixels with an aspect ratio of 5:6 and the other mode's pixels have a ratio of 5:12.

Type:	(colour/monochrome)
Columns:	(40/80)
Screen Colours:	
Text:	(white/black/deep-red/dark-blue/purple /dark-green/dark-grey/medium-blue/ light-blue/brown/orange/pink/light-green/ yellow/aquamarine)
Background:	(medium-blue/light-blue/brown/orange/light-grey/pink/light-green/yellow/aquamarine/ black/deep-red/dark-blue/purple/dark green/dark-grey)
Border:	(medium-blue/light-blue/brown/orange/ light-grey/pink/light-green/yellow/ aquamarine/white/black/deep-red/dark-blue/ purple/dark-green/dark-grey)
Standards:	
Hertz:	(50/60)

Figure III: Display control panel

SOUND

The old sound capabilities of the IIe are still there. To prove them we ran a commercial music games suite of programs and Applevision under integer

Basic. Each behaved correctly.

However, the machine is also fitted with a 32 channel sound chip from Ensoniq known as the DOC (Digital Oscillator Chip) which can reproduce digitised sound with 15 voices. Two channels are used for each voice and one channel is dedicated as a clock for the DOC and one is reserved.

The sound quality, which is fantastic, owes itself to the output section of the DOC which is a DAC (Digital to Analogue Converter) and which can control the volume and the waveform of the sound. The system is fitted with its own 64k of ram which is enough for 15 seconds using all channels. Less channels gives longer time.

One piece of 16 bit software, a simulation of a tape deck/editor, gave 35 seconds of playback from 800k of disc space with fantastic clarity and quality although the sound plays through a speaker no bigger or better than that of the IIe. Digitised music and singing was very clear – no hint of computer tinniness. A stereo jack at the rear of the machine can improve output.

The DOC is interfaced to the system by the sound GLU which in turn is controlled by a sound manager which is part of the on-board toolbox (see later). This gives low level control and a higher level note synthesiser enabling polyphonic synthesis. Apparently digitised music may also be input via the ADC which forms part of the DOC.

The strident ring of the old bell warning you of the latest syntax error has been replaced by a softer sound, adjustable from the control panel in pitch and volume from the almost inaudible to the strident.

CLOCK

There is an on-board clock set via the control panel which tells the time and date. On the control panel the time format can be set for 24hr or AM/PM and the date format can be set in the English (DD/MM/YY) or American (MM/DD/YY) form and also in the form YY/MM/DD (Figure IV). The clock does not use the same formats and commands as the Thunderclock and thus applications have to determine their environment.

Old ProDOS (that is v.1.1.1) cannot use this clock but the new ProDOS 8 and ProDOS 16 can and do, using both date and time to stamp files.

The clock and the preferences of the control panel are maintained by a lithium battery soldered to the motherboard. This should have a lifetime of 5 to 10 years, which seems long enough but should it need replacing an expert at soldering will be required. As it is possible to get user-replaceable lithium batteries it will be interesting to see if such are substituted in future.

I/O

The two built-in serial ports work in parallel with slots 1 and 2 although not at the same time. They are designated as the

Month:	(1-12)
Day:	(depends on month selected)
Year:	(0-99)
Format:	(MM/DD/YY, DD/MM/YY, YY/MM/DD)
Hour:	(1-12 AM/PM or 1-24)
Minute:	(0-59)
Second:	(0-59)
Format:	(AM-PM or 24 hour)

Figure IV: Clock control panel

printer and modem ports respectively but are actually identical and can be configured in many ways (Figures V and VI).

The ports are provided by a two channel serial communications chip (SCC 8530 from Zilog) and RS422 driver ICs. The firmware support for the ports emulates the Apple Super Serial Card, presumably in the same way as the IIc's port does. This means that any IIe communications software and any software which supports a particular printer interface using the IIe card hardware directly is unlikely to work correctly on the GS. Presumably as a corollary, if such software works on the IIc it will work on the GS.

The AppleTalk interface is built into the GS but cannot operate with both serial ports active – one has to be relinquished when AppleTalk is selected at the control panel.

One temporary problem is that the serial ports emerge via 8 pin miniature DIN plugs which are not yet easily obtainable in

this country, although Apple dealers do have them. Other machines such as the portable Epson also use them.

The built-in drive port has its own firmware known as the SmartPort which includes some of the IIc software and which can be called by applications to perform various functions expected of block devices.

Two 3.5in, two 5.25in and a ram emulated drive are supported by SmartPort. However, under DOS, Pascal 1.2, and Pascal 1.3 I was not able to format discs in the 5.25in drive. Under Pascal they were formatted but the volume name could not be written and I got the write protected disc error.

Under DOS they were formatted but I got an I/O error. The drive was perfectly able to write to the same discs if I formatted them elsewhere! I hope this is a small problem easily cleared up. It should be remembered that the review machine was a prototype and not a production model.

```
Device connected: (printer/modem)
Line length: (unlimited/40/72/80/132)
Delete first LF after CR: (No/Yes)
Add LF after CR: (Yes/No)
Echo: (No/Yes)
Buffering: (No/Yes)
Baud: (9600/19200/50/75/110/134.5/150/300/600/
       1200/1800/2400/3600/4800/7200)
Data/Stop Bits: (8/1,8/2,5/1,5/2,6/16/2,7/1,7/2)
Parity: (none/odd/even)
DCD Handshake: (Yes/No)
DSR/DTR Handshake: (Yes/No)
XON/XOFF Handshake: (No/Yes)
```

Figure V: Printer port control panel

Another new I/O capability is the Apple desktop bus which is interrupt driven and can support not only the keyboard and mouse but also other devices such as hand controls and graphics tablets. The order of connection is immaterial as the bus knows which device is requesting a service.

The list of interrupt events used on the GS include interrupts from peripheral cards, video vertical blanking (used for mouse events, although a passive mode is also available) and video scan line, the mouse, AppleTalk network and timer, the keyboard, the two serial ports, the sound chip, the clock, disc interrupts and power up and reset.

In place of the ports provided on the rear of the machine the user can opt via the control panel program to use the seven, more traditional slots (Figure VII). These appear to work well with most IIe cards.

A common problem with the II+/IIe is one of timing mismatches with Z-80 cards but a Cirtech Z-80 card which worked well in the IIe under CP/M v.2 also worked well in the GS (set to normal, slow speed), suggesting that there is a high degree of compatability. Similarly, a Digital Research Gold card running CP/M Plus worked fine.

I also tried a Blackboard parallel printer card and found no problems. Similarly an old disc II card in slot 5 or 6 worked faultlessly. Interestingly, when slot 5 was selected in order to support a drive II there, the Smart Port could still boot from the 5.25in drive connected to it via the 3.5in drive although the 3.5in drive was inoperative.

Booting can be from any chosen slot, or ram or rom disc, or the slots (and SmartPort) can be scanned from 7 downwards as on the IIe.

Running the GS at normal (slow) speed under ProDOS with a Cirtech 1mb RAM card – The Flipper – in slot 7 was apparently okay, but when any form of access to the Flipper occurred the directory appeared to be lost.

I tried the Flipper in other slots and switched off the Apple ram disc but try as I could the Flipper would not work. Nor would it be recognised by CP/M. Apple says that its memory card will work in the GS's slots but I have not been able to check this. (It seems somewhat unnecessary to have two mb of virtual disc space).

```
Device connected: (modem/printer)
Line length: (unlimited/40/72/80/132)
Delete first LF after CR: (No/Yes)
Add LF after CR: (No/Yes)
Echo: (No/Yes)
Buffering: (No/Yes)
Baud: (1200/1800/2400/3600/4800/7200/9600/19200/
       50/75/110/134.5/150/300/600)
Data/Stop Bits: (8/1,8/2,5/1,5/2,6/16/2,7/1,7/2)
Parity: (none/odd/even)
DCD Handshake: (Yes/No)
DSR/DTR Handshake: (Yes/No)
XON/XOFF Handshake: (No/Yes)
```

Figure VI: Modem port control panel

The games port appears on the rear of the machine as a 9 pin D-type connector as on the IIe. It also appears as a 16 pin DIL socket in the middle of the board. I connected my joystick there and played many games without problems as long as the system speed was set slow.

It will be interesting to see how long before interrupt driven games controllers and other devices appear which use the desktop bus rather than the games controller.

FIRMWARE

Firmware should appear on the GS in 128k of rom mapped into banks $FE and $FF but more can appear at $F0 to $FD. In fact our rom appeared in eprom on an extender board and was clearly a prototype since it signed on at boot up with Apple IIBF.

The rom contains the Applesoft Basic interpreter, the monitor, the I/O routines (including a memory manager) and resident desk accessories within a toolbox.

Basic appears to be the same as in the enhanced roms of the IIe/IIc. The most noticeable difference between this and the old Basic is the use of lower case commands and variable names is allowed. However, lower case is converted to upper case internally and so more variety with variable names is not gained.

The monitor is changed to reflect the new microprocessor, although major entry points appear at the same addresses as in the old. The old commands of the II+/IIe still work, but the display is new (Figures VIII and IX).

Although we did not have full instructions for the monitor it bore enough similarities to the original so that we could work it but we probably missed some important points on the way.

Memory is accessed in chunks of 64k unless the bank and a slash precedes the address. For example, from Basic a call –151 enters the monitor and the command 800I or 800L (upper and lower case are acceptable) will list from $800 in bank 0. The command FF/800L now lists from $800 in


```
Slot 1: (Printer port/your card)
Slot 2: (Modem port/your card)
Slot 3: (Built-in text display/your card)
Slot 4: (Mouse port/your card)
Slot 5: (Smart port/your card)
Slot 6: (Disc port/your card)
Slot 7: (Your card/built-in AppleTalk)
Startup slot: (Scan/1/2/3/4/5/6/7/ram disc/rom disc)
```

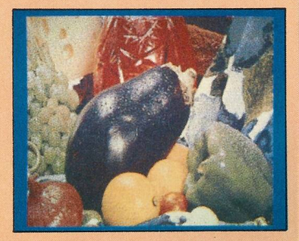
Figure VII: Slots control panel

the rom area.

A range of memory is still given in the form start.end and is followed by the command (such as V or M or just Return). Registers are examined by Control+E and I/O is still redirectable by Control+K and Control+P (as before DOS commands should normally be used).

Hexadecimal arithmetic is performed for 32 bit numbers with a 32 bit result for addition and subtraction and a 64 bit result for multiplication. There does not appear to be division. A hex number followed by an equals sign gives the decimal equivalent.

An exclamation mark enters a mini-assembler which understands the full 16 bit commands



(some are 4 bytes long) and 24 bit addresses of the microprocessor. Pressing Return in the address field exits back to the monitor. While in the monitor, besides Control+C and Control+B, Q will exit to Basic. The commands S and T bring up Step and Trace respectively although I could not perform such. I am not sure if they are supposed to, or if they are there to give compatibility with the old non-autostart rom.

The monitor is sufficiently similar to the old that I could easily discover and convert the table of command characters, and in doing so discovered other recognised commands such as P, backslash, quotation marks, Z, U, the underline character and Control+R and T. However, I could not discover their proper effects which presumably affect registers and flags of the microprocessor.

From remarks in our introductory manual the quotes are probably for searching memory for a sequence of bytes. U seems tied up with the toolbox in some way.

The toolbox is an idea more familiar to Mac than Apple II users. It serves two purposes, first to support the desktop user interface and second to make programming easier. Unfortunately we had no manuals for the toolbox and were therefore unable to use it directly.

However, the software we have seen, which presumably results in part from use of the toolbox, is quite impressive. The introductory manual describes the toolbox as having five main features. These are:

- The tool locator which handles the interface between the tools and the user. Tools are not only those provided but can be user written and reside in ram as well as rom.
- The memory manager.
- Quickdraw, which provides the primitive routines for drawing on the new graphics screens. It supports lines, rectangles (with square and rounded corners), ovals, polygons, arcs, pixel images together with text characters and strings. Calculations relative to images are also made.
- The Event Manager which is used to look after event driven applications which in turn may be using the mouse or windows or other interrupting events.
- Miscellany, which hosts a number of smaller tools to look after the clock, access peripherals, change vectors, take care of interrupt enabling and disabling and so on.

In addition there are tools to handle the desktop – windows, menus, icons and their needs, text via a line editor, and dialogue boxes – and desktop co-resident applications such as the classic control panel which can run in nearly all applications and others – described as non-classic – which run only in the new desktop environment, that is new 16 bit software applications.

Sound has its own manager which handles low level stuff such as sending data to the DOC and high level stuff to generate sound envelopes, to modulate pitch and volume and vibrato and to allow looped playback and so on.

There are mathematical tools which include single, double and extended resolution floating point arithemetic – 32, 64 and 80 bit computations – also 64 bit fixed point arithmetic. There is also integer arithmetic and interconversion between types.

There are two resident desktop accessories in the GS, the main one of which is the control panel. This is accessible at switch on time or while running many applications. (By the way at switch on the system may be set for 50 or 60 Hz display).

The control panel uses only the four arrow keys and Return to make all selections and is

```
1=m   1=x   1=LCbank (0/1)

FF/206A: A9 00        LDA #00
FF/206C: 80 20        BRA 208E (+20)
FF/206E: 5C 2C C2 30  JMP 30C22C
FF/2072: A0 80        LDY #80
FF/2074: 00 A9        BRK A9
FF/2076: 28           PLP
FF/2077: 00 20        BRK 20
FF/2079: 5C 1D 6B AA  JMP AA6B1D
FF/207D: BF 05 2A FF  LDA FF2A05,X
FF/2081: A0 21        LDY #21
FF/2083: 37 00        AND [00],Y
FF/2085: F0 E0        BEQ 2067 (-20)
FF/2087: C2 30        REP #30
FF/2089: 8A           TXA
FF/208A: 0A           ASL
FF/208B: 0A           ASL
FF/208C: 48           PHA
FF/208D: 0A           ASL
FF/208E: 63 01        ADC 01,S
FF/2090: FA           PLX
```

Figure VIII: Note the memory addressed at 206E, 2079 and 207D and some of the new op-codes

intelligent. For example, when selecting serial ports and AppleTalk you are warned that only two of the three are allowed, or when setting the date it is soon evident that the panel knows how many days there are in a month and about leap years.

SOFTWARE

Software is probably the most important factor in the success of a machine. The IIGS has old Apple II software to fall back on (although this was no guarantee for the Apple III) and hopefully will have new, 16 bit software to look forward to.

First the old. Last year, in a very forward looking editorial, Tom Weishaar of Open-Apple said, when talking of compatibility between any new machine and the old, that "compatibility means a microprocessor based on the 6502, Applesoft in rom, Apple II compatible memory mapping, Apple compatible slots, and 5.25in disc drives as standard equipment". He also said that unless the new could run Applevision it was not an Apple.

On these criteria the new IIGS is certainly compatible, but is that enough to test it fully? The most likely problem areas will be in display, accessing discs and using in-built routines, so I set about testing these.

First I played a number of games from the past, each based on a DOS formatted disc. All which booted played correctly except Microsoft's Decathlon which filled the text area under the graphics displays with 2s instead of clearing the area, but it went on to play correctly.

Some of the newer protected games would not boot on the 5.25in drive daisychained to the SmartPort.

I next tried utitilies such as Penguin's Graphics to test the display – all was well – and Disc

```
00/0800:00 19 00 0A 00 B2 20 20 2D 20 44 4F 53 20 33-.....2  -- DOS 3
00/0810:2E 33 20 48 45 4C 4C 4F 00 20 00 14 00 B2 20 00-.3 HELLO. ...2 .
00/0820:28 00 1E 00 89 3A BA 00 2E 00 28 00 97 00 54 00-(....:....(...T.
00/0830:32 00 BA 22 53 4C 41 56 45 20 44 49 53 43 2C 20-2..:"SLAVE DISC,
00/0840:49 4E 49 54 49 41 4C 49 53 45 44 20 38 2D 37 2D-INITIALISED 8-7-
00/0850:38 31 22 00 76 08 3C 00 BA 3A BA 22 41 50 50 4C-81".v.<.:::"APPL
00/0860:45 20 49 49 20 50 4C 55 53 20 4F 52 20 52 4F 4D-E II PLUS OR ROM
00/0870:43 41 52 44 22 00 7D 08 46 00 B2 20 00 9F 08 50-CARD".}.F.2 ...P
00/0880:00 B2 20 2D 2D 50 4F 4B 45 20 4C 41 4E 47 55 41-.2 --POKE LANGUA
00/0890:47 45 20 43 41 52 44 20 46 49 4E 44 45 52 00 F0-GE CARD FINDER.p
00/08A0:08 5A 00 B9 37 36 38 2C 30 3A B9 37 36 39 2C 31-.Z.9768,0:9769,1
```

Figure IX: Monitor memory dump

Arranger to test displays and disc accesses. Again all was well. Pressing ahead on disc accesses I tried Locksmith v.5.0 which worked and the Speed-Loader from Basug. This would not load without crashing into the monitor.

I suspect that this is due to a timing problem or just maybe the use of an illegal 6502 call because Speedloader will not work on a II+ fitted with a 65C02, However, a disc of programs created by Speed-loader on an Apple II+ loaded perfectly on the GS.

To test the use of machine routines I first tried Microsoft's Tasc compiler on the sample program and Penguin's Shortcuts with the "samplers". All was well.

I tried AppleWriter II/DOS and it failed completely, hanging the machine. This was intriguing, so I tried AppleWriter IIe/DOS. This at first seems to work, except for mouse characters appearing in the display bar at the top of the screen, but characters typed at the keyboard do not appear on the screen.

The use of the backspace at this point hung the computer, but Control+Q instead, followed by asking to quit and then changing my mind, seemed to allow the program to work correctly. Again very intriguing. So I tried AppleWriter IIe/

ProDOS, and this worked.

As a further test I tried Nikrom's Apple IIe diagnostic disc and found what I expected, namely the machine behaved as a IIe with extended 80 column card present. Of course, rom did not match up to the test, but just about everything else did.

I booted AppleWorks (which now comes on 3.5in discs and 5.25s) and used it extensively without any problems, although I was mildly surprised to find I had only a 55k desktop. Partly to overcome this I ran it at the fast processor speed from the 1mb ram disc – which is very impressive.

To test further I used CP/M v2.2 with a Cirtech Z-80 card which behaved faultlessly and CP/M Plus on a Digital Research Gold Card which also worked but the display was sometimes jittery. (Readers who have not seen this card should know that it handles video output.)

UCSD Pascal v.1.2 and v1.3 also worked faultlessly except for the formatting problem referred to above. Version 1.3 recognises the extra memory as a virtual disc called RAM5: and can start up from the 3.5in drive but not from RAM5:, at least not without patching.

Using old software is all very well to tide us over until the new arrives, but with the capabilities of this machine we can expect a lot more. Appleworks is very good on it, but think how nice AppleWorks with desktop accessories, graphics and communications built-in would be.

We got a taste for the future from the experimental software which came with the machine on 3.5in discs, and boy does it look good!

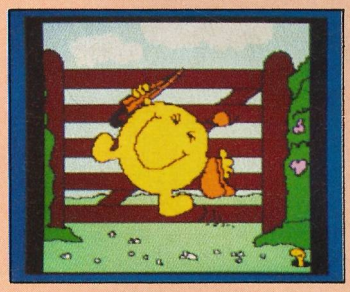
First was a new version of Mousedesk. Actually this was the least exciting of the samples, partly because it did not know about colour screens. Strange colour fringing effects, reminiscent of text on the hi-res screens in early games, made it almost illegible with a colour display selected, although it was perfectly clear on monochrome. Presumably this will be overcome in the final version.

Sound was remarkably well demonstrated by the mouse-operated tape deck and vision by a colour slide program. The resolution and colour of the pictures are superb.

Perhaps the most visually exciting piece was a "mouse paint" program analogous to MacPaint on the Macintosh but in full colour with other goodies thrown in such as the ability to animate a sequence of pictures and to save drawings as screens as well as mouse paint pictures.

The colour palette may be edited and selections made from 4096 colours and shades. A particular colour may be searched for in two ways. Running the mouse over the picture highlights the corresponding colour box at the bottom of the screen and running the mouse over the colour boxes highlights the corresponding colour on the screen. All of this is so fast it's almost unbelievable.

Finally there was a disc



which booted to give a programmer's workshop environment. This was called the CPW – the C stands for Cortland which harks back to an early code name for the machine.

In this environment, which operates under ProDOS although the user does not see it directly, several languages – among them a 16 bit macro assembly, C, and hopefully other compilers for other languages, come together to use common tools.

There is a standard file format which allows for relocatable program segments, possible from other languages, which may be dynamically loaded and library units available to each language.

How much of this exists for which languages I do not know – there is certainly a full 16 bit macro assembler and a C compiler together with an editor, a linker and a debugger.

There are also utilities to handle disc functions and, of course, the toolbox is there to be used.

All of this software came on experimental 8 bit and 16 bit ProDOS. ProDOS 1.1.1 ran perfectly on the machine, but apparently a new 8 bit version known as ProDOS 8 – which will run on other Apple IIs – has the ability to take advantage of some of the IGS's new features.

Also there is a ProDOS 16 which supports all the features of the GS but which runs only on the GS. Each of the ProDOS versions, old and new, use the same disc formats so files are interchangeable between discs but will not necessarily operate correctly on all machines.

The system loader automatically loads the appropriate version of ProDOS, depending on what it finds on disc.

THE FUTURE

The Apple II succeeded because of its graphics (advanced at the time), its approachability for software and hardware engineers and the different operating systems available such as DOS, the p-system and CP/M. It also got a boost from Visicalc.

The new machine has the advanced graphics and sound, the approachability, the old operating systems to fall back on and AppleWorks in place of VisiCalc. It has good quality software to tide it over until even better new stuff appears.

I'm sure that an even better AppleWorks will appear, and an MSDOS capability is promised from at least one third party. This will be interesting because it could be offered on the 3.5 or the 5.25in disc format or both.

IBM and most software seems to support 5.25s but the IBM portable has 3.5in. Old disc II drives would not be able to support MSDOS and so new drives will have to be bought by anyone wanting to upgrade.

In the long run 3.5in drives must be the favourite. The IIGS will take SCSI cards so that an external hard drive can be connected. I wonder if anyone will attempt to make an internal hard drive. It could be done given the space above the motherboard.

Under ProDOS, with Appletalk capability, I'm sure that word processors and other software will soon know how to talk to the Laserwriter and the possibility of such printers in general use will help their price to drop.

The price structure, which ranges from approximately £900 for the basic machine up to £2300 for everything including 20mb hard disc is similar to other business machines but roughly twice that of the new Amstrad with MSDOS. However, if you follow that path you are buying old technology.

You only have to see the GEM desktop system after viewing what the Apple IIGS has to offer in order to see that.

Finally, this is a machine which Apple II users will love and I suspect new business users will soon come over to.

You've got just 4 days to discover the power to succeed.

October 29th, 30th, 31st and November 1st are the days. The Business Design Centre in London is the place.

And AppleWorld is the event — the most important personal computer event ever held in this country.

Whether you use an Apple™ II™ or a Macintosh™ in business or education, you'll find a mind-boggling amount to fascinate you.

For one thing, we're using the exhibition for the public unveiling of the revolutionary new Apple IIGS.™ It's fast, powerful, communicative and colourful. And it can run every existing Apple II program.

Of course, all the major software developers will have a stand for demonstrations of their products. The very latest solutions for business, communications, design and education will be on display. And products that you've read about – like Apple's DeskTop Publishing System — and perhaps considered buying, will be on show.

To get in on AppleWorld, contact your local dealer. He'll give you more information about registering for the most important Apple event this year. Or dial 100 and ask for Freefone Apple.

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