IBM's NEXT GENERATION

The IBM PC-AT had claims made for it on its release that it not only harnessed the most advanced technology (hence the 'AT') but also surpassed the original PC in both power and speed (not hard...). Since then there's been a fair bit of controversy about how good the AT is, and claims that it's suffering from too many bugs to be commercially useful. Lloyd Borrett took a look at one of the new machines.

On August 14 1984, three years after the introduction of the first IBM Personal Computer, IBM US released the Personal Computer AT (for Advanced Technology). The PC-AT is an Intel 80286-based microcomputer that dwarfs the original PC in computational speed and power.

But not only did IBM release this new-generation microcomputer, it also announced three new operating systems (PC-DOS 3.0, PC-DOS 3.10 and XENIX), a local area network (PC Network), and a windowing environment (Topview). In the months since August there have been more announcements: Virtual Device Interface, Enhanced Graphics Board, and Professional Graphics Controller are just a few.

That is a *lot* for the industry to think about. To this day the sages of the microcomputer world are still trying to assimilate it all, but let me give you my brief version of what it all means. I'll start from scratch with the IBM PC-AT.

IBM Listened
This is one very fast, well thought-out machine. I've had one since early November and I'm impressed. IBM has listened to many of the criticisms levelled at the original PC and done something about them.

A lot of people thought the original PC should have been based on the Intel 8086 chip instead of the 8088. Actually I thought it was a wise move at the time; the 8086 wasn't readily available, and more importantly nor

were the 16-bit bus support chips required. The chips necessary to build an 8-bit bus system based on the Intel 8088 were not only available, but a lot cheaper. The real criticism here is that IBM should have released an 8086 or 80186-based system twelve to eighteen months ago when the market was ready for it. Its opposition did.

Well, IBM has answered the opposition by leaping ahead to an Intel 80286-based system, the PC-AT. Forget that IBM says you can only have three megabytes of memory, because the 80286 chip can address 16M of memory, and AST Research has already announced a multi-function board with 256K, expandable to 3M. In fact, running in its native mode the 80286 can support four tasks, each of which can use one gigabyte of virtual memory; the chip has all the instructions necessary to perform the required memory management. But let's come back to earth.

The Frilly Bits
The keyboard has been changed! Shock, horror! As a two-finger-and-thumbs typist, I actually *liked* the old keyboard. Quite a few people expressed other opinions, and IBM changed it. With over two years pecking out letters on the old keyboard the new one takes a little getting used to, but it *is* better. So there are now three keyboard layouts in use within the IBM's Personal Computer family: on the original PC, the 3270/PC, and the PC-AT.

Two of the really nice touches are the two-speed, temperature-controlled cooling fan and the lock. The new fan makes this system a lot quieter than any other member of the PC family, and in many office situations that can be a real blessing. When locked the PC-AT can be switched on but not used. The operating system won't boot, and the cover can't be removed. Once you're up and running, locking the system makes the keyboard inoperative.

Yes, I know these are but little frilly bits to many of you, but to those who use a computer for extended periods in the typical office environment they are quite important.
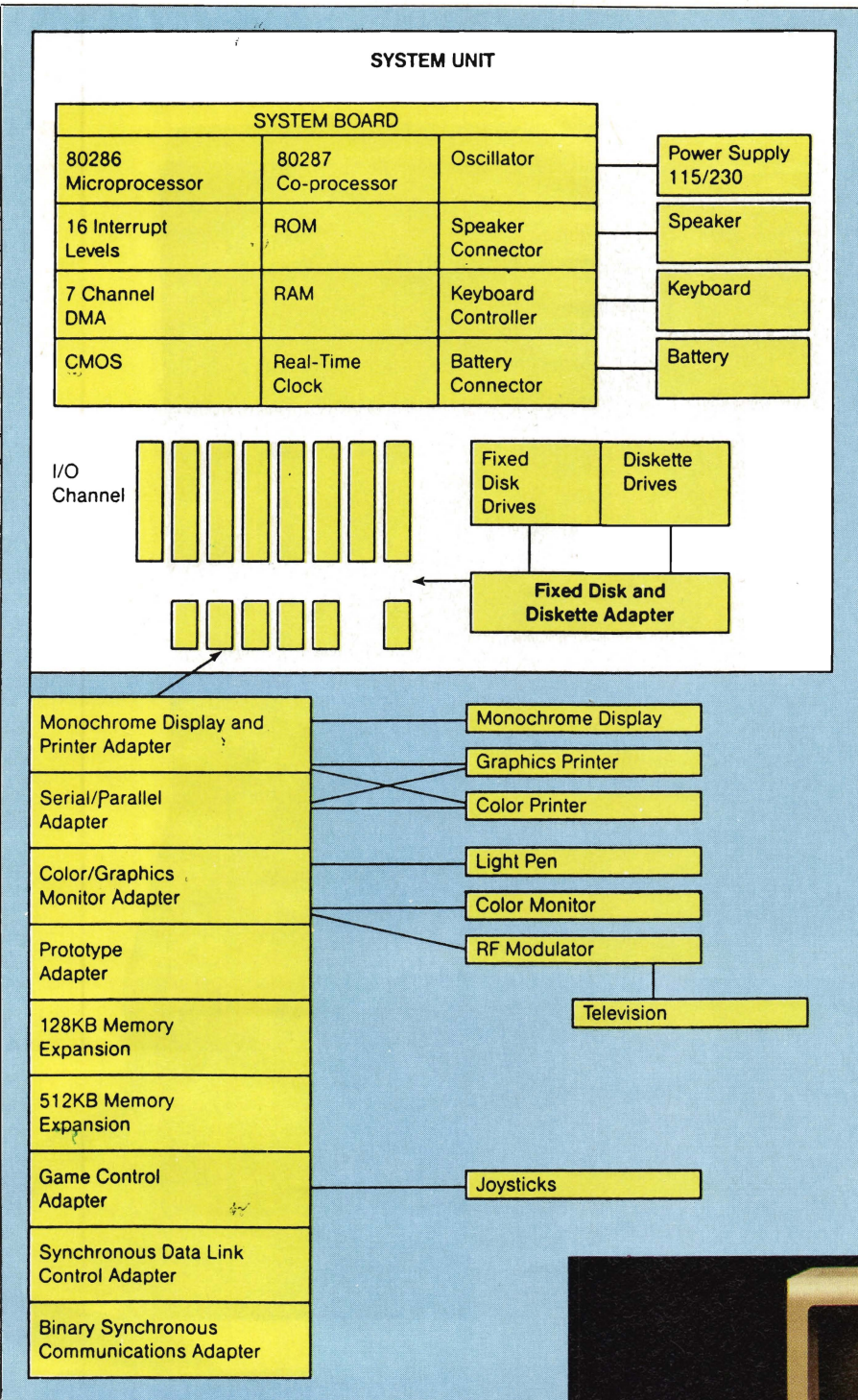
The Meat in the AT
Okay, let's get to the meat of it. The PC-AT comes as two models. The base model gets one half-height 1.2M diskette drive and 256K of memory, while the up-market one gets an additional full-height 20M fixed disk drive, serial and parallel ports, and a total of 512K of memory.

Disk storage can be further extended by adding a second 20M fixed disk drive, or your choice of a second 1.2M diskette drive or a half-height 320/360K diskette drive. (There is every chance that someone will come up with a way to add a half-height 20M fixed disk drive when two half-height diskette drives are already installed.)

This next bit isn't as confusing as it may first sound: you can use the 1.2M diskette drive to read and write to 1.2M diskettes with the 1.2M format, but you can't read these diskettes in existing 320/360K diskette drives. Well, you'd expect that, wouldn't you? But get this. You can use 1.2M diskette drives to read and write to 320/360K diskettes with the 320/360K format. Now for the catch. Once a 1.2M diskette drive has written on a 320/360K diskette, that diskette *can't* be read in a 320/360K diskette drive.

As the PC-AT I'm using doesn't yet

SYSTEM UNIT

SYSTEM BOARD

80286 Microprocessor	80287 Co-processor	Oscillator	Power Supply 115/230
16 Interrupt Levels	ROM	Speaker Connector	Speaker
7 Channel DMA	RAM	Keyboard Controller	Keyboard
CMOS	Real-Time Clock	Battery Connector	Battery

I/O Channel

Fixed Disk Drives	Diskette Drives

Fixed Disk and Diskette Adapter

Monochrome Display and Printer Adapter	Monochrome Display
Serial/Parallel Adapter	Graphics Printer
Color/Graphics Monitor Adapter	Color Printer
Prototype Adapter	Light Pen
128KB Memory Expansion	Color Monitor
512KB Memory Expansion	RF Modulator
Game Control Adapter	Television
Synchronous Data Link Control Adapter	Joysticks
Binary Synchronous Communications Adapter	

System diagram of the AT.

have a 320/360K diskette drive, and I like to move my work around between the various systems based on availability, that often eliminates the PC-AT from contention. Think carefully as to whether you should add a 320/360K diskette drive if buying a PC-AT; I would be very hesitant about adding a second 1.2M diskette drive.

The 512K of memory available on the motherboard is referred to as

base memory. To get 640K of base memory, as in the PC and PC-XT, an additional 16-bit bus 128K memory expansion card must be purchased. The 512K memory 16-bit bus memory expansion cards available from IBM go into the *extended* memory area above the one megabyte limit of an Intel 8088. Extended memory will be fully exploited by XENIX when it becomes available. PC-DOS 3.x can only use it as a RAM disk.

There are eight full-length expansion slots in the PC-AT. Six support both the old 8-bit and the new 16-bit bus, two support only the 8-bit bus. Some of the current option boards can only be used in the two 8-bit bus slots, while others can't be used at all. The IBM colour graphics adapter board is an example of one that must be in the 8-bit bus only slots.
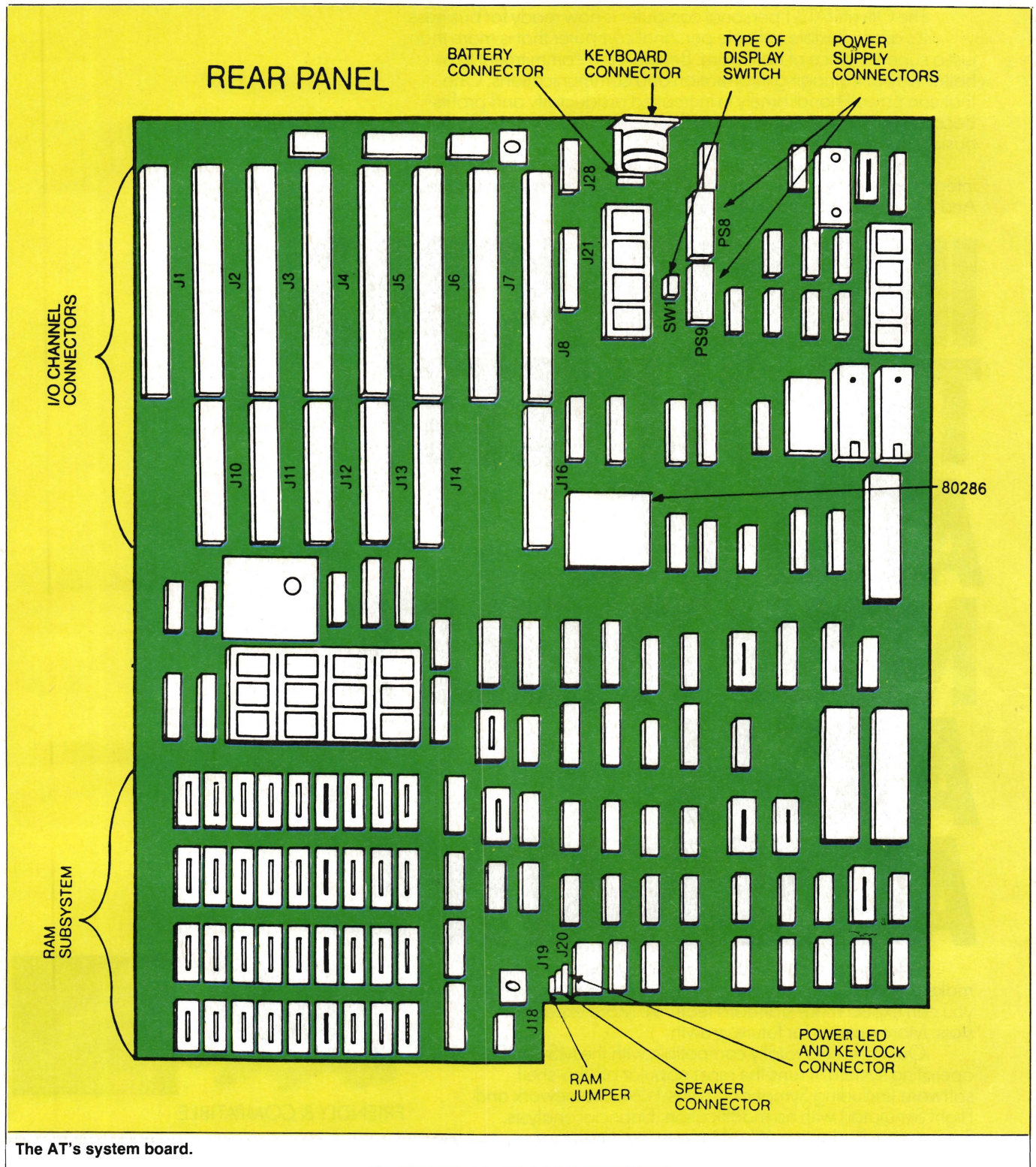
The new combination parallel and serial adaptor uses the same 25-pin connector for the parallel port, but a 9-pin connector for the serial port! If only they were the other way round! I'll rarely use that parallel port, but now I've got to get special communications cables made up for the serial port.

The PC-AT uses a CMOS RAM and a rechargeable battery to store the hardware configuration, instead of switches on the motherboard. This saves having to open up the box and reset switches when different combinations are being tested. Believe me, there are times when you really wish you didn't have to keep taking the cover off and putting it back on. The battery also keeps the built-in calendar clock going.

The Software

Now for the *really* important stuff, the software. To use the PC-AT, PC-DOS ▶

REAR PANEL

BATTERY CONNECTOR

KEYBOARD CONNECTOR

TYPE OF DISPLAY SWITCH

POWER SUPPLY CONNECTORS

I/O CHANNEL CONNECTORS

J1 J2 J3 J4 J5 J6 J7

J28

J21

J8

J10 J11 J12 J13 J14

J16

PS8

SW1

PS9

80286

RAM SUBSYSTEM

J19 J20

J18

RAM JUMPER

SPEAKER CONNECTOR

POWER LED AND KEYLOCK CONNECTOR

The AT's system board.

3.0 is required. It has the changes necessary to support the new 1.2M diskette drive, the 20M fixed disk drive, the calendar clock, and so on. There are a few nice additions to DOS 3.0, such as an IBM-supported RAMDISK driver, a change volume labels command, and an enhanced print command. The one I like the most is the ability to use the COUNTRY= option in the CONFIG.SYS file to specify Australia. Most of the DOS commands then display the time and date in our format instead of the usual US format.

If you're an existing user of DOS 2.0 or 2.10, I wouldn't rush out and buy DOS 3.0; the few extra nice bits aren't really worth the additional expenditure. Okay, you would get a few new features, but it also uses more memory. Wait, and buy DOS 3.10 when you want PC Network support later on.

Incompatibility?

Currently there is one big problem

with the PC-AT: not all the existing PC software will run on it. In fact quite a fair amount of it won't. But, in the words on the cover of that infamous book, DON'T PANIC.

This is a problem that has been coming for a long time. When a manufacturer provides the programmer with an operating system to access the hardware, it is expected that the programmer will use the interface defined by the operating system. But there are always programmers who are smarter than that, and for various reasons decide to bypass the operating system. In the case of the PC they either use the BIOS code in ROM on the motherboard, or go direct to the hardware itself.

These programmers can always justify why they do this. Strangely enough, they are also the first to complain when the manufacturer changes the rules, and their software stops working. In the PC-AT, IBM has made some significant hardware changes, and also changes to the ROM on the motherboard. Result scratch quite a few programs.

In most cases the reason the programs no longer work is that they are doing direct ROM BIOS and hardware calls in order to implement various copy protection mechanisms. The 1.2M diskette drive and 20M fixed disk drive required some major changes that have brought such programs unstuck. Those of you who already know my opinion of copy protection mechanisms will understand how this is giving me a warm feeling inside. I try to avoid programs that are protected, or can't be unprotected – all the programs I have in day-to-day use run on the PC-AT.

New 'fixed' versions of most programs that don't currently run on the PC-AT are in the pipeline;

| APPLICATION LAYER |
| PRESENTATION LAYER |
| SESSION LAYER |
| TRANSPORT LAYER |
| NETWORK LAYER |
| DATA LINK LAYER |
| PHYSICAL LAYER |

The ISO System Interconnection Model.

examples include Framework, dBase III and Symphony. But what's the bet these programs will still bypass the DOS interface? That means they are likely to get caught again real soon.

One good thing programs bypassing the DOS interface do is provide compatibility tests. Programs such as Microsoft's Flight Simulator and the Norton Utilities have been used by reviewers as the classic test as to how compatible XYZ's new lookalike really is. These same reviewers have used the fact that such programs have problems running on the PC-AT to write nice sensational stories about how incompatible the PC-AT is.

Apparently there have been problems with the 20M fixed disk drives on a few PC-ATs in the US, and that too makes great copy. Because IBM has such a long-standing reputation for not having such problems, any that surface are given wide coverage. At the same time, some rather fundamental problems with other systems are quite often glossed over. I know a number of other users of the PC-AT in Australia, and only one has had a problem – a faulty memory chip.

It's Fast
Okay, I've already said the PC-AT is fast, and those who have used it would certainly agree. But how fast is it?

Well, all the benchmark tests I've done indicate that the AT outperforms the XT and PC by three to one on memory or calculation-intensive tasks. A specific example is a Lotus 1-2-3 spreadsheet that took 300 seconds to recalculate on the XT and only 110 seconds on the AT.

When comparing the I/O performance of the 20M fixed disk drive on the AT against the 10M fixed disk drive on the XT, the ratio is two to one. A read/write test of 5000 random records took 415 seconds to finish on the XT and 190 seconds on the AT.

IBM's Local Area Network
I believe the most significant parts of the August announcements are PC Network and DOS 3.10. The network is an important strategic move for IBM, notable for what it does and doesn't do. First, it's not Ethernet. Second, it's not compatible with any of the other major contenders for the network crown. Third, it's a network

for PCs and true PC compatibles, not for other microcomputers. Fourth, it's not supported by XENIX. Finally, it's IBM's own interface.

PC Network is not IBM's planned overall token-passing network. It is a broadband-based PC network specifically designed to interconnect personal computers. IBM has promised there will be a gateway between the PC Network and the token-ring, cabling system-based network, and IBM has traditionally made good on such promises.

The broadband-based IBM PC Network was mostly built by Sytek, a Californian LAN specialist, but significant parts of the network's design are IBM's.

The board components are separated by the logical function they perform, roughly along the lines specified for the different layers of the open systems interconnection (OSI) model now being defined within the International Standards Organisation (ISO). By replacing the coaxial-cable electronics with circuitry for twisted-pair interface, and CSMA/CD control with token-passing, a similar board could accommodate IBM's proposed token-ring network.

It is significant that only layers three to five of the OSI model (network, transport and session levels) are Sytek-developed. While the network is open to software developers, the communications protocol embedded in layers three to five is the property of Sytek. Sytek technicians say there is no way anyone can build an interface card to the PC network without a licence to use that protocol or the IBM PC Network board itself.

The all-important layer seven (user/device/application interface level) is implemented via an 8K Network Basic Input/Output System (NETBIOS) ROM which IBM defined. So be wary of the recent Sytek advertisements which claim buying their product now is the same as buying IBM's PC Network.

IBM's PC Network is obviously aimed at its large competitors. Going with Ethernet or some *de facto* standard would have aided Xerox or another large vendor, so IBM chose to go its own way. It's not hard to guess they're hoping PC Network will become the new *de facto* standard.

What does this mean? Well, finally