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MARCH 1985

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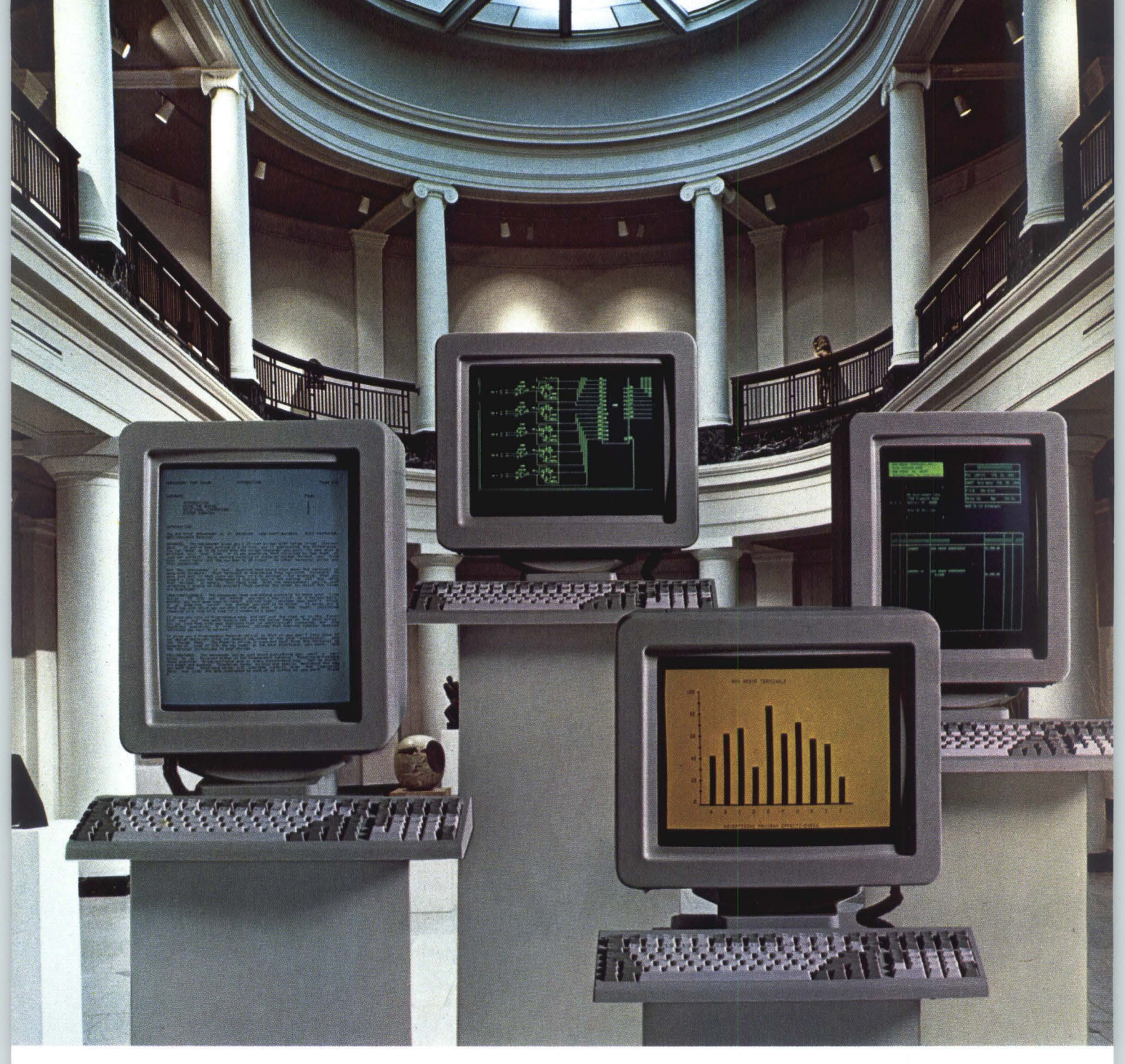

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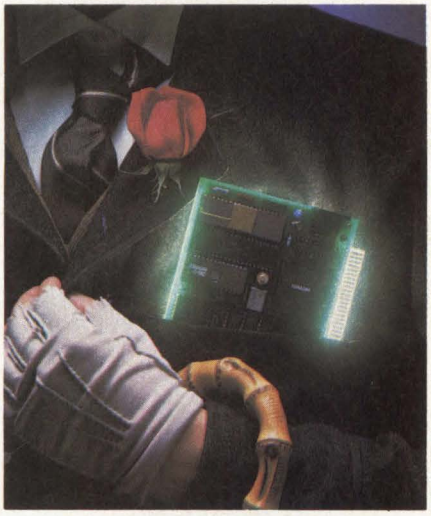

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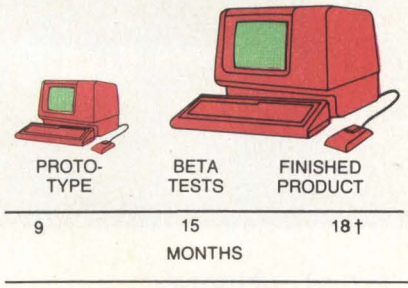

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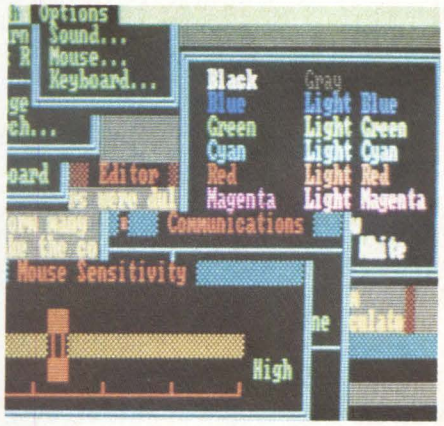

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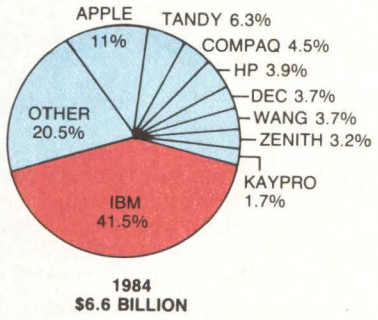

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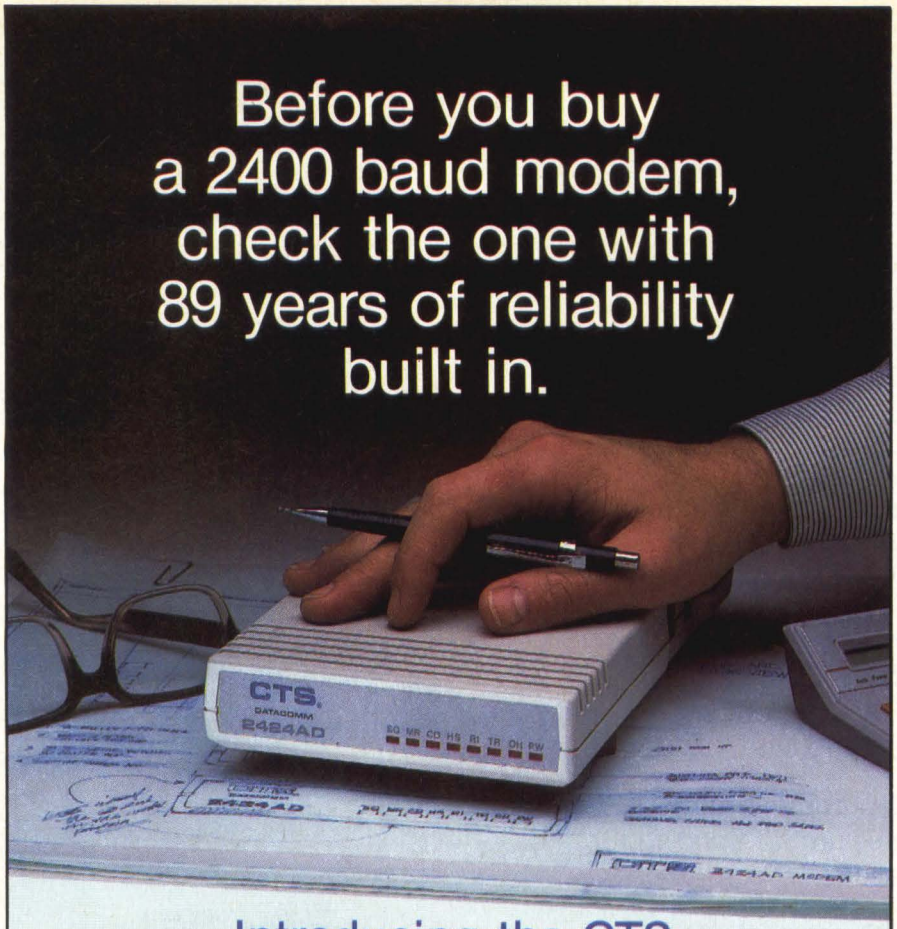

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Editorial Offices

Boston: 221 Columbus Ave., Boston, MA 02116. (617)536-7780. **Irvine:** 2041 Business Center Dr., Suite 109, Irvine, CA 92715. **Los Angeles:** 12233 W. Olympic Blvd., Los Angeles, CA 90064. **San Jose:** 3031 Tisch Way, San Jose, CA 95128. **London:** P.O. Box 37E, Worcester Park, Surrey, KT4 8RQ, England.

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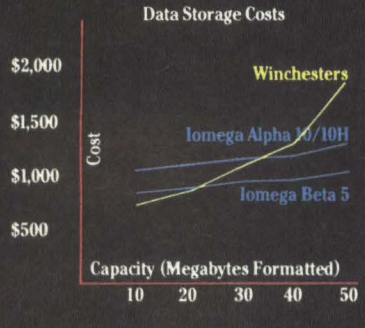
A DECLAR
DATA INDE

When In The Course Of Business Events . . .

OEMs designing systems for today's businesses face two realities. One, data processing is rapidly becoming more decentralized. It is pushing outwards into individualized work units, defined more by job function and applications, performed by more people in more places, demanding more data flexibility—more data independence.

Which brings OEMs face to face with a second reality. Winchesters. Because the prevailing mass storage technology—in the form of large storage units used for access or downloading, or smaller, high capacity desk-top mechanisms—continues to head in the opposite direction. Rather than freeing users to operate effectively in the new environments of distributed data processing, Winchesters keep them device-dependent, keep them tied to a shared system of storage.

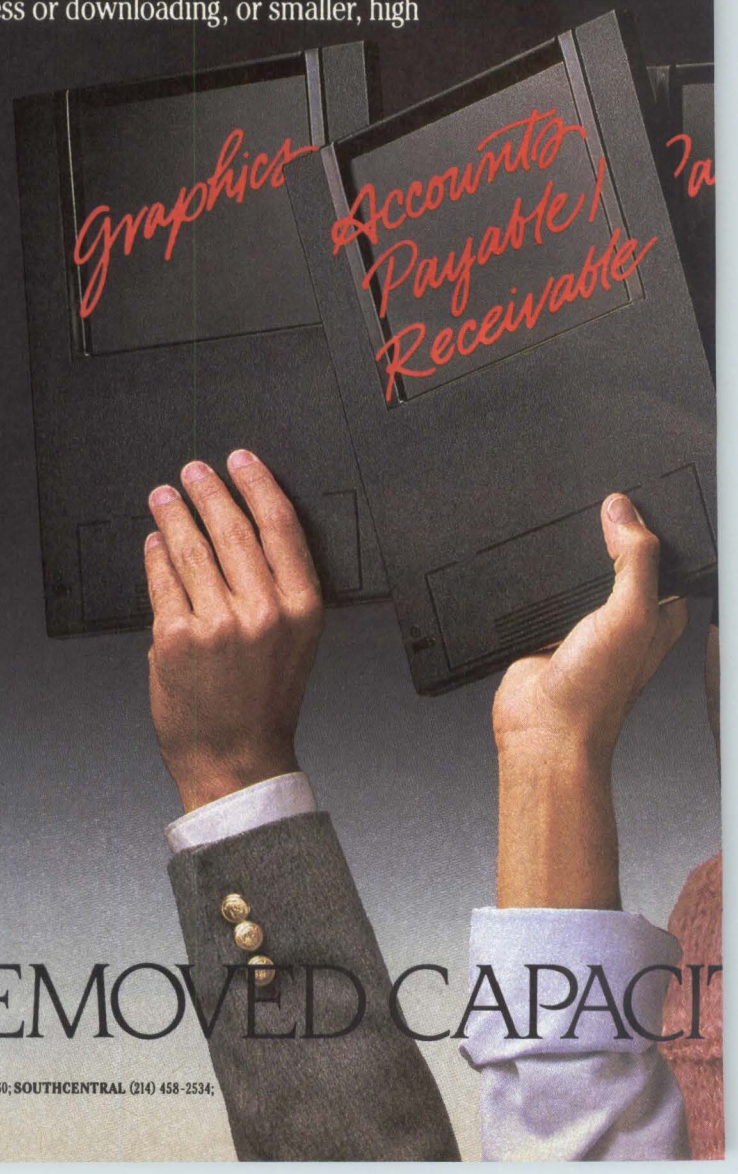


Slavery By Any Name . . .

There are lessons here. That the central issue isn't more data, but more data dynamics. And that Winchesters are hardly data dynamic at all.

Consider the aggravations of "wait your turn" access, or the need for lots of "system savvy" on the user's part. Consider the time consumed in backing up and restoring data. And consider the ever-present risk of a system going down or files lost to expensive head crashes.

Now consider the alternative.



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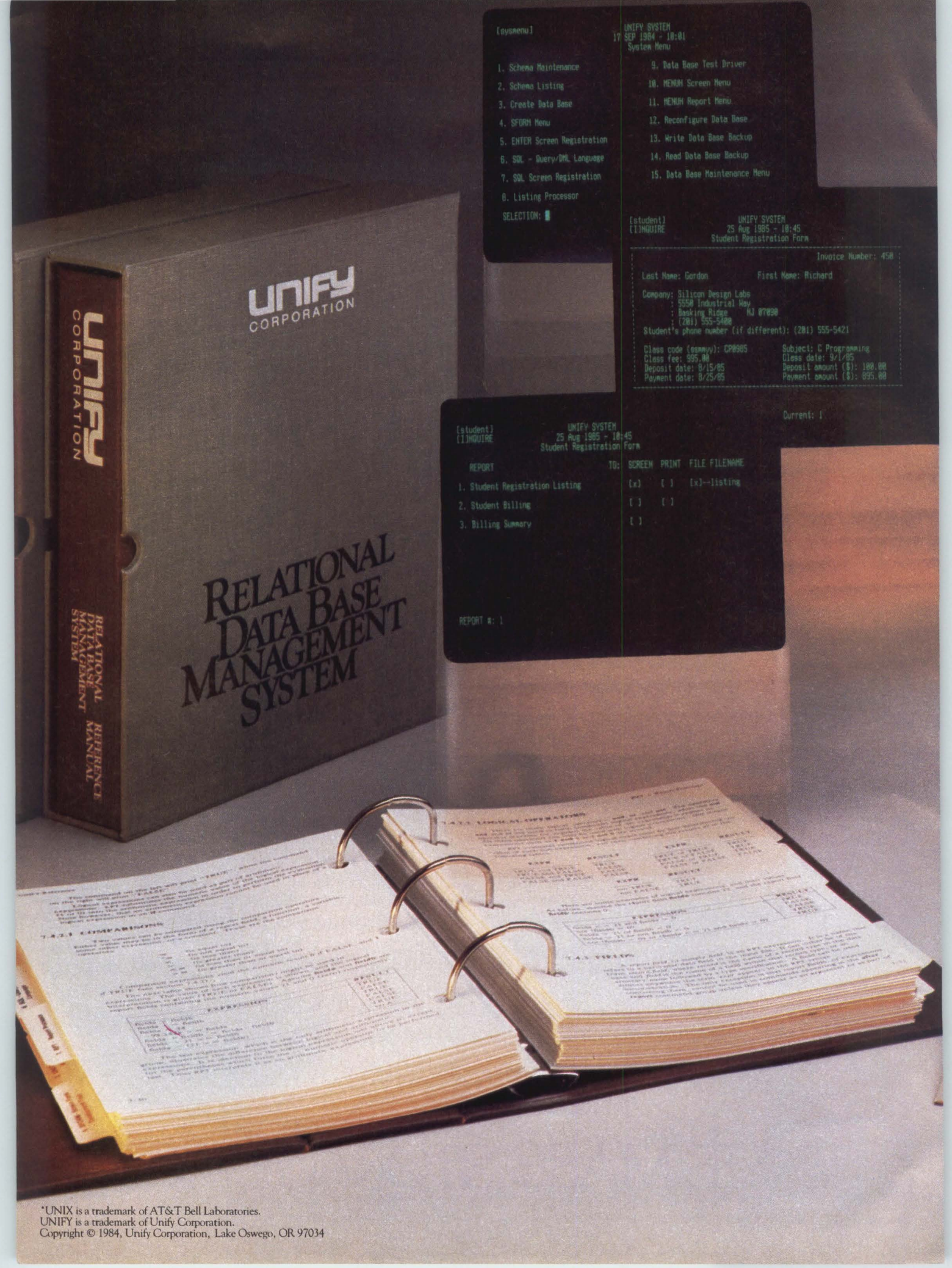

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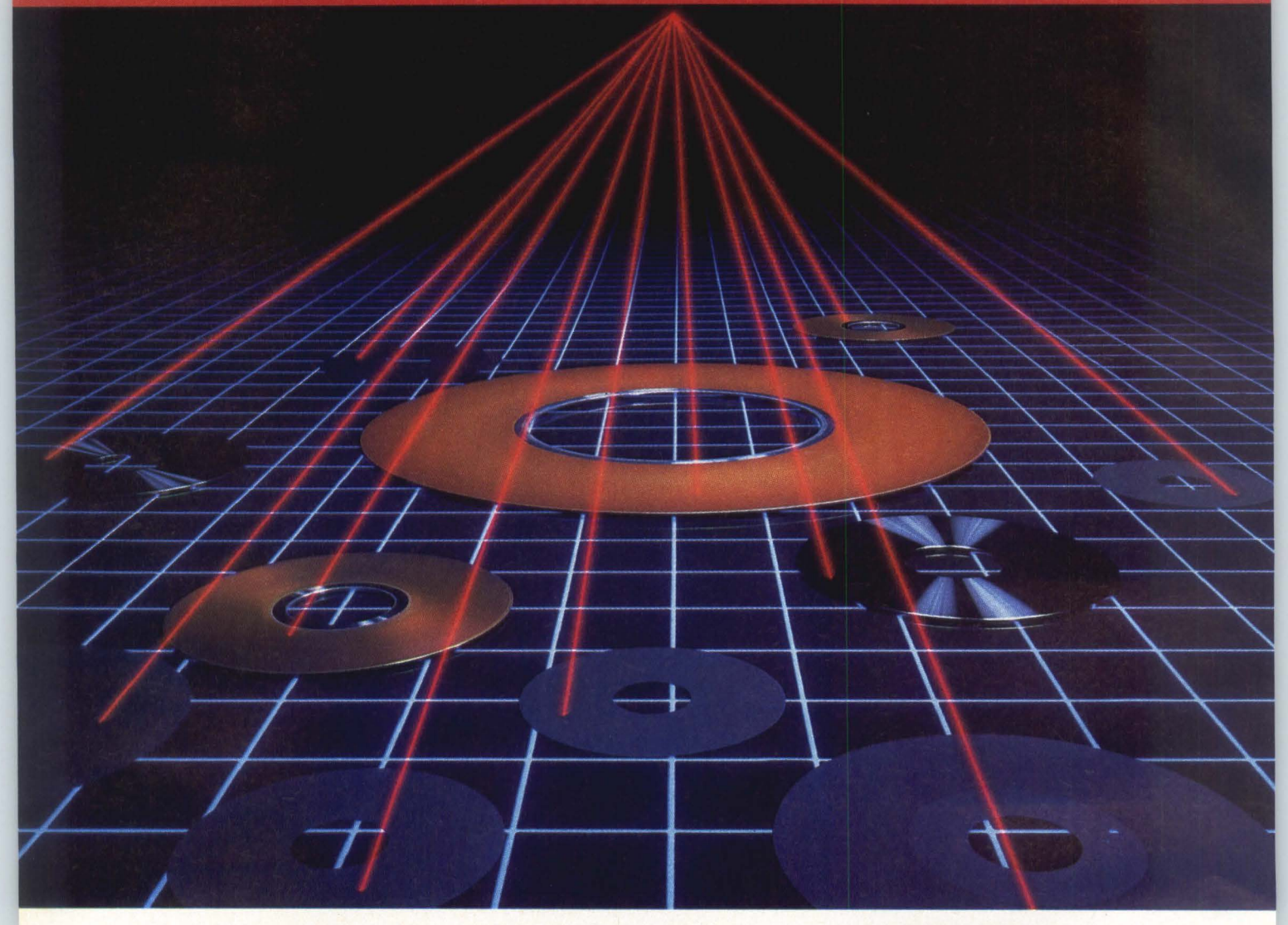

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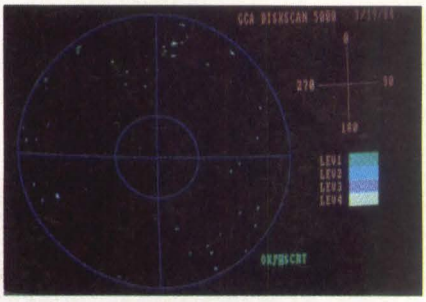

Typical disk defect map.

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EDITORIAL

PERSONAL COMPUTER MARKET GROWTH DECELERATES

According to InfoCorp, a Cupertino, Calif., market research company, bankruptcy, poor financial results and layoffs have become commonplace among computer and peripheral manufacturers. Based on their recent study, *"The Personal Computer Market, The Pieces Add Up to a Slowdown,"* the two key causes center on industry maturation and a softening U.S. economy. Both have created computer-market conditions that have exposed deficient product sales strategies. The report concludes that the decline in high-end, personal-computer sales has rippled down to, and is similarly affecting, computer-system, mass-storage-device, media and component sales.

On the bright side, though, personal-computer shipments totaled more than 7.5 million units during 1984, states International Data Corp. (IDC), a Framingham, Mass., research company. Furthermore, IDC claims that 1985 computer shipments will exceed 9.6 million units. The growth rate, however, will slacken to about 28 percent. Recent years have rung up growth rates in excess of 50 percent.

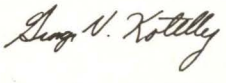
Similar analyses are presented by International Resource Development Inc. (IRD), a Norwalk, Conn., research organization. IRD estimates that 1985 personal-computer shipments will increase to about 7.6 million, a 36 percent growth rate over 1984's 5.6 million. The ever-expanding, installed personal-computer base, says IRD, is limiting percentage growth.

If computer shipments are still increasing, then why is the market's growth rate slowing down? Industry experts all agree that the omnipresence of IBM Corp. shakes and moves the personal-computer marketplace. In 1984, according to Future Computing Inc., a Dallas research house, IBM emerged as the sales leader in the office personal-computer market. IBM grabbed 41.5 percent of U.S. market share with revenues of $2.75 billion. Over the past two years, IBM has more than doubled its market share, while runner-up Apple Computer Inc. has dropped to 11 percent from 22 percent. Trailing far behind, in third and fourth place, respectively, are Tandy Corp. at 6.3 percent of market share and Compaq Computer Corp. at 4.5 percent.

This surge to the forefront by IBM has caused a shakeout in the personal-computer industry. Companies that ranked high in sales and profits in 1982, such as Columbia Data Products, Eagle Computer Inc., Franklin Computer Corp. and Osborne Computer Corp., have dropped out of the market or been pushed to the brink. Therefore, fewer companies are producing more computer products. And because fewer computer manufacturers need less product support, the number of peripheral-device vendors is shrinking rapidly. In particular, disk drive companies are down to a precious few.

The survival tactic for 1985, say industry experts, in unison, lies in the value-added reseller (VAR) sales channel. Conceding the computer retail channel to IBM, Apple, Tandy and Compaq, the remaining competition is, therefore, moving briskly to establish growth positions in vertical VAR markets. For example, IDC claims that VARs sold $4.3 billion worth of microcomputers in 1984. In 1985, VAR sales should top $5.8 billion, and reach $13.9 billion by 1989.

But the VAR channel looks good to IBM as well. Future Computing says that IBM will have 500 value-added dealers (VADs) in place during 1985 and will sell about 170,000 personal-computer systems. The key determinants for future success in the computer market, therefore, says George D. Elling, vice president and security analyst at New York-based Oppenheimer and Co. Inc., include strong, new products and solutions targeted to high-growth, vertical markets.



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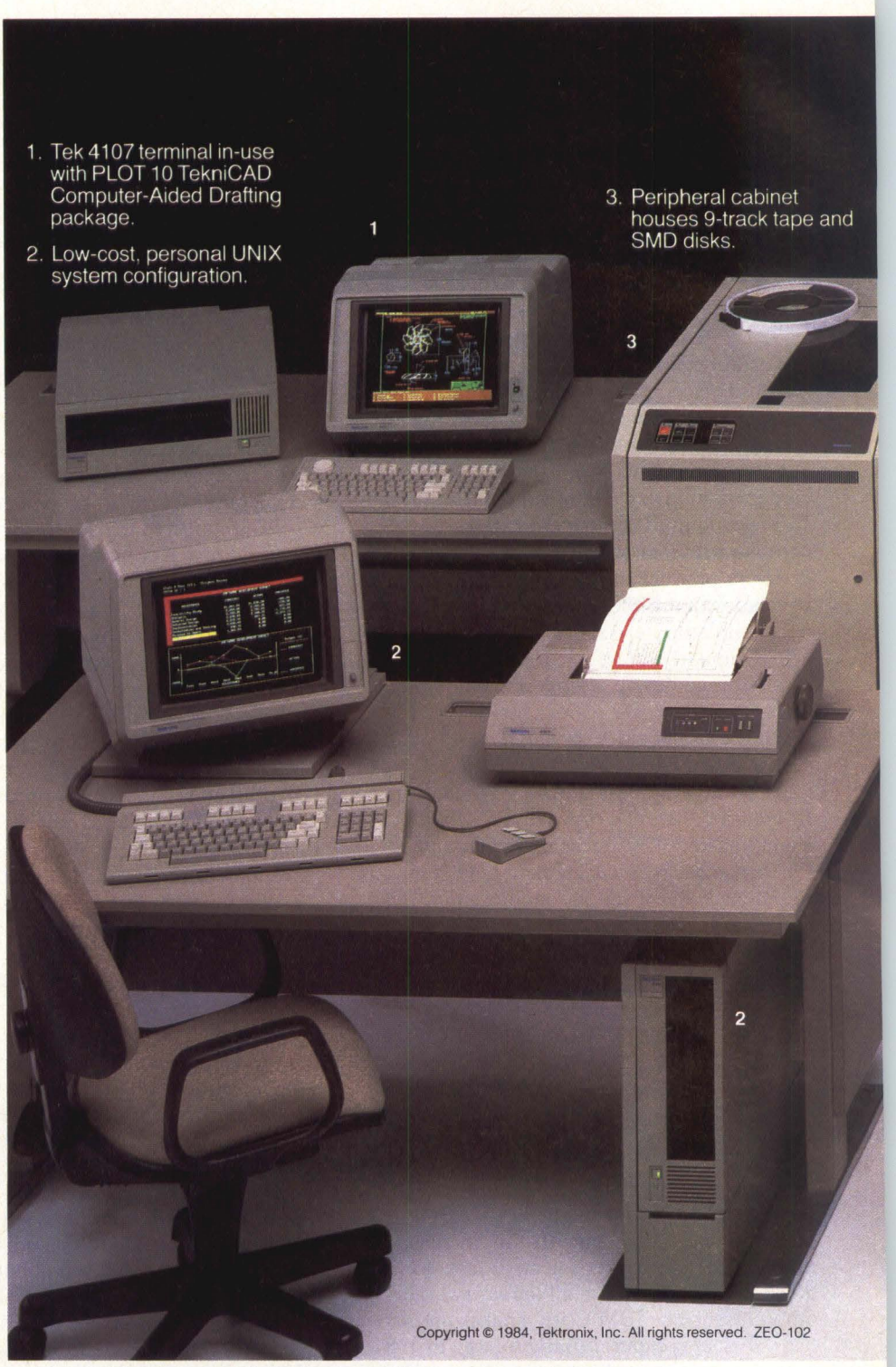

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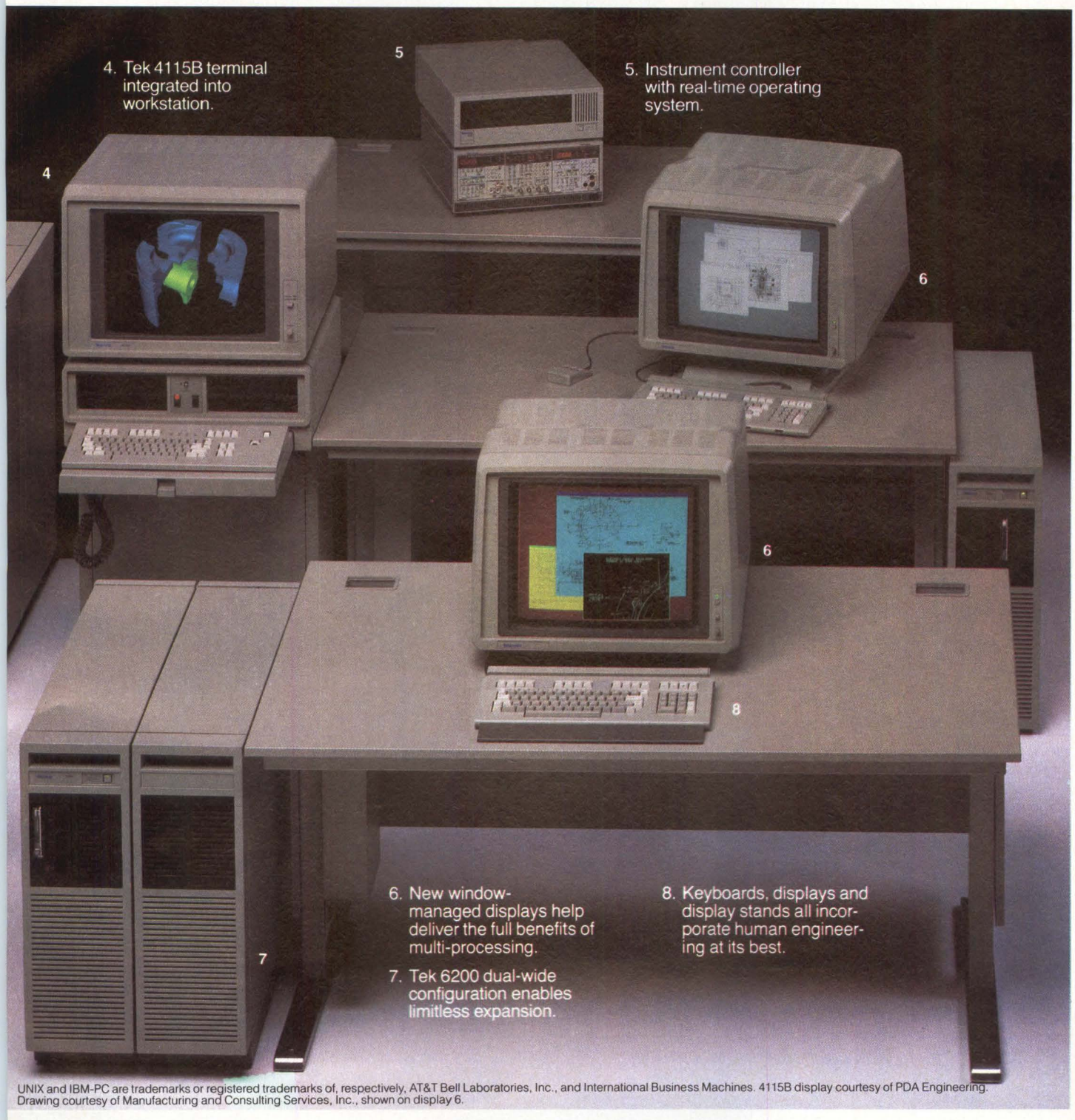

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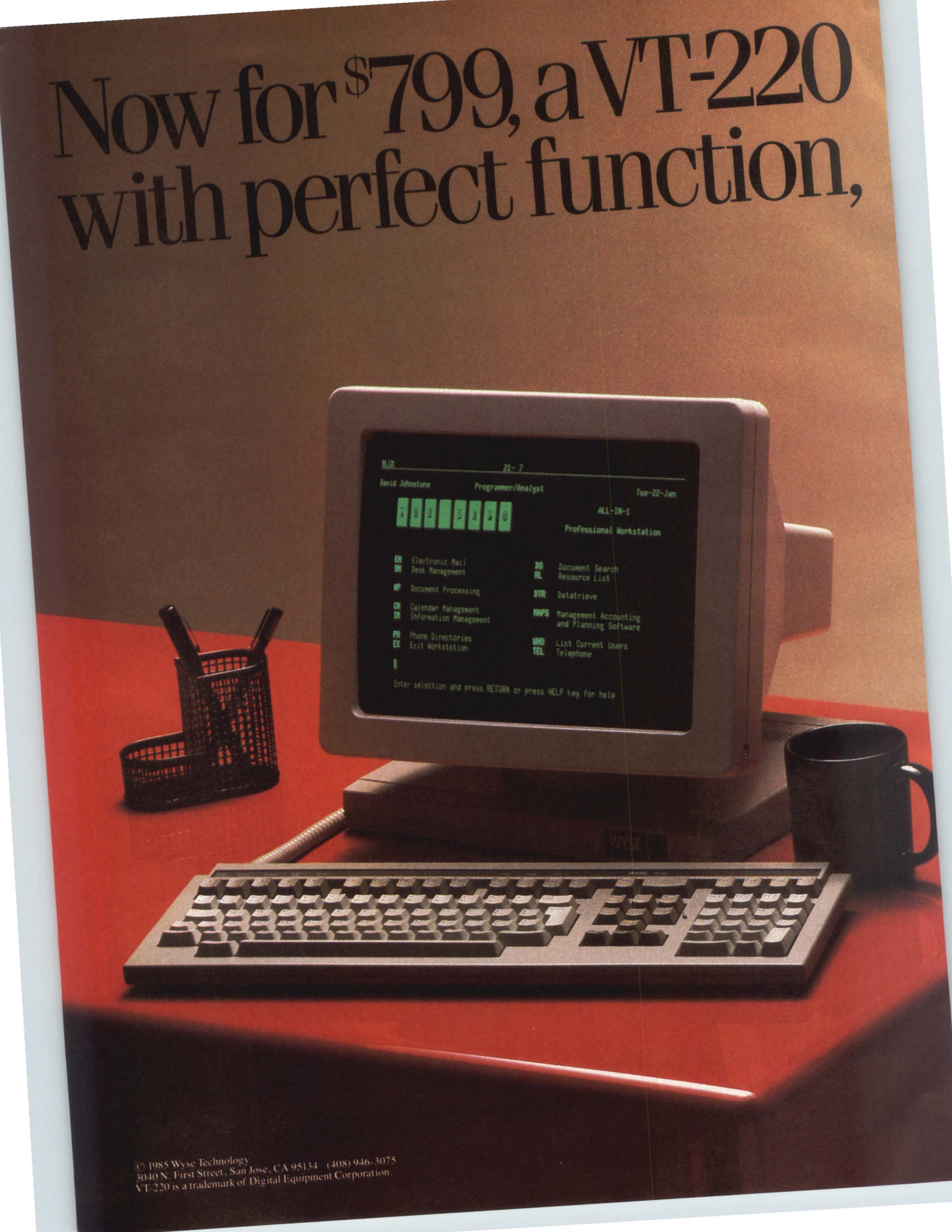

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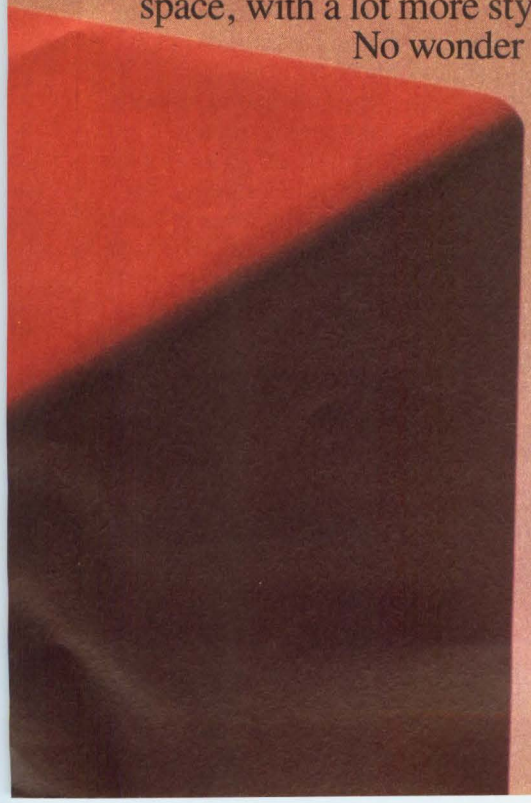

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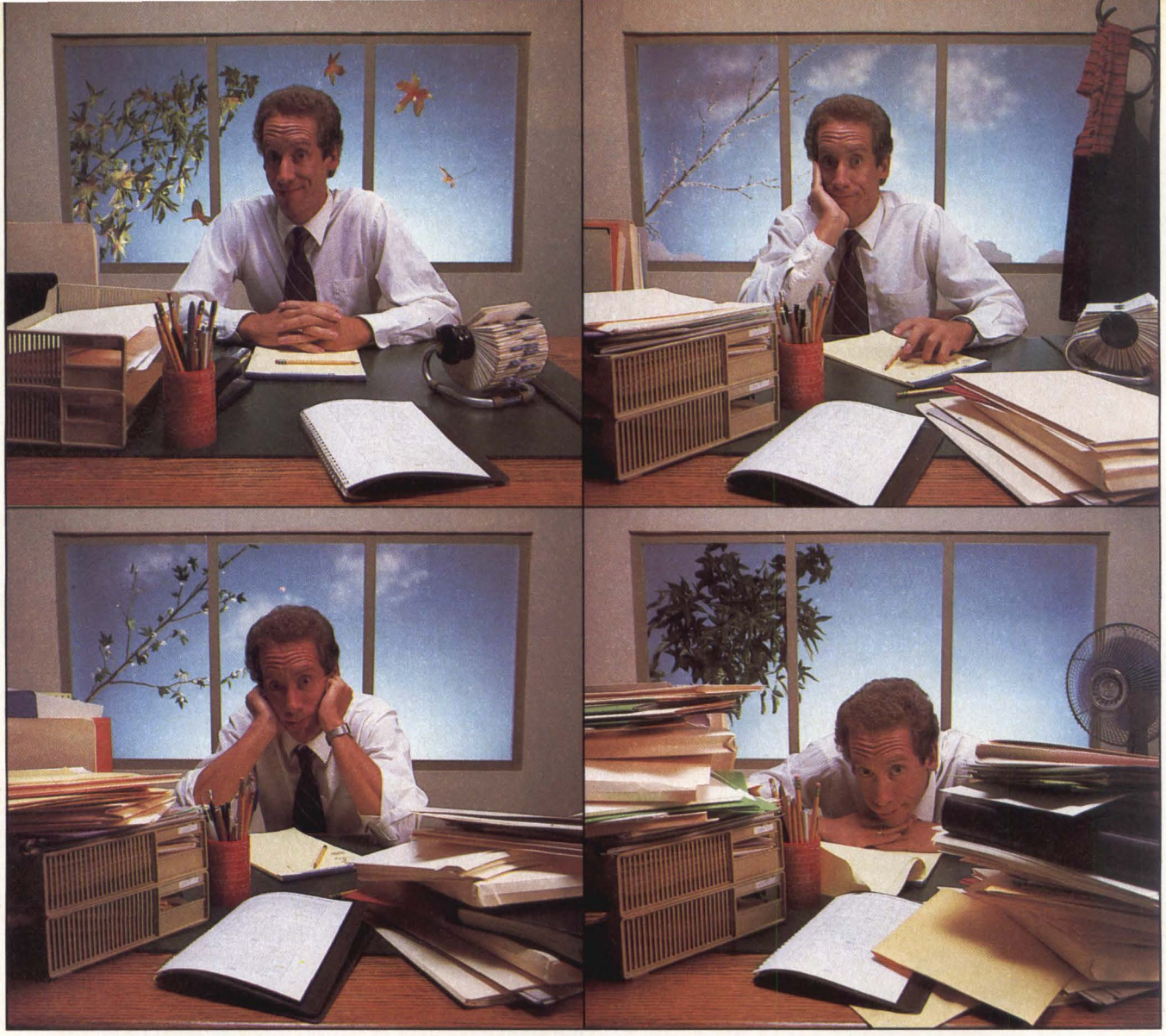

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CIRCLE NO. 10 ON INQUIRY CARD

BREAKPOINTS

HEWLETT-PACKARD TO ANNOUNCE LAN FOR HP 3000 MINICOMPUTERS

Hewlett-Packard Co. was expected to introduce LAN/3000 Link, the first local area network for its HP 3000 family of minicomputers, at The Interface Group Inc.'s annual communications show in Atlanta this month. The LAN/3000 Link is a full implementation of the IEEE 802.3 carrier sense multiple access with collision detection baseband LAN standard for office applications and the IEEE 802.2 logical-link-control specification. Because of the network's high speed—10M bits per second—throughput is two to six times better than that of the currently used point-to-point links, according to HP officials. As many as 100 HP 3000 minicomputers can be connected. HP also planned to introduce a product, called HP SNA IMF, to enable interactive communications between the HP 3000 machines and IBM Corp. mainframes using the IBM Systems Network Architecture (SNA) protocol. Link prices start at $5,000, and SNA product licenses are $3,500.—D. Bright

JAPANESE LEGISLATORS NEAR PROTECTION OF CHIPS

Japan's version of chip-copyright-protection legislation is nearing approval in the Diet, the national legislative body. The Diet still needs to determine at what point in the design process a semiconductor device is protected and whether criminal penalties should be provided in addition to a designer's right to sue for damages in civil court. In other respects, the chip-copyright bill resembles the American law that took effect last October. The developer of a semiconductor pattern would have rights similar to a patent for 10 years and would be able to seek court injunctions to stop alleged copyright violators. The Japanese are recommending that American and Japanese semiconductor makers, which produce 90 percent of the world's chips, should work for an international chip-copyright convention through the World Intellectual Property Organization. That body helps protect music and literary compositions from piracy.—I. Kakehashi

DIGITAL RESEARCH, KOREAN COMPANY SIGN SOFTWARE-DISTRIBUTION AGREEMENT

Digital Research (Japan) Inc., and A.I. Soft Korea Inc., Seoul, have formed a sales agreement in which the Korean software developer will modify and distribute operating systems and development and application programs based on programs from Digital Research Inc., Pacific Grove, Calif. The initial emphasis will be on Korean versions of CP/M operating systems and Concurrent DOS for 16-bit computers. M. Morimoto, general manager of Digital Research (Japan), says the agreement will encourage Korean software development and make it easier to promote software based on the big library of CP/M- and MS-DOS-based programs available in other languages. That software will be translated into Korean hangul characters for Korean-made microcomputers.—I. Kakehashi

BREAKPOINTS

BRITISH COMPANY WANTS U.S. DATABASE-PACKAGE CONTRACTS

Compsoft Plc., Guildford, England, wants to link up with U.S. manufacturers of 16-bit personal computers running MS-DOS to sell Compsoft's new database-management system, Delta 4. Compsoft marketing director Heather Kearsley says Delta 4 already is being sold by IBM United Kingdom Ltd., the British subsidiary of IBM Corp. She hopes IBM will soon offer Delta 4 in Belgium, France, Italy, Spain, and Switzerland as well. IBM already sells an earlier product, Delta 1, in those countries. Digital Equipment Corp. and Hewlett-Packard Co. also sell Delta 1 in most parts of Europe. Delta 4 is priced at a bit more than $500 for end users. It is designed for ease of use by non-programmers, says Kearsley.—K. Jones

XEROX, DATAPRODUCTS REMARKET AI-BASED GRAPHICS SOFTWARE

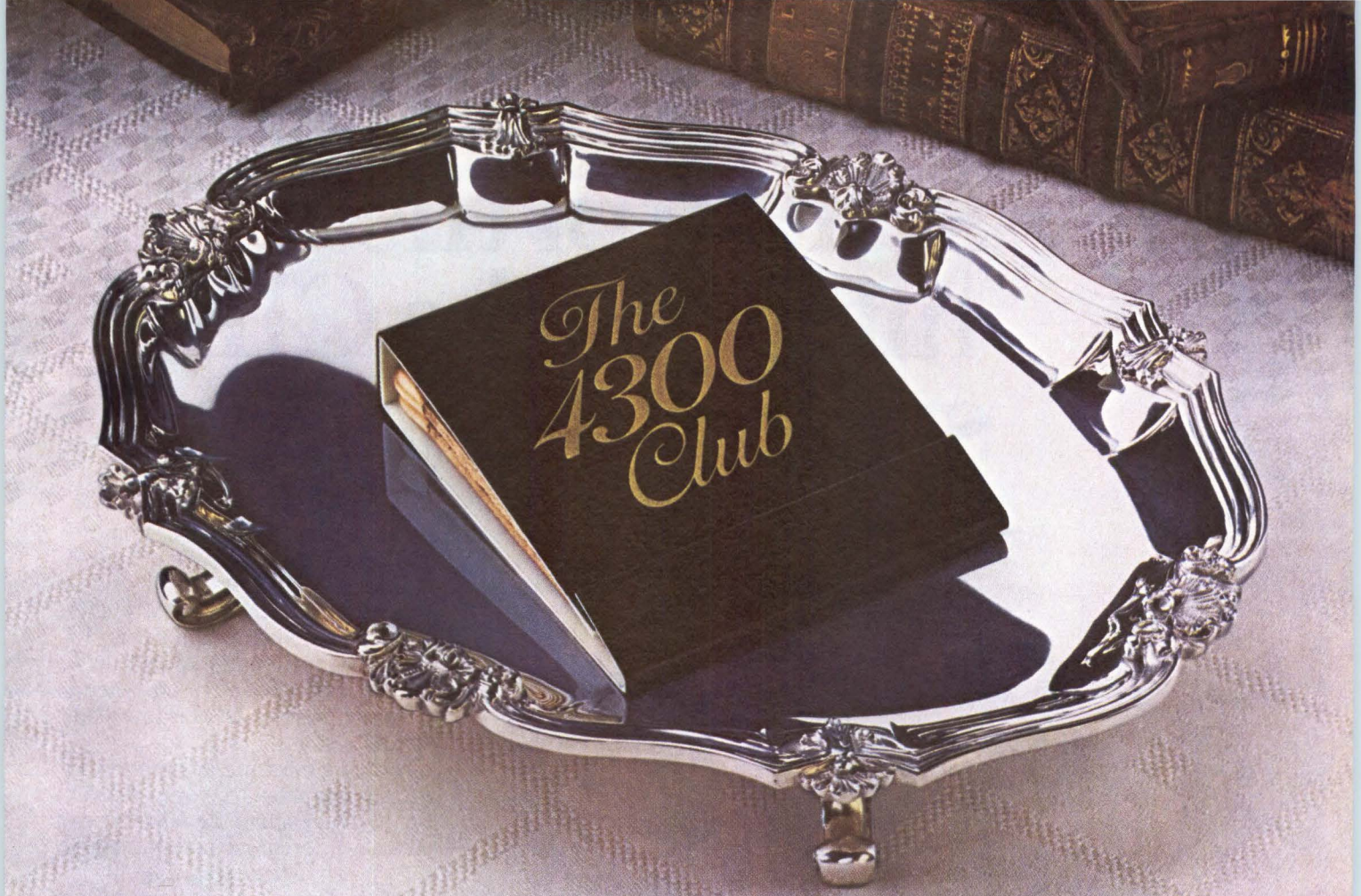
InfoGraphics Inc., Irvine, Calif., has introduced an artificial-intelligence-based business-graphics software package for MS-DOS- and CP/M-based personal computers. Called Choice, the package will be jointly marketed by InfoGraphics, Xerox Corp. and Dataproducts Corp. With Choice, users can select graphics parameters or have the software make the decisions. The package accesses data from Lotus Development Corp.'s 1-2-3 integrated package, other business programs and optical character readers. Users can also input data directly. Choice, which prints on 32 printers and plotters, does not require a graphics card or color monitor. List price is $395. Xerox and Dataproducts will bundle the software with their personal computer products.—D. Bright

SIEMENS 16-BIT MICROCOMPUTER BUS TO BECOME A STANDARD

The AMS 16-bit microcomputer bus defined by Siemens AG, Munich, West Germany, should be published as a standard this year by the International Electrotechnical Commission (IEC), Geneva, Switzerland. AMS is electrically identical to the IEEE's Multibus I standard, notes Udo Schöllmann, assistant marketing manager in the microcomputer systems division of the Siemens component group. But it possesses some mechanical characteristics that are more widely used by board builders in Europe than in the United States. The two notable characteristics are the Eurocard form factor and the two-part connector defined by the West German standards body, the Deutsche Institut für Normung. Schöllmann says Siemens now is encouraging other European manufacturers to build boards complying with the standard it initiated, which the IEC has designated the Microprocessor Systems Bus I. More than 40 countries worldwide, including the United States, belong to IEC.—K. Jones

PLEXUS BROADENS SYSTEM CAPABILITIES

Plexus Computers Inc., San Jose, Calif., is broadening its P series of UNIX-based systems with the P-15 and P-20 models. The P-15, which



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should be shipped this month, supports as many as six users and runs AT&T's latest version of UNIX with the Berkeley enhancements, UNIX 5.2. A standard unit with 512K bytes of RAM, eight serial ports, UNIX, one 12M-byte Winchester drive and a floppy disk drive is priced at $10,950. The P-20, which Plexus plans to ship in May, has a three-slot Multibus card cage that supports an advanced communications processor. That processor, which should be ready by fall, is expected to yield an aggregate throughput of 700,000 characters per second and will use direct memory access to transfer data to the system bus.—C. Warren

BOARD MANUFACTURERS ADOPT NATIONAL'S 32-BIT CHIP

Board manufacturers are starting to use National Semiconductor Corp.'s series of 32-bit microprocessors. Owl Computers Inc., Encinitas, Calif., this month plans to ship its Owl 32032M Multibus board set, which includes the National 32032 CPU, the 32201 interrupt-control unit, the 32202 timing-control unit, the 32081 floating-point chip and the 32082 memory-management unit. The price is $3,540 per 100 units. The board supports as much as 128K bytes of EPROM and has two RS232C channels. Another company, Definicon Systems Inc., Calabasas, Calif., has implemented the 32032 on its model DSI-32 coprocessor board, which houses as much as 1M byte of RAM. The board can be added to the IBM Corp. PC and is priced at $2,300 per 100 units. It includes two serial ports, a 32081 floating-point processor and the option to add an IEEE-488 bus. Definicon is supplying software utilities that allow the National processor to work in an MS-DOS environment.—C. Warren

BILL TO COUNTERATTACK FOREIGN COPYRIGHT VIOLATIONS

Senator Frank Lautenberg, D-N.J., has introduced legislation to pressure foreign governments to maintain copyright protection of U.S. computer software. The bill provides that, if a nation establishes less than 25 years of copyright protection for software or lessens protection in any other way, the software developed in that foreign nation will receive no copyright protection in the United States. The bill, according to a Lautenberg aide, has been introduced in response to proposals in certain countries, notably Japan and Brazil, to weaken or abandon copyright protection afforded to foreign software sold in those countries. The bill has received the support of the Association of Data Processing Service Organizations, an industry trade group, and other associations.—S. Shaw

HEWLETT-PACKARD UNVEILS GROUP OF PERSONAL COMPUTER SOFTWARE PACKAGES

Hewlett-Packard Co. planned to introduce late last month a series of software products for its HP 150 touch-screen personal computer and for the IBM Corp. PC. Two "Gallery" graphics programs for the HP 150 are used for creating shapes with text and charts. The packages are integrated

BREAKPOINTS

and can be used with HP's Laser Jet laser printer. Several packages, including Microsoft Corp.'s Word word-processing software, have been ported to the HP 150 from the IBM PC. There now are about 1,500 programs for the HP 150 available worldwide. HP also has ported some of its own software, such as MemoMaker, to the IBM PC.—D. Bright

KAYPRO READIES TWO IBM-COMPATIBLE COMPUTERS

Kaypro Computers Inc., Solana Beach, Calif., late last month planned to introduce an IBM Corp. PC-AT-compatible computer called the 286i. Running DOS 3.0 and including dual 1.2M-byte floppy disk drives, two parallel ports, one serial port, 512K bytes of RAM and eight expansion slots, the unit will be priced at $4,550. Kaypro also plans to release early next month an IBM-compatible portable computer called the Kaypro 2000.—C. Warren

TECH FILES: A QUICK LOOK AT INDUSTRY DEVELOPMENTS

SOFTWARE FILES: Network Innovations, San Jose, Calif., has been formed by James Groff and Paul Weinberg, both formerly with Plexus Computers Inc. The new company's first product is Multiplex, a $695 software package that networks PC/XTs and PC-ATs to UNIX-hosted databases and downloads information in Symphony, dBase II and III, SYLK, DIF or ASCII formats. Multiplex, which fits into 128K bytes of memory, runs over Ethernet or RS232 links.—A. Kaplan

GRAPHICS FILES: After recently taking volume orders from Gould Inc. and Data General Corp., **Raster Technologies Inc.,** North Billerica, Mass., has signed a $10 million contract with West Germany's Siemens AG. Siemens plans to introduce a computer-aided design/computer-aided manufacturing workstation based on Raster's Model One/380, a high-resolution 3-D system, at next month's fair in Hannover, West Germany.—D. Bright

MINI FILES: The Department of Justice has notified executives of **C3 Inc.,** a Reston, Va., computer system integrator, that the government has terminated one of two investigations into alleged contract improprieties. The company has released a statement that it has been informed by the department that the U.S. attorney's office of the Eastern District of Virginia is ending its investigation into a C3 contract to supply the U.S. Army with several minicomputer systems at the White Sands (N.M.) Missile Range. C3 said it had been told that no indictments were to be filed. The U.S. attorney's office is still investigating another government contract with C3.—S. Shaw

NOTES FROM OVERSEAS: Nixdorf Computer AG, Paderborn, West Germany, is easing itself into the retail market with an OEM contract for Panasonic of Japan's IBM-

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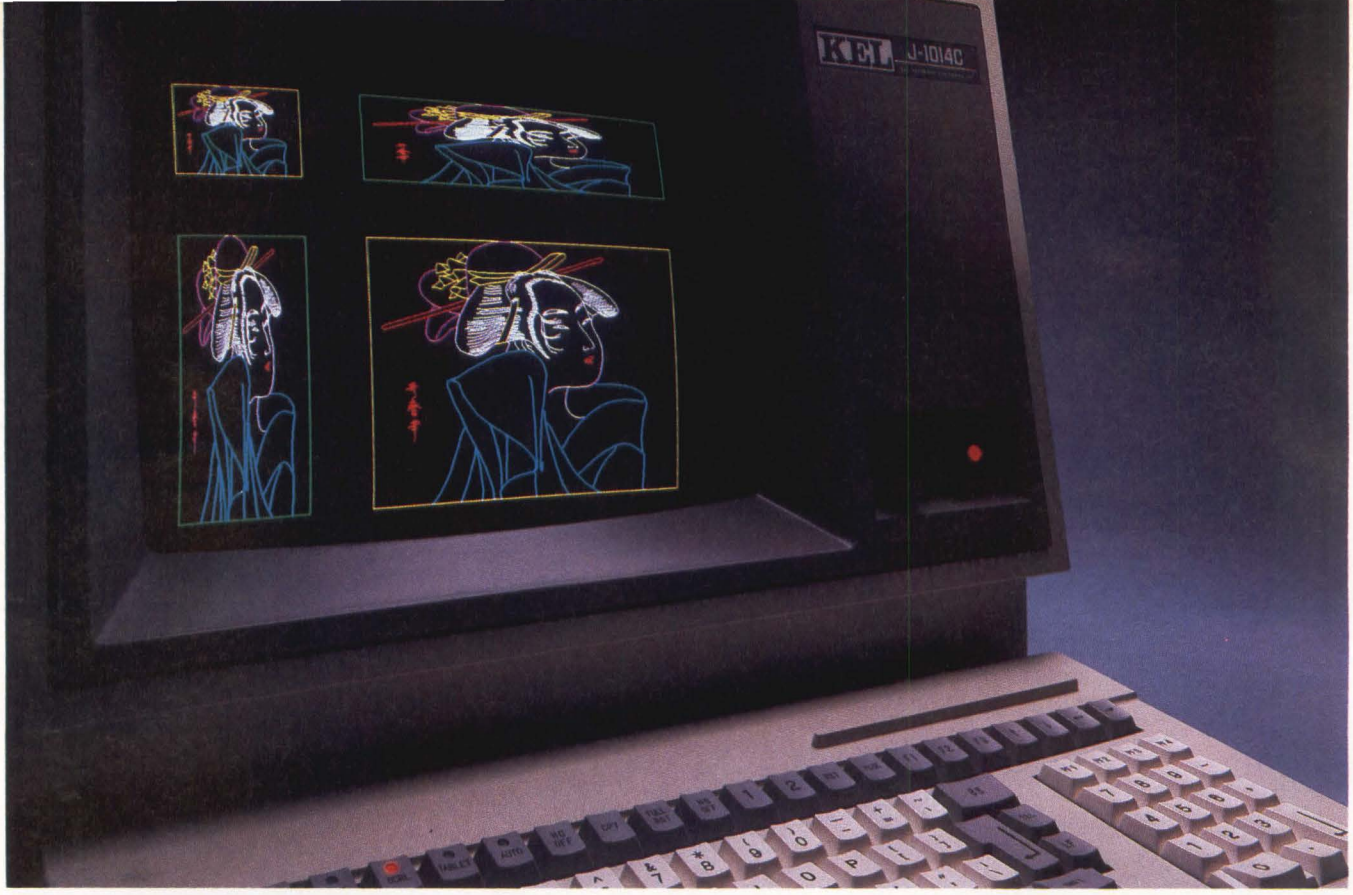

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Model J1014 Monochrome Display

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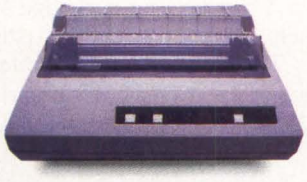
The KEL 4120 Printer produces hard copy directly from any KEL terminal, ending long waits for computer-room copies. At 120 dot-per-inch resolution, even the smallest size screen characters are clearly legible when printed. The Model 4120 is a dot-matrix impact printer which uses a 16-wire head and provides a full screen dump in 60 seconds (bi-directional mode). The Model 4120 also operates as a receive-only ASCII printer. In the ASCII mode, it prints at 120 CPS, 136 characters per line, and six lines per inch. The 4120 Printer is equipped with a tractor-feed mechanism and an 11-inch forms control.



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BREAKPOINTS

compatible personal computer. According to Nixdorf's sales manager, Frederick-Karl Conrad, his company is buying a slightly modified version of the 8088 floppy disk-based Panasonic RL-H7000W "luggable," whose chief distinction is its built-in printer. Nixdorf has dubbed the new machine the 8810/25. The systems are earmarked for a chain of Nixdorf-owned stores to be started this year as solution-oriented information and sales centers inside the Nixdorf branch offices in Munich, Dusseldorf and Hamburg. To back up the centers, Nixdorf plans to recruit value-added resellers, system houses and software companies to move the new personal computers into vertical markets while its own worldwide sales force tries to offset IBM Corp.'s impact on Nixdorf's large accounts. Nixdorf expects to sell 10,000 IBM-compatibles in Germany this year.—M. O'Gara

Considerable research is being done in Japan on alternatives to CRT displays. **The Asahi Glass Co.,** increasingly involved in electronics, has developed a glass with an electrochromic dimmer effect that changes the transmissivity of the glass after application of an electric current. Asahi Glass engineers say that the glass uses electrolytic and tungsten-oxide films to create a "sandwich." The amount of light passing through can be changed from 85 percent transparency to a nearly opaque 10 percent by one touch of a switch. The films have a memory effect that retains the degree of transmissivity without constant voltage application. Among potential applications—still two or three years away—are simpler display- and shutter-matrix panels for terminal screens and printers.—I. Kakehashi

Having been rebuffed in its multiple bids to buy Inmos, the British 32-bit-chip maker, **AT&T** is now offering to set up its own advanced microchip center in the United Kingdom. The center is part of a strategic move to woo millions of dollars worth of private-automatic-branch-exchange contracts out of British Telecom on behalf of the year-old AT&T/N.V. Philips joint telecommunications venture. There are apparently several proposals on the table, including one for a $123 million facility that would be equipped to design and produce custom chips with tiny, 1.7-micron-wide circuitry. Such a plant would be the most advanced in Britain, and AT&T is promising to make it available to British industry. The U.S. giant nonetheless faces stiff competition from Northern Telecom and a Thorn EMI/Ericsson partnership.—M. O'Gara

At the upcoming Hannover Fair in West Germany next month, **Panasonic** of Japan plans to unveil an IBM-compatible prototype personal computer featuring an 11-inch, 640-by-400-pixel plasma screen display. The unit fits into an attache case, and Panasonic will be pegging it as breakthrough technology. The Japanese company has reportedly found a way to prolong the life of typical plasma displays, which normally last about two years.

BREAKPOINTS

Panasonic, which reportedly has been working on the product for IBM Corp., expects to go into production with the unit in June or July.—M. O'Gara

Fujitsu Ltd. and **Amdahl Corp.,** the Sunnyvale, Calif., computer company that Fujitsu controls, are expanding the ability of their machines to run under UNIX-based operating systems. Amdahl has licensed Fujitsu to use its universal time-sharing system (UTS). Fujitsu expects to have its own version available for domestic and export marketing by the year-end. Fujitsu emphasizes that it will continue to produce its MSP, FSP and other primary operating systems, which are not UNIX-compatible.—I. Kakehashi

Mitsubishi Rayon Co. is preparing to make available in June a display-screen filter that it says improves color perception while reducing eyestrain for terminal operators. The filter panels are made of Acry-Filter Nd, a compound of neodymium and rare earths applied as a film over an acrylic base. Mitsubishi Rayon says the compound has a high absorption rate for light wavelengths.—I. Kakehashi

Oki Electric Industry Co. Ltd. of Tokyo should start marketing in Japan this month high-end extensions of its if-800 series of 16-bit microcomputers based on the Intel 8086. The new Model 60 uses a multiple-windowing program called SuperView that provides overlays of several pieces of information from a large common database without scrolling. The basic machine has 512K bytes of ROM, expandable to 1.02M bytes, and can handle up to three 1M-byte, 5¼-inch floppy disk drives and a 10M-byte hard disk drive. An optical mouse cursor controller is standard. The basic package is priced in Japan at about $1,830.—I. Kakehashi

A compound that makes erasable, re-recordable optical disks much longer-lasting and more stable than those now available, has been developed by **Fujitsu Ltd.** of Japan. The compound of selenium, antimony and indium crystal is applied by vapor deposition over a silicon film on an acrylic base. When activated by a 830-nanometer semiconductor laser with 1-micron beam concentration for 100 to 200 nsec, a depression appears on the film surface. A weaker pulse on the same area restores the surface to its original smoothness. Laboratory tests indicate that a disk surface could withstand more than 1 million changes—erase, record, erase again—with a storage life of at least 10 years. Fujitsu Labs says that a 20-cm-diameter disk coated with the compound could store 1G byte of information. That would be about 600 times as much data capacity as an 8-inch floppy disk, or roughly 15,000 letter-size documents. A product using the material is still two to three years away from market, Fujitsu engineers say.—I. Kakehashi

Viasyn (vī′ uh sin) *n.* [L., *via*, a way or road; Gr., *syn*, together or integrated], formerly *CompuPro*. 1. *n.* a twelve year old manufacturer of microprocessor systems, subsystems and components, notably multi-user computers used in business, science and industry. 2. *adj.* related to Viasyn, formerly *CompuPro*, quality, i.e., possessing extraordinary reliability, performance, modularity and ruggedness. See *CompuPro* (previous name).

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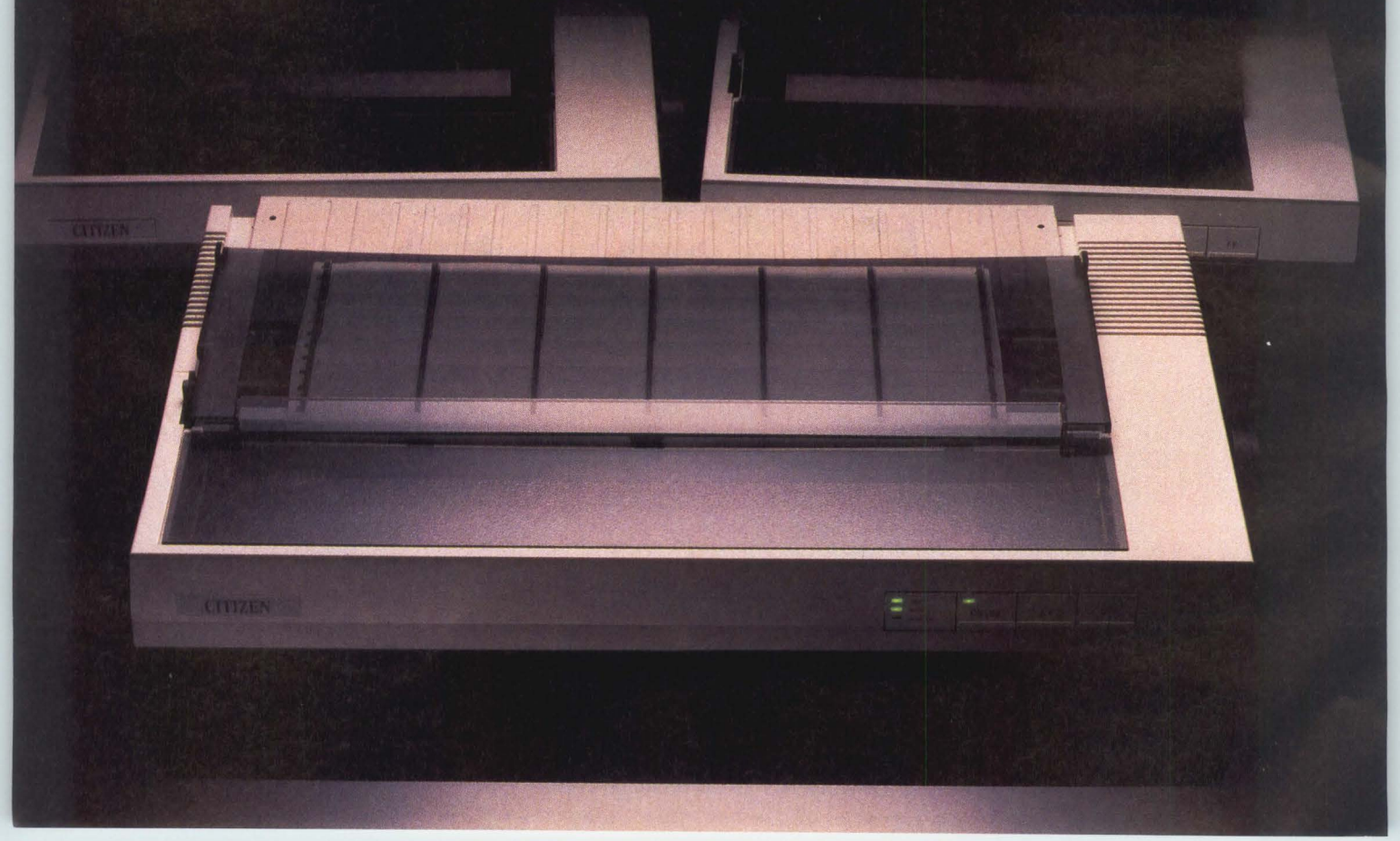
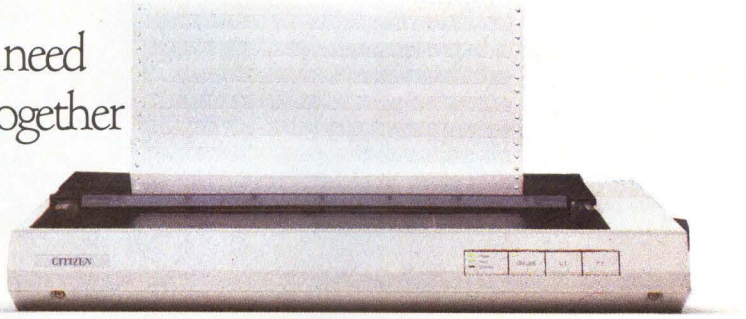
CIRCLE NO. 15 ON INQUIRY CARD

CITIZENS FOR WORKING WITHIN THE SYSTEM.



The last thing you need when you're putting together a hardware package is a printer that bucks the system.



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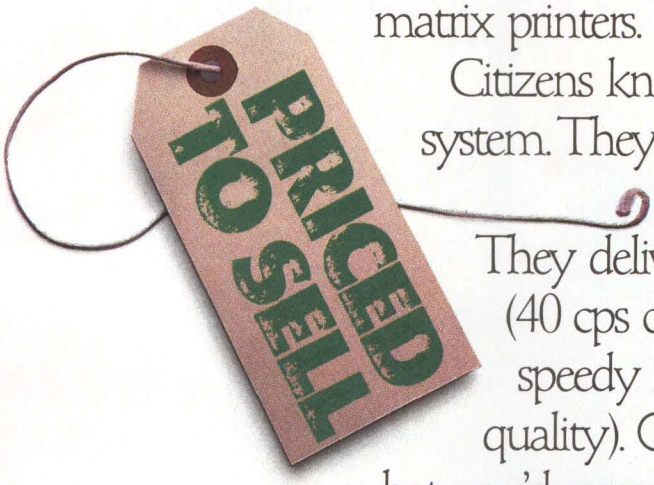

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CIRCLE NO. 16 ON INQUIRY CARD

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The value of your investment in UNIX software just went up. Because the price of a complete UNIX system just came down.

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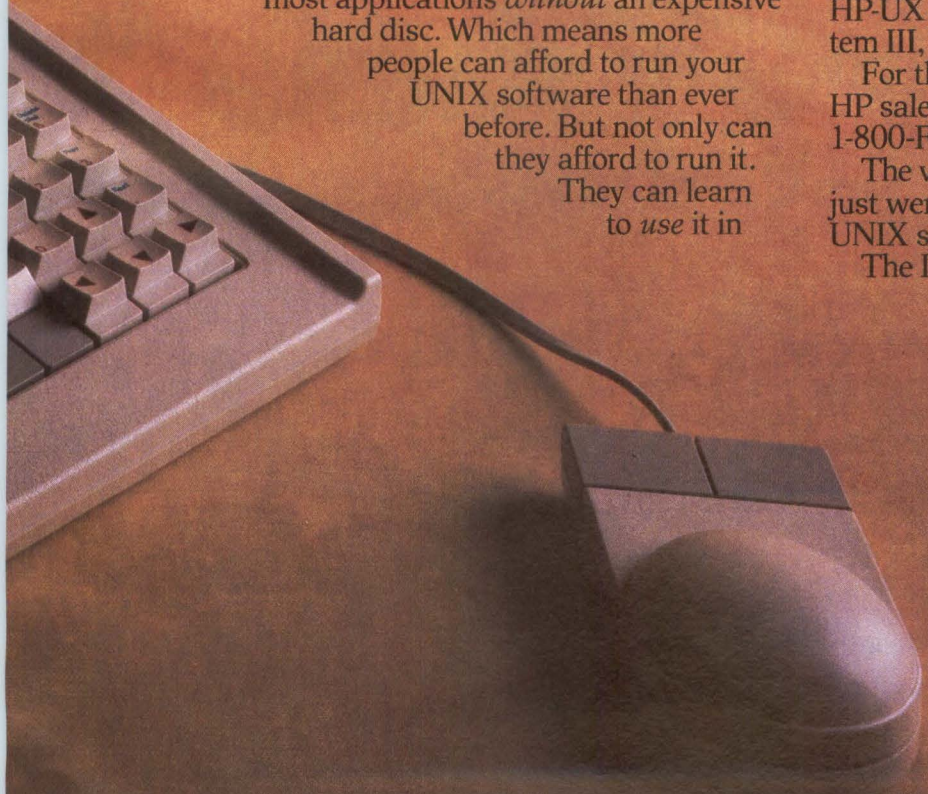

HEWLETT PACKARD

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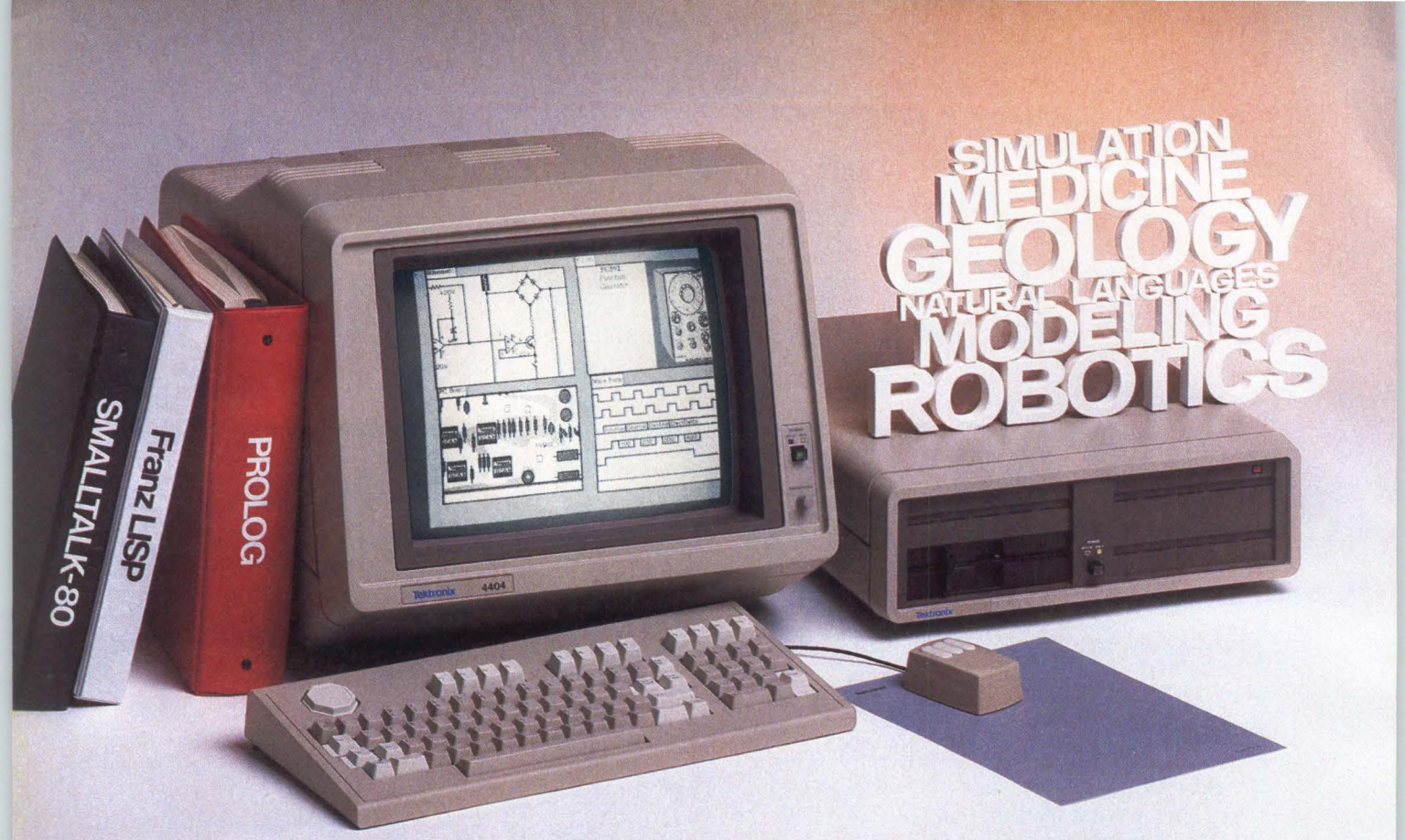
PGO2504

UNIX is a trademark of AT&T Bell Laboratories.
Mouse is optional. *$4,995 is suggested U.S. list price; prices elsewhere may vary.



ARTIFICIAL INTELLIGENCE: TEK INTRODUCES A NEW SOURCE OF POWER.

Tek's new personal 4404 AI development system bypasses one of the last bottlenecks to making artificial intelligence systems commonplace. That bottleneck: the high price and scarcity of AI compute power.

The powerful, 32-bit 4404 supports three major development languages. The Smalltalk-80™ programming environment is standard. Franz LISP and Prolog are available as options. And Tek supports the industry-wide Common LISP standardization effort. Standard configuration also includes virtual memory, expandable hard disk mass storage and much more. Its new window-managed display is everything you expect from a world graphics leader.

But what really makes the 4404 a major new force in AI is its price: at less than $15,000, it is the first personal AI development system.

The power of Tek is behind it. Thanks to Tektronix technology, AI specialists and worldwide service organization, the 4404 is truly the first AI system you can use without reservations. And it is only the beginning of Tek's growing commitment to the AI community.

For more information, contact your nearest Tektronix field office. Or call toll-free 1-800-547-1512. In Oregon, 1-800-452-1877.

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CIRCLE NO. 18 ON INQUIRY CARD

Tiny single-board PC may spark big markets

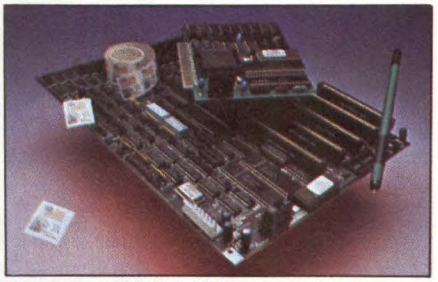
IBM PC-compatible board with passive backplane poses challenge to STDbus

Rick Dalrymple, Senior Editor

Faraday Electronics hopes to crack new and emerging markets with a recently produced IBM PC-compatible board of reduced size and power consumption. New markets eyed by the Sunnyvale, Calif., manufacturer include harsh-environment applications in science, industry and engineering—which could put the board in almost head-to-head competition with the STDbus.

According to computer-industry analysts, who had a pre-introduction peek at Faraday's new Micro PC board, system integrators have a host of new application possibilities for this 3.9-by-5.5-inch, PC-compatible, single-board computer. Introduced this month, the Micro PC shrinks all the functions of an IBM Corp. PC motherboard down to its near-note-card size by using Faraday's FE2010 custom very large-scale integration (VSLI), complimentary metal-oxide semiconductor (CMOS) chip. The chip contains all the motherboard components except the 8088 microprocessor, optional 8087 coprocessor, 64K-byte basic input/output system (BIOS), EPROM and 256K bytes of RAM.

At $495, or about $300 apiece in quantities of 500, the Micro PC price matches the current price of Faraday's first motherboard—the FE6400. Unlike the FE6400, however, the Micro PC plugs into a passive backplane (also available from Faraday), which means it does not require on-board expansion slot connectors.



Faraday Electronics' new *Micro PC board (3.9 by 5.5 inches) rests on top of Faraday's first IBM PC-compatible motherboard.*

Motherboards limit the number of expansion slots available to the system integrator. A backplane arrangement, on the other hand, allows system integrators to use as many available slots

FARADAY'S PROGRAM TO ADD FUNCTIONS, REDUCE SIZE

Product	Introduction date	Dimensions (inches)	Number of expansion slots	Price ($ Q1)	Comments
Motherboards					
FE6400	February 1983	8.5 x 12	5	495	Faraday's first IBM PC-compatible board; one parallel and two serial ports; 32K-byte ROM
FE6410 Series	May 1984	8.5 x 12	3	596-695	expanded memory to 512K bytes; one serial and one parallel port; added on-board floppy disk controller or monochrome video controller; 32K-byte ROM space
FE620 Series	June 1984	8.5 x 12	8	515-595	expanded memory to 640K bytes; one parallel and two serial ports; added 8087 coprocessor socket; on-board floppy disk controller; 64K-byte ROM space
Plug-in boards	(used with passive backplane)				
Bus PC	January 1985	3.9 x 13.15	none	495	64K to 256K bytes of memory; one parallel and two serial ports; 8087 coprocessor socket; 32K-byte ROM space
Micro PC	March 1985	3.9 x 5.5	none	495	64K to 256K bytes of memory; no serial or parallel ports; 8087 coprocessor socket; 32K-byte ROM space

NEWS

as the power supply allows.

The next step for Faraday is a total CMOS Micro PC. This version would further reduce power consumption and allow the tiny board to be sealed in an enclosure so that it can be used in harsh environments. Even though CMOS versions of the 8088 and RAM chips are available today, however, the price tag on a total CMOS Micro PC may preclude widespread use.

Could challenge STDbus

Norm DeWitt, director of personal computer service at Dataquest Inc., San Jose, Calif., sees the Faraday board as the first step in an eventual challenge to the STDbus. DeWitt points out that the 3.9-inch-by-5.5-inch Micro PC is close in size to the 4.5-inch-by-6.5-inch STD boards. The passive backplane of the Micro PC performs many of the same functions as the STDbus backplane. "What makes the [situation] very different," observes DeWitt, "is that STDbus boards are available from many different manufacturers, while boards about the size of the Micro PC are now only available from Faraday."

If the manufacturers of IBM PC add-in boards begin to adopt board sizes in the range of Faraday's Micro PC, says DeWitt, the Micro PC bus could be a formidable STDbus alternative, even threatening areas where the STDbus is entrenched, such as industrial and scientific applications, he says. Faraday's vice president of marketing, Ron Mazza, says the company is beginning to call on STDbus distributors to point out what Faraday sees as the advantages of the Micro PC bus over the STDbus. Mazza argues that, in addition to accessing the huge library of MS-DOS-based software, system integrators also gain the advantage of a software-development machine that is identical to the target processor —an IBM PC.

Paul Virgo, STDbus products marketing manager at PRO-LOG Corp., Monterey, Calif., notes that the PC bus is an attractive way to build human interfaces. Many STDbus systems, he points out, do not have a user interface. PRO-LOG markets an STDbus-to-PC-bus connector and Virgo sees value in exploiting the advantages of both buses. But Virgo does not expect

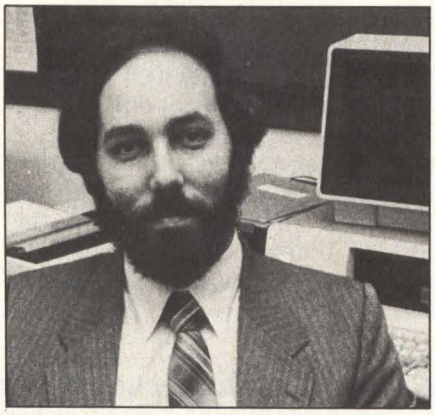
Some IBM mimics jump, some stall at PC-AT delays

Lori Valigra, Senior Editor

If the battered IBM PC-compatible makers don't have enough worries with IBM Corp.'s aggressive pricing and prosecution of counterfeiters, they can add another concern to their list: when and how to produce a PC-AT look-alike.

Major mimickers agree that designing PC-AT-compatibles is more complex than making earlier PC workalikes. For one thing, IBM incorporates a different processor with an incompatible instruction set—an Intel Corp. 80286 rather than the standard Intel 8088. For another, the PC-DOS 3.0 operating systems' ROM basic input/output system (BIOS) that controls most input/output routines for attaching peripherals differs from the earlier operating system's ROM BIOS.

But making even those who claim to have mastered these issues gun-shy is the shortage of PC-ATs, which some industry participants say has held back third-party development. There also is the lack of key software for the PC-AT, such as the PC-DOS 3.1 and XENIX operating systems, networking software and the TopView windowing program. Those four products are scheduled for availability this quarter but had not been shipped as of press time.



Neil Colvin, *president of Phoenix Software, says compatibility has turned from a hardware to a software issue with IBM's PC-AT.*

Shortages, rumors persist

Before last Christmas, IBM reallocated shipments of the enhanced PC-AT computers with 20M-byte Winchester disk drives. A spokesman acknowledges the company told dealers that IBM would be unable to fill all orders for enhanced PC-ATs during the first quarter because of demand and shortages of the 20M-byte drives. But he says IBM increased allocation of the floppy disk-based PC-ATs.

This led to industry speculation that IBM had stopped shipping hard disk-based PC-ATs and that there was a problem with the system. One major IBM PC-AT retailer says customers complained that the PC-AT lost files written to the 20M-byte Winchester disk drive. That retailer suspected there were problems with the operating system and thought IBM might alter it. But the IBM spokesman says there are no problems with the disk drive or operating system. "Speculations that there will be major changes to the operating system or BIOS are way out of line," he says. He says shipments have not stopped and maintains there will be "no changes in the machine."

George Colony, president of Forrester Research, Cambridge, Mass., says retailers head the queue for PC-AT supplies, even ahead of IBM's own direct sales force. Because of this, large end users will not receive shipments of PC-ATs until April or May. He cites two contacts of his who are waiting for large PC-AT shipments—one for 250 units and the other for 350.

an early demise for the STDbus: "I think the STDbus has another five- to 10-year lease on life."

Possibilities beckon

For the Micro PC, the key to success in the STDbus market will be the participation of other manufacturers of similar boards. Jerry Orosz, director of OEM marketing at AST Research Inc., Irvine, Calif., is aware of the application possibilities of the Micro PC. While declining to comment on his company's plans to build Micro PC-size boards, Orosz did say that some of AST's customers, who are involved in energy management in construction and industry, may find a small, low-powered, PC-compatible, single-board computer attractive for the control of lights, air conditioning and heat exchangers. Orosz could also see the product finding its way into protocol converters and network file servers, as well as intelligent telephones, terminals, printers and disk drives. "If the board could run on battery power," says Orosz, "obviously portable computers and instrumentation would be logical markets."

Asked about the market for a PC-compatible, single-board computer, Faraday's president John Lemons answered, "Our economies of scale are such that companies can't design and build their own CPU for less than they could buy them from us—and we intend to keep it that way." Lemons claims that, from scratch, it could cost as much as $300,000 to develop an IBM PC-compatible board with supporting sofware.

Future markets which Mazza says he foresees include using PC-compatible computers as part of a milking-machine system. Using a spreadsheet program like Lotus Development Corp.'s Symphony to log milking records, calculate feed and vitamin dosage, plus forecast the expected pounds of milk per cow for next Tuesday, will help the dairy farmer improve efficiency.

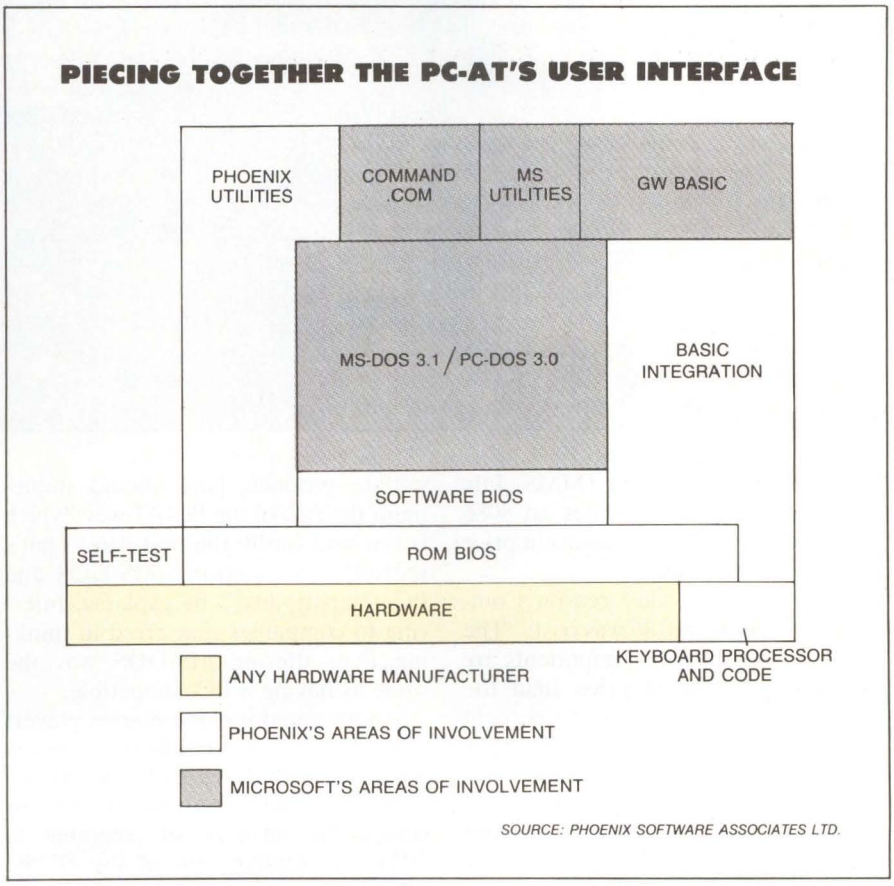
And, when a totally CMOS Micro PC is available, Mazza thinks the fact that it can fit into a small, sealed enclosure will allow scientists to use PC-compatible computers for weather monitors at sea and to control experiments on board probes launched into space. □

Until the supply problem eases, Colony predicts, the PC-AT-compatible market will not be really active. "Independent software vendors will slow down development until there is more of an installed base of PC-ATs," he maintains. Forrester Research calculates 40,000 PC-ATs were installed by the end of last year and expects 250,000 to be installed by the end of this year.

Jumping IBM is dangerous

Leapfrogging IBM to get a compatible computer system to market makes some manufacturers nervous. Any hardware changes IBM might make are not of as much concern to top-seeded compatible maker Compaq Computer Corp., Houston, as are undelivered software products, explains Michael S. Swavely, director of marketing at Compaq. "Until [PC Network software, XENIX and TopView] are deliverable, any product delivered in the meantime may not be compatible with the PC-AT. [This situation] is more dangerous than if there were major hardware changes to the PC-AT."

Nonetheless, Compaq and others have gone over the PC-AT with a fine-tooth comb. Swavely claims Compaq could quickly produce a PC-AT-compatible computer, should the market demand it. "We considered using the 80286 in the Deskpro but did not because the compatibility level [with the IBM PC] was unacceptable," he says. Compaq's Deskpro desktop sys-



Phoenix's *adjuncts to Microsoft's MS-DOS operating system (used by IBM as PC-DOS) include the software BIOS and the ROM BIOS.*

NEWS

What is PC-AT compatibility?

As with IBM Corp.'s PC, suppliers of compatible systems, components and software must assess what the PC-AT is, and what compatibility with it means. Many major independent product developers already agree that IBM's implementation of Intel Corp.'s 80286 must be strictly followed and that producing the basic input/output system (BIOS) is necessary for a complete match.

In its publication for independent developers of IBM PC products, IBM underlines its commitment to making major compatibility testing efforts. "Our first priority is to remove any incompatibilities which we discover in the hardware. The next priority is to mask the incompatibility in the ROM BIOS. If this is not feasible, then we attempt to mask the difference in the new DOS. Only if these alternatives fail will we allow the incompatibility to remain," the publication states. IBM lists three areas in which compatibility failed: the faster performance of the 80286 and its clock speed, the 20M-byte fixed disk and instruction differences between the PC's and PC/XT's 8088 and the PC-AT's 80286 processors.

Following are major differences between the PC and PC/XT and the PC-AT as listed by major compatible producers and by IBM in its publication.

- The PC-AT works in two modes, real-address mode and protected, virtual-address mode. In real-address mode, the PC-AT acts like an 8088, so that PC and PC/XT programs can be run. In protected mode as an 80286, the PC-AT uses memory management to support multitasking, which in turn provides as much as 1G byte of virtual address space per task. The PC-AT's 1M byte of memory can only be accessed in the protected mode by two new BIOS function calls.
- The PC-AT's ROM BIOS includes some limited multitasking capabilities, such as wait loops and interrupt service routines. But IBM does not support asynchronous communications. The company claims that will allow a multitasking operating system to be implemented using the ROM BIOS. This means that the software BIOS portion of PC-DOS would require a minimal rewrite.
- The PC-DOS BIOS microcode for the PC-AT is not the same as that for other PCs. For example, the fixed-disk BIOS was rewritten, and the keyboard BIOS was modified. However, the interrupt codes and function codes remain the same. IBM recommends that application programs use only the BIOS and DOS interrupt interfaces. If a program bypasses BIOS interrupt calls to speed performance and directly accesses routines and/or storage locations in one system, it may not run on another PC model.
- The ROM BIOS also is different. Extra code handles differences between the adapter interfaces for PC/XT and PC-AT fixed-disk drives. The adapter interface chip for the PC-AT's 20M-byte fixed disk is not compatible with the adapter for the PC/XT.
- The new disk adapter also includes circuitry for the 1.2M-byte floppy disk drive and the 320K/360K-byte disk drive. That disk adapter is a superset of the PC's disk adapter, so that the PC-AT can support the higher data rates in the 1.2M-byte drives and select various data rates (250K, 300K or 500K bps). The ROM BIOS controls data-rate selection. This means that applications operating at

tem, introduced last June (MMS, July 1984, Page 31), incorporates an 8086 processor for speed and begins in price at about $2,500.

Swavely says another reason Compaq bypassed the 80286 was cost. "The 80286 and its support components are 50 percent higher in price than the 8088. So we'd have to add 50 percent to the retail price margin to justify putting them in. A 25-percent incremental speed advantage [with the 80286] doesn't justify a 50-percent higher price."

Sticking to PC-AT compatibility

Compaq's Swavely cautions compatible manufacturers against improving IBM's design and thus risking incompatibilities. "If you do a PC-AT-compatible product, [you should implement the 80286] the PC-AT way, which is not necessarily the best way. That's the difference between MS-DOS and PC compatibility," he explains, referring to companies that erred in thinking that offering MS-DOS was the same as having a PC-compatible.

Another major clone-market player, systems software publisher Phoenix Software Associates Ltd., Norwood, Mass., seconds the importance for compatible makers of keeping to IBM's implementation of the 80286. "We are doing a PC-AT-compatible [ROM BIOS]. It is compatible with the PC-AT and the 80286 implementation in the PC-AT," explains Neil Colvin, Phoenix's president.

Every company licensing the MS-DOS operating system must write a BIOS for it. IBM wrote part of the BIOS in software and implemented part in a ROM. The software BIOS effectively "supervises" the ROM BIOS.

Colvin says that, while the Phoenix ROM BIOS supports IBM's PC-AT implementation of the 80286, it remains compatible with earlier 8088-based PCs. IBM also took this tack with its own ROM BIOS and BIOS. IBM's published guide for independent developers notes that the BIOS interrupt codes and function codes remain the same for the PC and PC-AT models but that added function codes support unique features in the PC-AT and assist in masking hardware differences.

the BIOS interface level will run, but programs directly addressing the disk interface hardware will fall victim to any data-rate variation, the increased track density on the 1.2M-byte drives and possibly the drive's rotational speed difference.

- Disks for the 1.2M-byte drive can't be used in the 320K/360K-byte drive. Also, although the 1.2M-byte drive can read and write to disks for the 320K/360K-byte drive, once the 1.2M-byte drive writes information onto the lower capacity disk, only the 1.2M-byte drive can read that information.
- Since the PC-AT's 80286 runs faster than the 8088 in PCs, application programs depending on time must account for the speed differences. IBM recommends not depending on instruction execution speed to get specific application timing. Timing functions are available in BASIC or on the system timer for assembly language programs.
- I/O devices may perform differently on different PC models, so IBM notes third parties should avoid using I/O device timing in an application.
- Expansion slots on the PC-AT's system board have a 62-pin connector and a 36-pin connector. Add-in boards using the 36-pin connector will not work with other PCs.
- The PC-AT's keyboard uses its own processor and is not plug-compatible with other PC keyboards. It performs all functions of other PCs.
- Some copy-protection schemes will not work on the PC-AT. This is the case when copy protection bypasses the BIOS and works directly with the track density and data-transfer rate on drives. Also, protection depending on the rotational speed, access time, head geometry or disk-change signal on a drive will not work on the 1.2M-byte drive. If the method employs the current used to write on a fixed disk, it will not work on the PC-AT.
- PC-DOS 3.0 for the PC-AT includes the functions of the earlier PC-DOS 2.1 but includes enhancements supporting the PC-AT's hardware.

HOW THE ROM BIOS DIFFERS AMONG IBM'S PCs

Model	PC	PC/XT	PC-AT
Winchester hard disk support	no	yes	yes
High-density floppy disk support	no	no	yes
80286 support	no	no	yes
Cassette I/O support	yes	yes	no
Extended memory support (more than 1M byte)	no	no	yes
SYS. REQ key support	no	no	yes
Keyboard status lights	no	no	yes*
Day/date clock support	no	no	yes*
Extended video function	no	no	yes*

*functions specific to the PC-AT and not the 80286 processor

Source: Phoenix Software Associates Ltd.

IBM has changed *its ROM BIOS to accommodate new hardware in the PC-AT, such as the 80286 processor.*

Colvin explains that changes in the PC-AT's ROM BIOS from the PC and PC/XT make the PC-AT more efficient. Some functions in the PC-AT ROM BIOS support the 80286 only, and not the 8088. Other changes in the PC-AT ROM BIOS are not specific to the 80286, such as support for the 1.2M-byte, higher density disk drives.

Phoenix's PC-AT ROM BIOS takes advantage of the enhanced functions of the PC-AT. Those enhancements include support for 1.2M-byte and 360K-byte floppy drives and video features such as saving time by writing a string of characters in one ROM call rather than character-by-character as in earlier PC models. It also supports the PC-AT's intelligent keyboard, which uses its own processor. Other 80286 functions in the BIOS include diagnostic routines for the 80286 and 80287 mathematics coprocessor and support for more than 1M byte of main memory.

Software controls compatibility

Colvin says compatibility is becoming more of a software than a hardware issue. Because the PC-AT uses a different processor than the PC, Phoenix officials maintain that, to be compatible with IBM's PC family, the industry must shift from being driven by hardware to being driven by software. "By coming out with a machine [the PC-AT] that is incompatible with its own PC, IBM is...enabling a greater level of creativity and flexibility in the [software] industry," says Colvin. He recommends that software writers adopt as a new standard a subset of the PC and PC-AT software interfaces.

Mirroring the image

Phoenix spokesmen contend that, since the first round of compatibility, PC mimickers have learned from their mistakes—copying the ROM BIOS, using different hardware from IBM and not offering completely compatible software. "Every manufacturer has learned this time around that PC-AT [compatibility] must take into account all hardware and software dependencies made by IBM," says Richard Levandov, vice president of marketing at Phoenix. This is why, he says, most major hardware manufacturers are considering adopting IBM's 80286 im-

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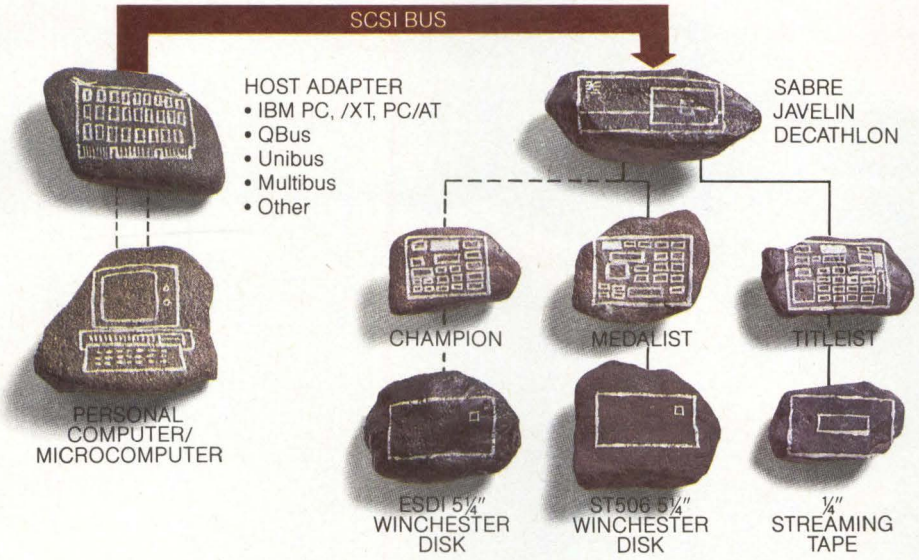

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Copy	Permits data transfer between devices without host intervention.
Search Data	Used to search one or more logical blocks for less than, greater than or equal to a specified data pattern.
Reserve/ Release	Device can be reserved for exclusive use by a single host in multiple host configuration.
High Level Command Set	Provides host with device independence for a given type of device.

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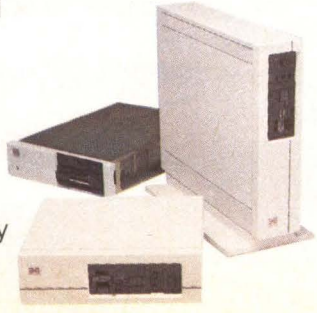

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Winchester *(ST506 or ESDI)* **Floppy** *(5¼", 8" or KODAK)*	520D	5286D	5250D
Winchester *(ST506 or ESDI)* **Streaming Tape** *(QIC 02)*	530D	5386D	5350D
Winchester *(ST506 or ESDI)* **Floppy** *(5¼", 8" or KODAK)* **Streaming Tape** *(QIC 02)*	540D	5486D	5450D

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CIRCLE NO. 20 ON INQUIRY CARD

plementation on the PC-AT.

Levandov claims companies now are designing compatibility into their hardware. For example, IBM uses an 8250 communications controller. Some software companies, explains Levandov, wrote software calls in programs directly to the 8250 for performance. This means that if a hardware designer chooses to use the less expensive 8251 communications controller, the level of PC compatibility will be diminished.

This demand for hardware compatibility has led Phoenix to begin licensing an 8088 processor-based motherboard design within the last two months. Each purchaser receives a computer-aided-design/computer-aid-

Off-the-shelf parts hasten cloning of IBM's PC-AT

While IBM Corp. stretches lead times for its new PC-AT 16-bit computer, some PC-AT-compatible suppliers are jumping into the market in hopes of finding a rich bounty of new applications.

Phoenix Software Associates Ltd., Norwood, Mass., brings to market this month PC-AT-compatible hardware and software components to help manufacturers ready products quickly by reducing design time.

The software comprises a ROM basic input/output system (BIOS), GW BASIC, MS-DOS, keyboard support code and utilities for $420,000. The company also will offer a PC-AT-compatible board design for license at an as-yet-undetermined fee.

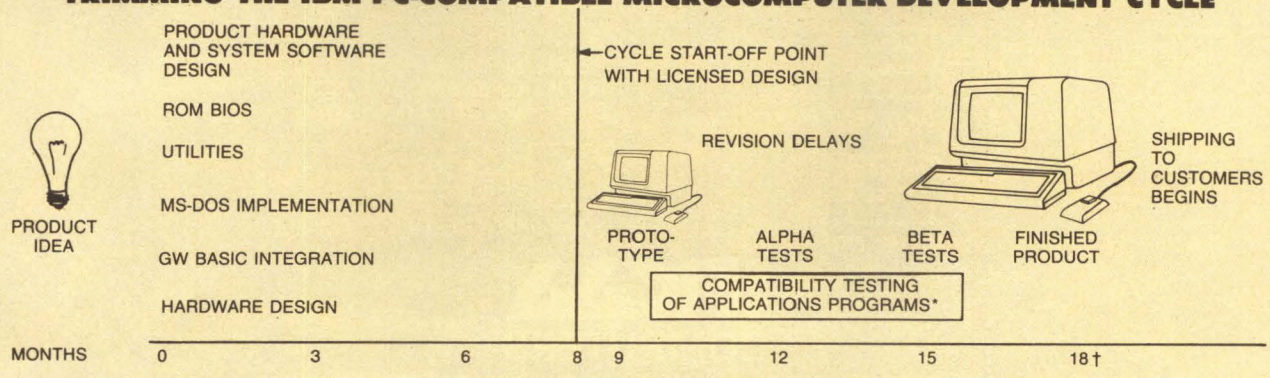
George Colony, president of Cambridge, Mass., consulting company Forrester Research, says Phoenix is on the right track. "Why would anyone want to reinvent the wheel?" asks Colony. He says there are no PC-AT-compatible systems yet, although Durango Systems Inc., San Jose, Calif., and Corona Data Systems Inc., Westlake Village, Calif., have 80286-based computers.

Phoenix's vice president of marketing, Richard Levandov, says the trend in PC-AT compatibility is for purchasers to license the BIOS rather than trying to write it themselves. With the PC, compatible makers either wrote the BIOS themselves, licensed it from a third party or copied it from IBM and were hauled into litigation.

Companies can cut their product development time in about half by buying off-the-shelf parts, Levandov says. "We're forcing the major computer companies to make a make-or-buy decision. The companies must make rapid announcements of new personal computer products...which strains the companies' resources," he maintains. Colony agrees that most companies will buy ready-made parts from companies like Phoenix and Faraday Electronics, Sunnyvale, Calif., which makes IBM-compatible motherboards.

Neil Colvin, president of Phoenix, points to new applications opening up for machines with the PC-AT's power (the PC-AT is two to three times faster than the PC), such as the scientific and engineering applications once dominated by Digital Equipment Corp. and Data General Corp. minicomputers. He says process control is one application in which the PC-AT is fast enough but the basic PC is not.

TRIMMING THE IBM PC-COMPATIBLE MICROCOMPUTER DEVELOPMENT CYCLE



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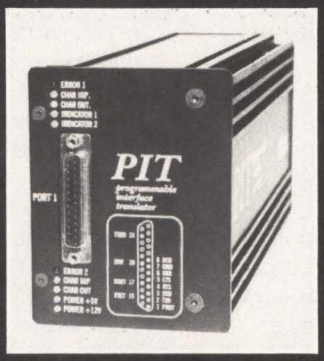

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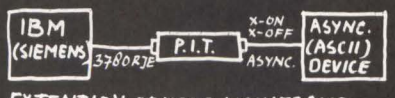
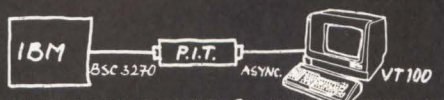
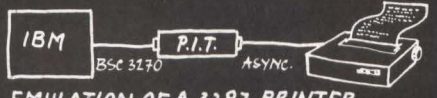


EXTENTION OF YOUR MAINFRAME WITH ALMOST ANY PERIPHERAL

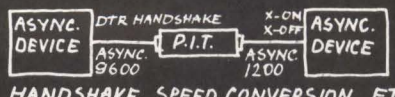


EMULATION OF A 3278 DISPLAY STATION

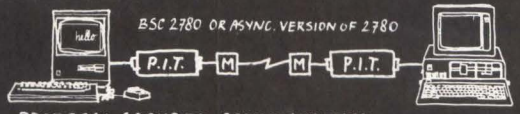


EMULATION OF A 3287 PRINTER

INTERFACING COMPUTERS OF DIFFERENT MAKES



HANDSHAKE, SPEED CONVERSION, ETC.



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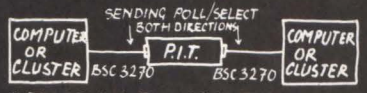
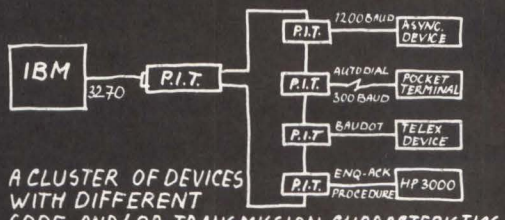


INTERFACING TWO 3274 TYPE DEVICES BY EMULATING A COMM. CONTROLLER AT BOTH SIDES



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				Switzerland	Interep SA	Geneva	022-431 150

ed-manufacturing tape that can be customized for a desired board layout before the customer manufactures the board. Levandov says this comes in handy to potential customers such as voice data-terminal suppliers wanting to respond to Rolm Corp.'s announcement of an IBM PC-compatible voice and data system (MMS, November 1984, Page 31). The company also planned to introduce this quarter a PC-AT-compatible motherboard design, also up for license. Prices had not been set as of press time.

Phoenix's PC-AT ROM BIOS should be available now. The price is $200,000 for the ROM BIOS, $20,000 for the 8042 processor code required for keyboard operation, $100,000 for GW BASIC, $50,000 for MS-DOS and $50,000 for utilities, totaling $420,000. Customers who have purchased Phoenix's PC/XT ROM BIOS will get a 30-percent discount on a PC-AT ROM BIOS license. Levandov says Phoenix can work out an extended payment schedule for small, start-up companies.

Because little software has been written so far to take advantage of the PC-AT hardware, Phoenix sources say the company has been unable to completely test its PC-AT ROM BIOS.

Food for the smaller fish

Levandov says most purchasers will ship more than 10,000 PC-compatible computers with the ROM BIOS, which would amortize the ROM BIOS cost to less than $50 a system. For Phoenix's standard PC BIOS, the cost would be about $29 per system. But another company is catering to the smaller companies that can't afford more than $290,000 for a PC ROM BIOS from Phoenix or that don't intend to produce 10,000 computers.

Display Telecommunications Corp., Dallas, has shipped thousands of PC/XT ROM BIOS units and motherboards in a product called the Mega-Board XT. Prices range from $99.95 for a bare-bones board to $595 for a complete board. Robert E. Lindsley, company president, explains the products are marketed to small customers and to large customers for limited applications. For example, many of his products are sold to General Electric Co. and Ford Motor Co. for industrial applications.

This month, Display Telecommunications plans to introduce a Mega-Board AT-compatible listing for $199.95. Lindsley will not comment on specifics about the product until it's ready to be shipped.

Lindsley says marketers will see a huge opportunity as long as IBM cannot meet demand. "A lot of companies will rush in so fast they will not have done their homework well. They'll come into [the market] with marginally compatible machines and will do well at first." But he says that later, when full PC-AT compatibility is demanded by customers, interest in less compatible computers will taper off. He says that how companies implement PC-AT compatibility will make or break their market entry. □

3Com brings network servers to small LANs

Tom Moran, Associate Editor
and **Michael Tucker,** Associate Editor

Saying "a new kind of beast has entered the world," officials of 3Com Corp., Mountain View, Calif., have introduced "3Server," a network file server for local area networks (LANs) of personal computers. One of the first servers in the low-end LAN market, the 3Server provides file, printer and electronic-mail services for 3Com's EtherSeries network.

"We wanted to build a machine that *was* a network for a low-end market," says 3Com founder and chairman Bob Metcalfe. 3Server is designed for small business and office networks of up to 50 microcomputers. The price is $7,495.

3Server has an 8MHz Intel Corp. 80186 microprocessor, an 82586 Ethernet controller, a 36M-byte Winchester disk drive, a small computer systems interface (SCSI), 512K bytes of RAM and a 60M-byte tape-backup option. It can also support one serial and one parallel printer.

Up to six 36M-byte Winchester disk drives can be added to the basic system at $3,295 apiece for a total of 252M bytes of storage. Suggested retail price of the optional tape backup is $2,995. Shared-disk, utility software will list for $695, printer-sharing software for $395 and electronic-mail software, available later this year, for $995.

Options: *Users can expand 3Server (bottom) with an optional 60M-byte tape-backup unit (center) and 36M-byte expansion disk (top).*

During the second quarter of this year, 3Com plans to introduce communications packages to support IBM Corp. Systems Network Architecture (SNA) communication protocols and

NEWS

allow personal computers to access networks over phone lines.

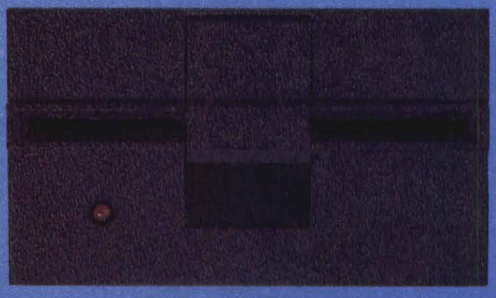
The company believes 3Server will fit into a market niche between large network file servers and microcomputers operating as file servers in small networks of other microcomputers. It's being distributed through retail channels. The 3Server can run popular personal computer database and accounting software—notably Lotus Development Corp.'s 1-2-3.

"I think our market can be broken down into two segments," says Doug Pollack, 3Com's server-product manager. "On one hand we have department-sized organizations that have found networks of personal computers increasingly useful. On the other, we have people in small business who are looking to networks of personal computers as an alternative to multiuser supermicrocomputers or low-end minis."

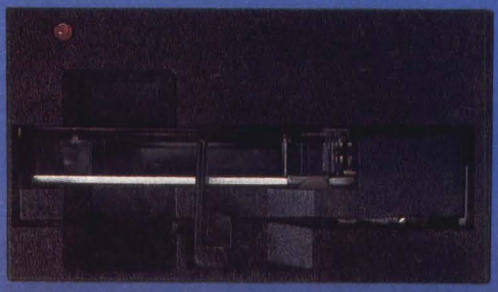
While file and network servers for

HOW LITTLE LANs STACK UP

Manufacturer, product	Server type	Processor	RAM (K bytes)	Disk storage (M bytes)	Ports	Network type
Corvus Systems, OmniDrive	disk server	6801	8	5.5	1 OmniNet	OmniNet
IBM, IBM PC-AT with PC Network	file server	8088 80188 on adapter card	256	20		PC Network
Nestar, PLAN 3000	file server, plus two additional functions of the user's choice	6800	250	24-56		ARCnet
TeleVideo, TeleVideo Personal Mini	file server, disk server, print server, opt. electronic mail server	80186, Z80	256-512	22	1 parallel 1 serial 4 RS422	proprietary Star Network
3Com, 3Server	file server, print server, electronic mail server	80186	512	36	1 parallel 1 serial 2 SCSI-bus	Ethernet



THE END OF THE SECONDARY STORAGE SPECTRUM EVERYONE FORGOT ABOUT WAS THE MIDDLE.



Maximum users	Price ($)	Backup
63	2,095	optional streaming tape
72	6,515 (IBM PC-AT plus PC Network hard- and software)	various products
255	10,000	streaming tape
8-16	6,995	streaming tape
50	7,495	optional streaming tape

large LANs are fairly common, file servers dedicated solely to small LANs of personal computers are rare. Integrators have usually turned one of the personal computers in a network into a file server.

3Server's main competition may come from personal computers doing double duty as file servers—particularly the IBM PC-AT with a hard disk. Last August, IBM announced plans for a PC LAN, now expected to be available this quarter.

Analysts have speculated that a PC networking product would dominate the low-end LAN market due to IBM's sheer mass. But 3Com officials are confident that 3Server can withstand the IBM threat. The PC-AT, notes Metcalfe, "was designed to be a personal computer. It has option slots, a keyboard, a monitor and, by running some software, it can masquerade as a network server."

An IBM representative says that although the PC-AT was not designed as a file server it can function as one "because it is a very powerful and versatile system." IBM has not made any announcement of a dedicated file server for networked personal computers, and the representative declined to reveal the company's plans.

Market analysts seem generally enthusiastic about the 3Server. Louis Herndon Wells, analyst with the research concern Dataquest Inc., San Jose, Calif., says, "We think it's terrific. A file server is an indispensable element of a functional local area network...the 3Server also adds network-management capability."

Aaron Goldberg, director of microsystems research for International Data Corp., Santa Clara, Calif., is equally upbeat about the 3Server. "It's designed as a solution rather than as [just] a piece of hardware, or software, or cabling. Essentially, what they have done is a very intelligent design that

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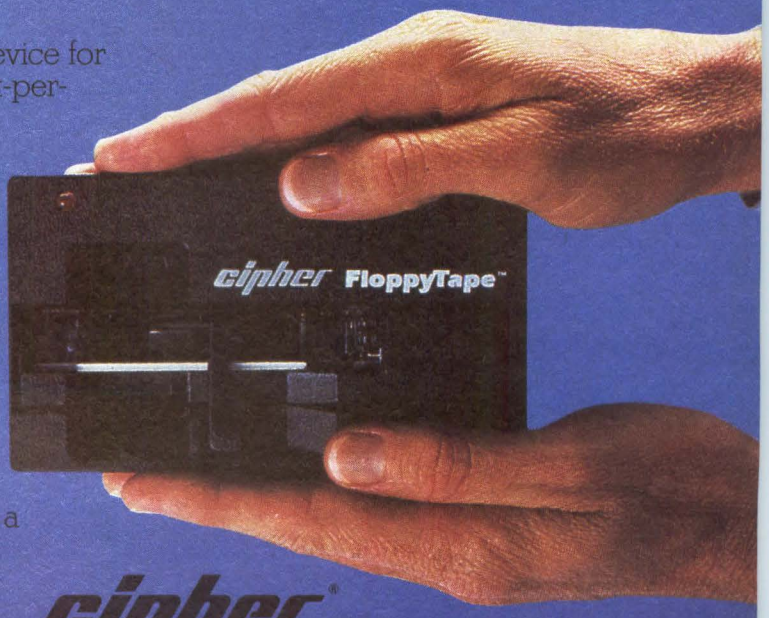

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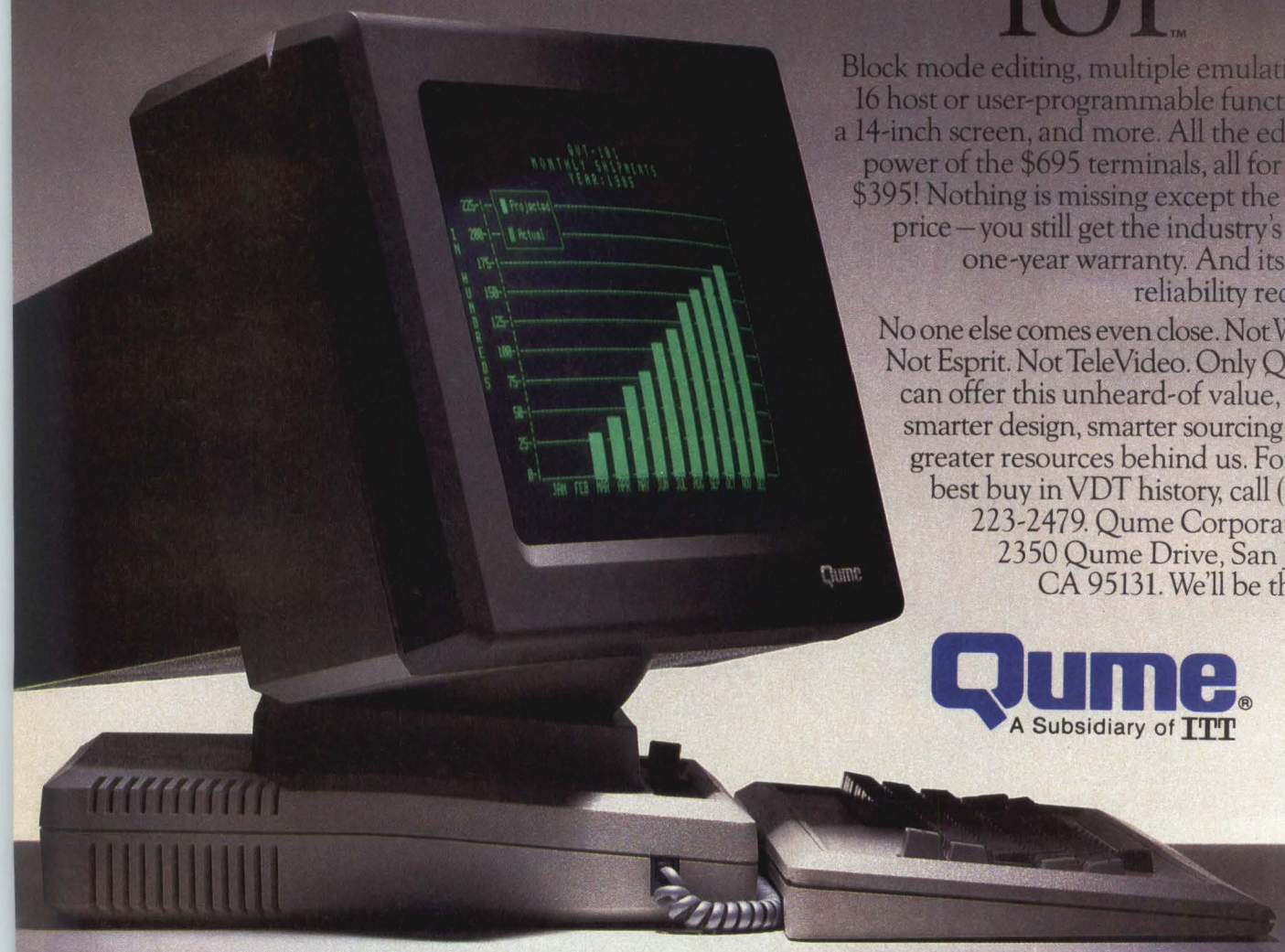

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makes administration of the file server far less taxing than [using] a Xerox copier...that's important because [file servers] are going to sit in administrative offices, and the system administrator is unlikely to be a trained data processor."

Analysts also suggest the 3Server may be able to take advantage of a file-server market boom. "Our research shows that a personal computer in a business environment will [currently] have anywhere from one to five people who use it at [various] times," notes Goldberg. "When multitasking occurs, and a personal computer becomes good for so many things that you do the bulk of your work on it, it becomes impossible to share."

The result, he says, will be more personal computers and file servers. □

Atari strives for a comeback with Macintosh look-alike

Lucy Huffman
Contributing Correspondent

In a major bid to re-establish itself in the personal computer market, Atari Inc., Sunnyvale, Calif., has introduced a new line of computers with the same power and features of Apple Computer Inc.'s Macintosh, but for half the price. The two new Atari ST computers also mark the company's first new product announcement since Jack Tramiel, former chairman of competing Commodore International, took over the ailing Atari six months ago. While the market for, and certain aspects of, the line remain unclear, many analysts are bullish about Tramiel's ability to turn Atari around.

The new models were unveiled in prototype at the recent winter Consumer Electronics Show in Las Vegas. Conference attendees dubbed them "Jackintosh": a play on Tramiel's first name and the machines' similarity to the Apple computer. Atari officials, however, claim one major difference. Both ST models, including monitors and disk drives, will be available for less than $1,000. What's more, the ST machines feature color graphics, unlike the black-and-white Macintosh. Said one enthusiastic analyst who saw the prototype, "It's like delivering a color Macintosh for under $1,000."

The Atari ST computers use a 16/32-bit Motorola Inc. MC68000 microprocessor, the same chip used in the Macintosh. The 130ST has 131K bytes of RAM, while the 520ST has 524K bytes of RAM. Both have 512 available colors for graphics. Each has 196K bytes of built-in ROM, expandable to 327K bytes with plug-in cartridges.

Atari adopts GEM graphics

What makes the new line so similar to the Macintosh is its operating environment. Atari is one of the first companies to use the Graphics Environment Manager (GEM) recently introduced by Digital Research Inc. GEM eliminates cryptic operating-system commands by using a pictorial representation of a desk's surface, including such familiar icons as a wastebasket or file folder. The user commands the machine by moving a mouse and clicking a button. For ex-

CIRCLE NO. 24 ON INQUIRY CARD

ample, a cut-and-paste feature allows users to merge spreadsheet, data or files.

Other internal features of the new ST line include a high-speed hard disk interface, direct-memory access at 1.33M bytes per second, built-in cartridge access and an integrated floppy disk controller. Also included are a Centronics parallel interface for printers, an RS232C serial modem interface, a disk interface and two joystick ports, one configured for the mouse.

To complement the ST line, Atari is also coming out with a new set of peripherals. While both STs can be used with a standard television set, Atari monitors will feature 12-inch, individually addressable, 32K bit-mapped screens and will be available in high-resolution monochrome or medium-resolution RGB (red, green, blue) color. Either 3½-inch floppy disk (500K bytes) or 3½-inch hard disk (10M bytes) drives are available for the ST machines. Atari is also developing both color and black-and-white printers.

Low price, comparable features

Atari is touting the new line as offering customers "power without the price." The ST models are expected to retail from $400 to $600, with monitors and disk drives running less than $200 apiece. Hard disks are said to be in the $600 range. At those prices, the Atari 520ST would cost about $1,000, compared with a similarly outfitted Macintosh retailing for more than $2,000. Atari would not confirm those preliminary prices, however. The company has scheduled delivery for April, but the fourth quarter of 1985 is a more likely date, say industry experts.

Hoopla aside, as many questions as answers surround the Atari ST line. "A lot about this product is vague," said Peter Teige, an analyst with Dataquest Inc., a San Jose, Calif., research firm. "You don't know who it's for or what software there is."

Most industry analysts believe that software will be the key to the new line's success, but experts say virtually no third-party software for the machines exists yet. "With Atari, nothing has really been said about software," said Teige.

The new GEM environment may account for at least part of the software uncertainty. GEM was introduced just last November and, besides Atari, only one European manufacturer is using it. But DRI officials say GEM software can run on any MS-DOS-based or Concurrent-DOS-based machine, thus allowing programmers using an IBM Corp. PC, for example, to develop software that can be recompiled for the new Atari personal computer.

What's more, the DRI officials say eight independent software vendors have agreed to write to the GEM environment with potentially "hundreds" more ready to commit themselves by spring. Among those already committed are Chang Laboratories, San Jose, Calif., Matrix Systems Group Corp., Boston, and Thorn EMI, Costa Mesa, Calif.

Software slow in coming

Jan Lewis, an analyst with InfoCorp, Cupertino, Calif., believes that momentum among programmers for using GEM will be slow, even though those designing for the Macintosh may be lured by the similarity of Atari's STs to the Macintosh. And, she added, Atari may be trying to defy internationally conventional wisdom that says it will be in trouble unless it develops the ST software market on its own. "Maybe Atari believes it can sell its razors cheaper than anyone else, and let everyone else sell the blades," she said.

In addition to the uncertainties about software availability, the company is not clear about who its customers will be, industry sources say. "The philosophy of the company is not to separate the different markets," said an Atari spokesman. "We deliver to individuals. We don't make home computer/business computer distinctions."

Despite that claim and the ST line's

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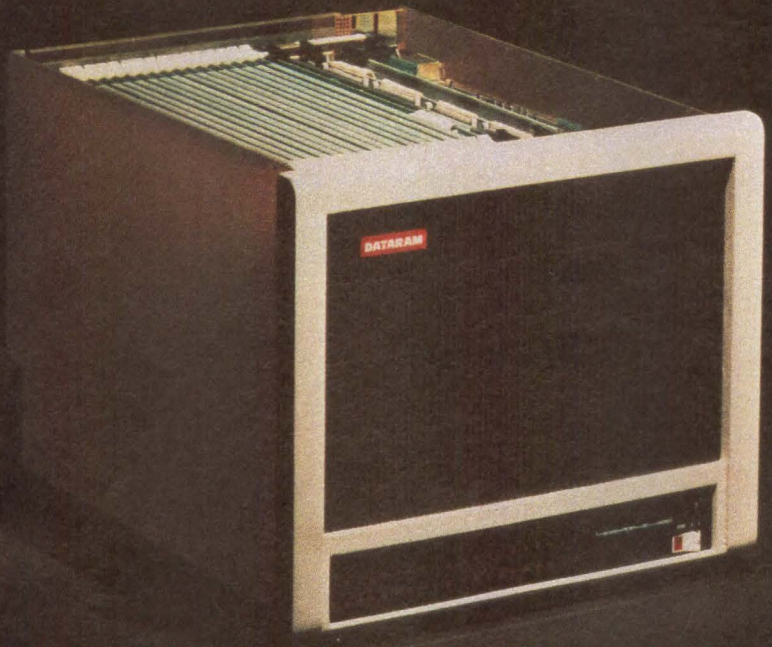

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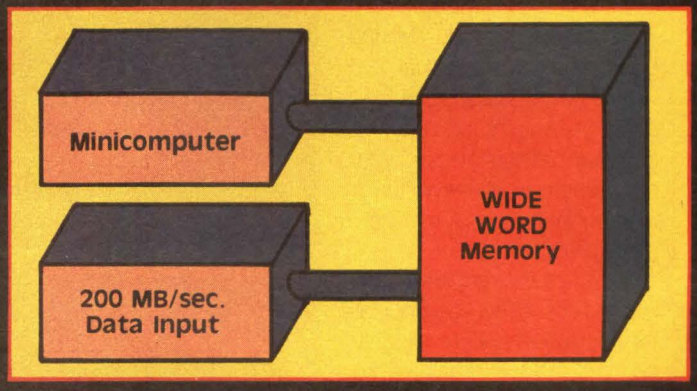

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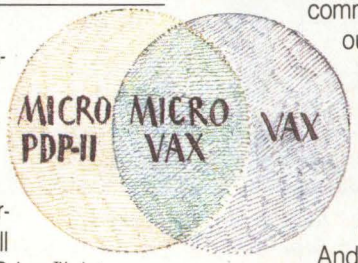

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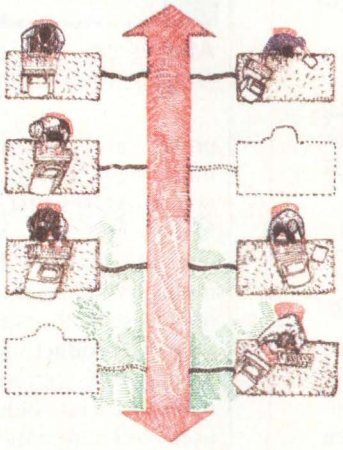

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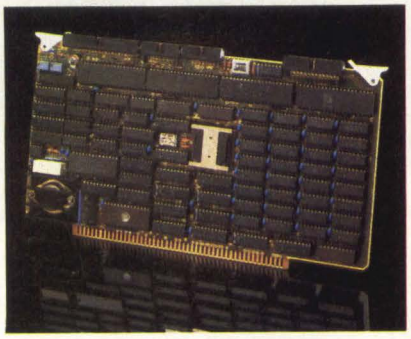

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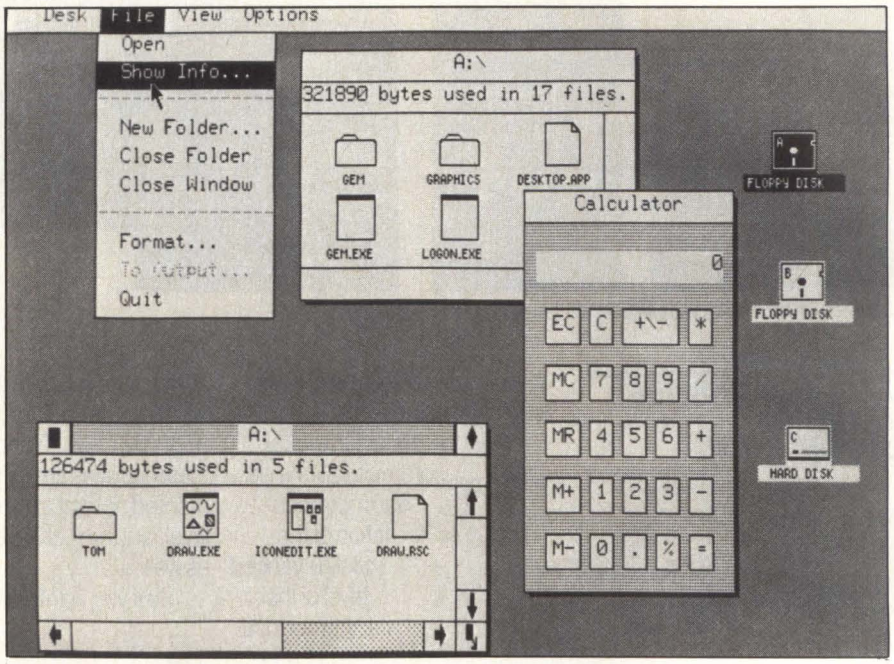

Atari *is one of the first companies to use Digital Research's GEM Graphics Environment Manager in Atari's Macintosh look-alikes.*

power and performance capability, many signs indicate the home market will be Atari's first goal. One example is the name itself. When Tramiel took over the company from Warner Communications, he intentionally kept the name, said the spokesman, because Atari's product recognition among consumers is extraordinarily high. But many experts believe that business users will automatically shy away from a firm whose fortunes so publicly rose and crashed with the video game craze. As Dataquest's Teige put it, "If they wanted the business market, they bought the wrong name."

Then there is Atari's planned marketing scheme. The company has said it will not distribute through computer retailers, as presently do IBM and Apple, but instead will go through mass marketers such as Sears Roebuck & Co., Toys R Us and K Mart Discount Department Stores. Atari has also devised a system of color coding each new computer model and its related software and peripherals. The company expects color coding to reduce confusion, especially among novices, and to aid in the self-service methods of mass-merchant business.

The distinction between the home market and the low end of the business market may eventually break of its own accord, particularly if IBM or Apple begin selling in mass-market outlets. What's more, if software is developed quickly for the Atari line, business users could be lured by the lower price, all else being equal. While Teige says the firm appears to initially be going after the home market, he adds, "I'm not clear that that's their ultimate strategy."

Can success return?

Finally, questions remain about the company itself as a result of the video game debacle. Most experts agree that the biggest asset Atari has is its chairman, Tramiel, the aggressive entrepreneur who built Commodore into a billion-dollar company.

According to the Atari spokesman, 95 percent of the firm's personnel are new to Atari and "everybody's wearing 50 million different hats."

InfoCorp's Lewis is enthusiastic about Tramiel's ability to raise financing, now that the product has been introduced: "Every time I say 'Atari,' I really mean Jack Tramiel." □

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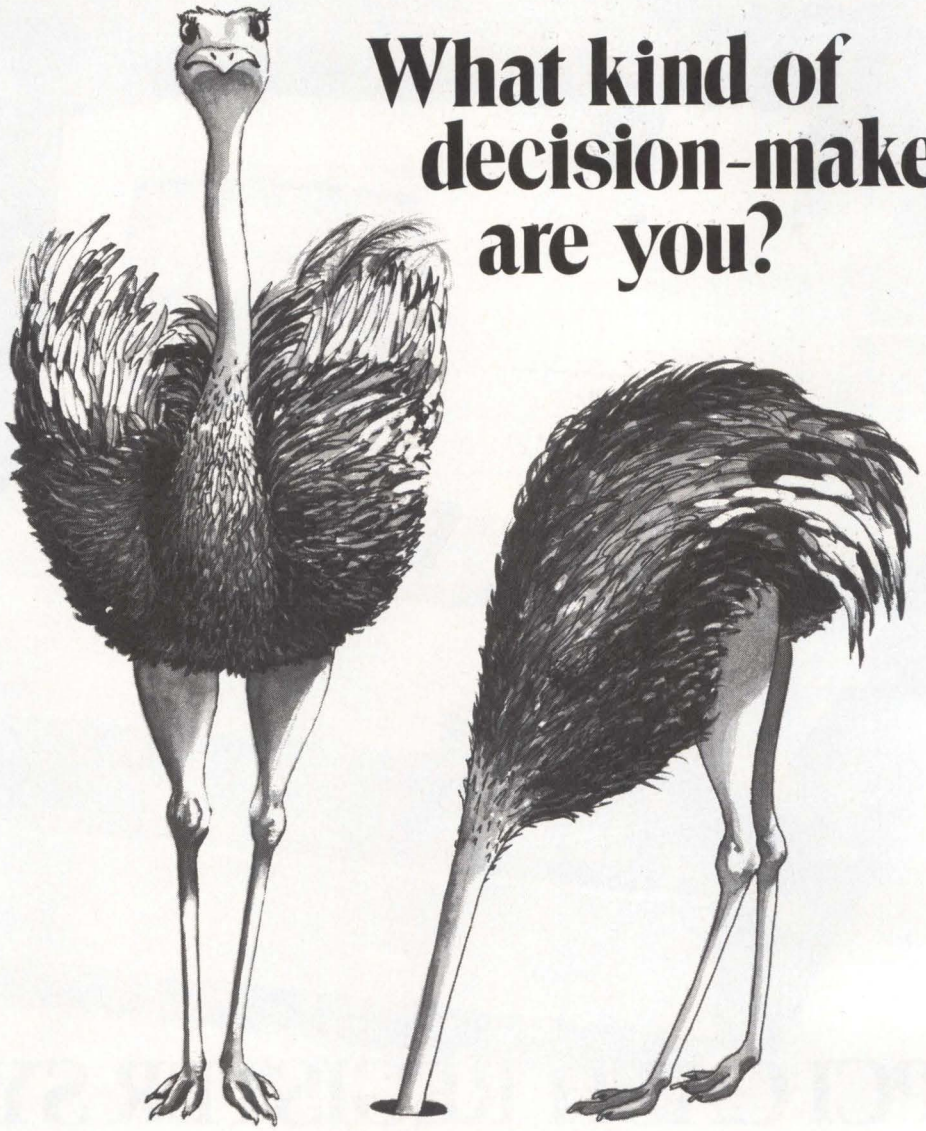

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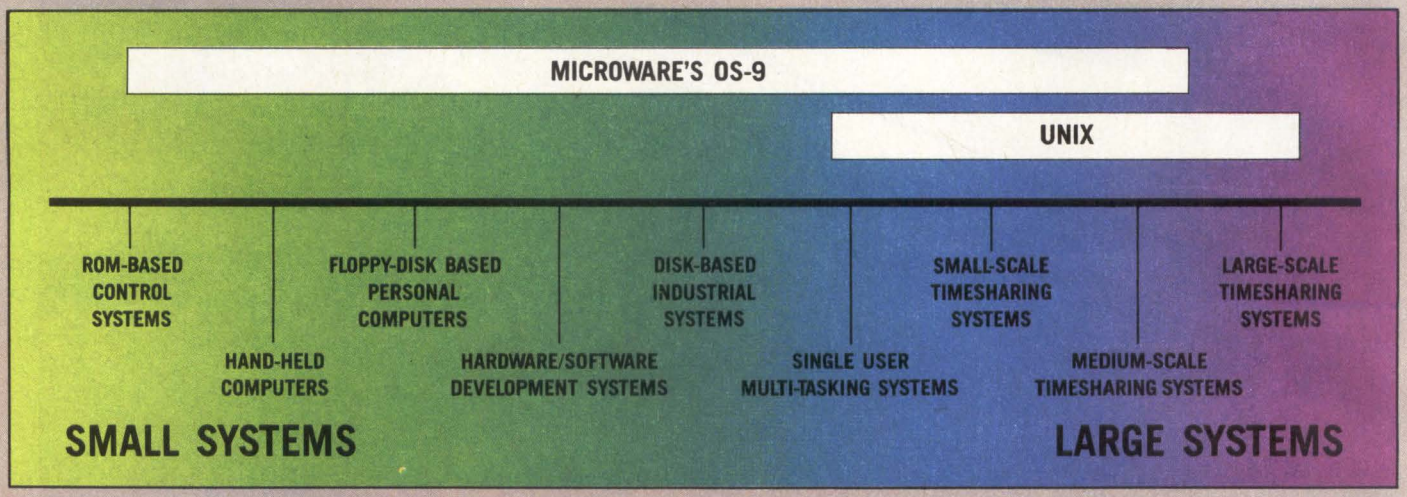

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CIRCLE NO. 32 ON INQUIRY CARD

When doing business in China, expect the unexpected

China is no place like home when East meets West in joint-venture projects

Lori Valigra, Senior Editor

A European businessman, resting after a long day at a computer show in China, was awakened by a loud knock on his hotel room door. Four Chinese he had met at the Beijing (Peking) exhibition stood before him, unannounced, eager to resume discussing business.

An American businessman decided to fly to Shanghai, for two extra days of work, thus requiring a change in his flight schedule back to the United States. He found that the next available flight was 11 days later.

Still another Western businessman plugged in a computer system exhibited at a show. An electrical surge burned a hole in the computer's I/O board.

Such incidents are common in China. The country, open to Americans for less than a decade, still has a long way to go toward providing Western-style services.

Phones are a luxury

For example, one Beijing representative for computer retailer ComputerLand is pleased when he can successfully complete four telephone calls in a day. The phone is not casually regarded as a communications tool in China. There, most people devote more than 50 percent of their income to food and clothing, so the phone is a luxury. Beijing, with a population of more than 9 million, has only 250,000 phones, according to U.S. Embassy Commercial Service figures.

LM Ericsson's *Chinese contract for a 7,500-line digital-telephone exchange helped inspire other companies to do business in China.*

According to the Commercial Service, China wants to boost the number of telephones to at least 2.8 per 100 people by the year 2000, an eightfold increase. Comparatively, there were 70 phones per 100 people in the United States in 1975.

Indicative of China's push to modernize quickly, Sweden's telecommunications giant, LM Ericsson, last November secured an order for a 7,500-line digital-telephone exchange for use in several major Beijing hotels. In January, Ericsson set up a subsidiary to cover China.

In search of contracts like the one awarded Ericsson, Americans, Europeans and Southeast Asians are willing to forsake the comforts of home to do business in China.

Hoping endurance brings rewards

Many market analysts look on China as the world's largest untapped market for high-technology equipment. The country plans to spend more than $14.2 billion over the next three years on foreign technology. The investment is primarily for modernizing industry and is expected to support 4,820 projects, according to the *China Daily*, an English-language newspaper in China. Another move China's government made to spur technological growth was to increase the buying power of local governments. They now can select technical upgrading projects requiring an investment of $5 million, a fivefold hike in their allocation dollars.

Additionally, China has set up 14 so-called "Special Economic Zones" that offer better city infrastructures (water, housing and transportation) and tax breaks. It is in these zones that joint-venture manufacturing and assembly reside.

But companies rushing in to take advantage of the seemingly open opportunities in China might heed the advice of veteran China travelers, whose general recommendation is to abandon any preconceived notions about the country and expect the unexpected.

Most companies doing business in China caution against trying to make

money fast. "You can't come anywhere in the Far East to make a quick buck," says Jon Covington, international markets manager for Apple Computer Inc., Cupertino, Calif. "And you have to be willing to give as much as you get. You must make [a long-term] investment. It isn't just harvest time all the time." His advice to first-time business visitors to China is to be patient: "Don't expect to make a sale on the first trip. Don't even expect to know what you're doing."

Covington also advises China-bound travelers to get rid of certain preconceived notions, such as "putting a plug into the wall and expecting electricity." Amperage can fluctuate greatly at 220V, "if someone turns on a factory," he says. Reportedly, because China is still developing its power industry, electricity is sometimes rerouted from a plant to a convention site, for example, and fluctuations are common.

"Nothing is standard," seconds Pete Sillari, a representative in ComputerLand's Beijing office, which is setting up a joint venture with the Chinese. He says the Chinese make things work but not necessarily in the way to which Westerners are accustomed. For example, he says, a wall socket for two plugs may have the lead wire on the right for one plug and on the left for the other.

Those expecting to set up manufacturing quickly must be aware that many factories in China are not equipped for high-volume production, explains Raymond S. Shimrak, director of international sales at Datamedia Corp., Pennsauken, N.J. "There's no climate control, power is intermittent, there's lots of dust, and there's no static electricity control."

Other business services spotty

Getting money can also be a problem. Even if a company is willing to wait overnight to place an overseas phone call, problems arise in having money wired to China. Shimrak says one reason many large companies locate in Hong Kong instead of in China is to avoid the problem of moving cash.

AS CHINA OPENS ITS DOORS TO HIGH TECHNOLOGY, JOINT-VENTURE PROPOSALS POUR IN

Partners	Activities
Charles River Data Systems Inc. and Tianjin Electronic Computer Factory	Charles River sold $5 million in UNIX-compatible computers to Tianjin Electronic.
Cullinet Software Inc. and China Computer Technical Service Corp. of the Ministry of Electronics	China Computer acts as a marketing agent for Cullinet.
Georgia Institute of Technology and China Association for Science and Technology	Pair created a joint venture called C/Tech to assist China in purchasing technology-related factories, licenses and equipment, to expand technology transfer between the United States and China and to stage educational conferences.
Hewlett-Packard Co. and China Electronics Import & Export Corp. (CEIEC)	China-Hewlett-Packard Co. Ltd., will manufacture HP computers and instruments.
IBM China Inc. and Ministry of Machine Building Industry and Beijing Municipal Government	They will establish a data-services center and conduct customer-education classes.
IBM China Inc. and Ministry of Electronics	They will establish an assembly and test facility for IBM's 5550 Chinese personal computer.
IBM China Inc. and Ministry of Electronics	The Ministry is to develop software for IBM.
Wang Laboratories Inc. and Ministry of Electronics	Wang to get $50 million to produce low-end VS computers and develop software and also help manufacture 50,000 office automation systems in Shanghai, develop Chinese language software and assemble 30,000 Professional microcomputers in Xiamen.

Prime Computer Inc., ComputerLand, and others either plan, are negotiating or have recently concluded deals with China.

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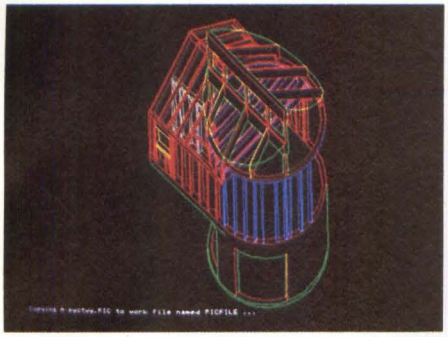
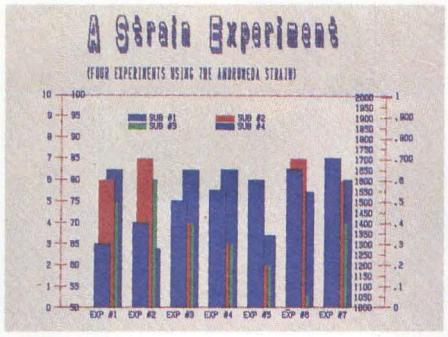
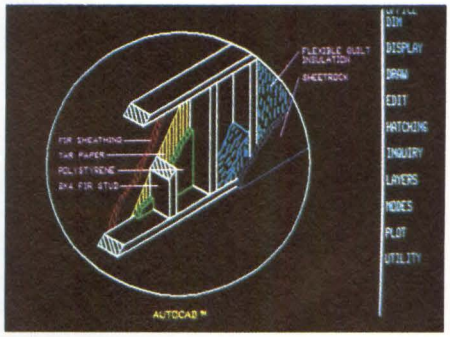


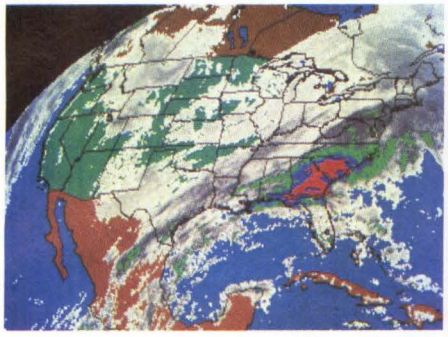
1. High Speed (MicroCAD Software)



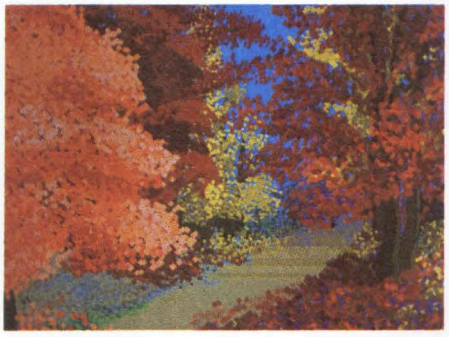
2. Dual Display Modes (Energraphics Software)



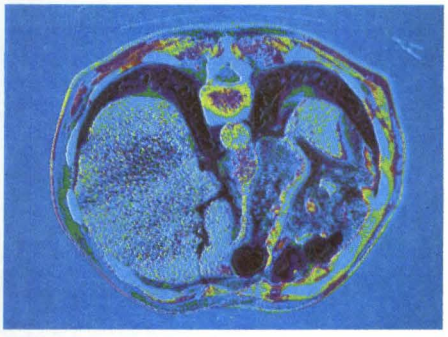
3. Simplified Processing (AutoCAD Software)



4. 9 Bit Planes (Courtesy WSI Inc., Bedford, MA)



5. 16.8M Color Shades (Courtesy Catherine Del Tito, Wave Graphics)



6. High Resolution (Courtesy University of North Carolina at Chapel Hill, Depts of Computer Science and Radiology)

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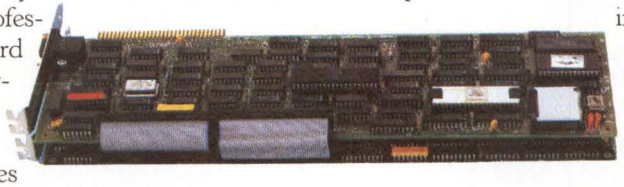

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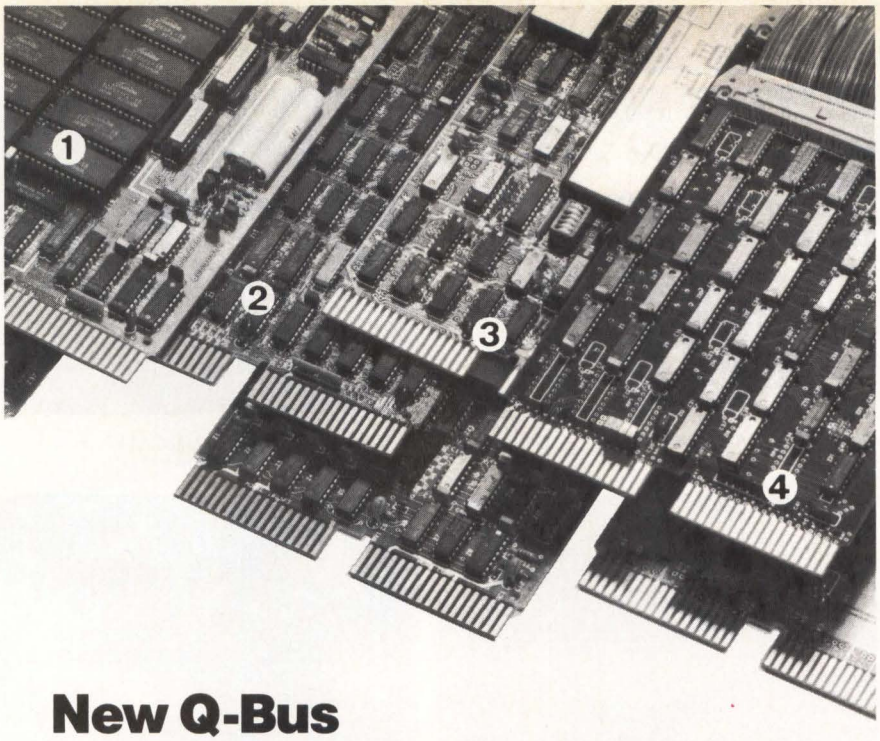

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CORPORATE AND FINANCIAL

It can take up to two weeks to get money wired to China. Some experienced Westerners suspect that the money may come in but is intercepted, temporarily deposited for its interest and then passed on to its intended recipient.

Those who do choose to locate in China are assigned offices in hotels by the government. Prime Computer Inc., Natick, Mass., recently opened an office in Beijing's Jianguo Hotel. Prime Computer (Hong Kong) Ltd.'s managing director, Joseph R. Thompson, says it costs $65,000 yearly to have "one room, a typewriter and a teapot" in the Jianguo. Since the hotel room is wired for either a private telex or telephone, Thompson says, Prime opted to use the hotel's telex and has its own telephone line. He says Prime had to pay the first six months' rent in advance, plus service and tax.

Larger operations can cost more than $200,000 a year. John Y.B. Hood, business development specialist with Western Geophysical, Houston, a value-added dealer for IBM Corp. PCs, says it costs $200,000 to $250,000 annually to support a one-man staff in China, including office space and housing. Western Geophysical has offices in Beijing's new Great Wall Hotel.

But even at the Great Wall Hotel, long tours of duty can be trying. Cultural events are scarce, and work occupies most of the employee's time. "Hotels are the housing, food is from the hotel restaurant, and the laundry is the hotel laundry," says Hood.

However, it's getting more difficult to single out a business partner in China, some sources say. The established channels of importing and distributing products are becoming less and less clear. Until last fall, each ministry purchasing or selling products did so through the Ministry of Foreign Economic Relations and Trade (MOFERT), a state trading company, explains Dana I. Robinson, marketing manager for Prime's China Project. However, reforms in China last October decentralized the MOFERT, and now there are several "foreign trade corporations," and outsiders must discern which one or ones to contact. □

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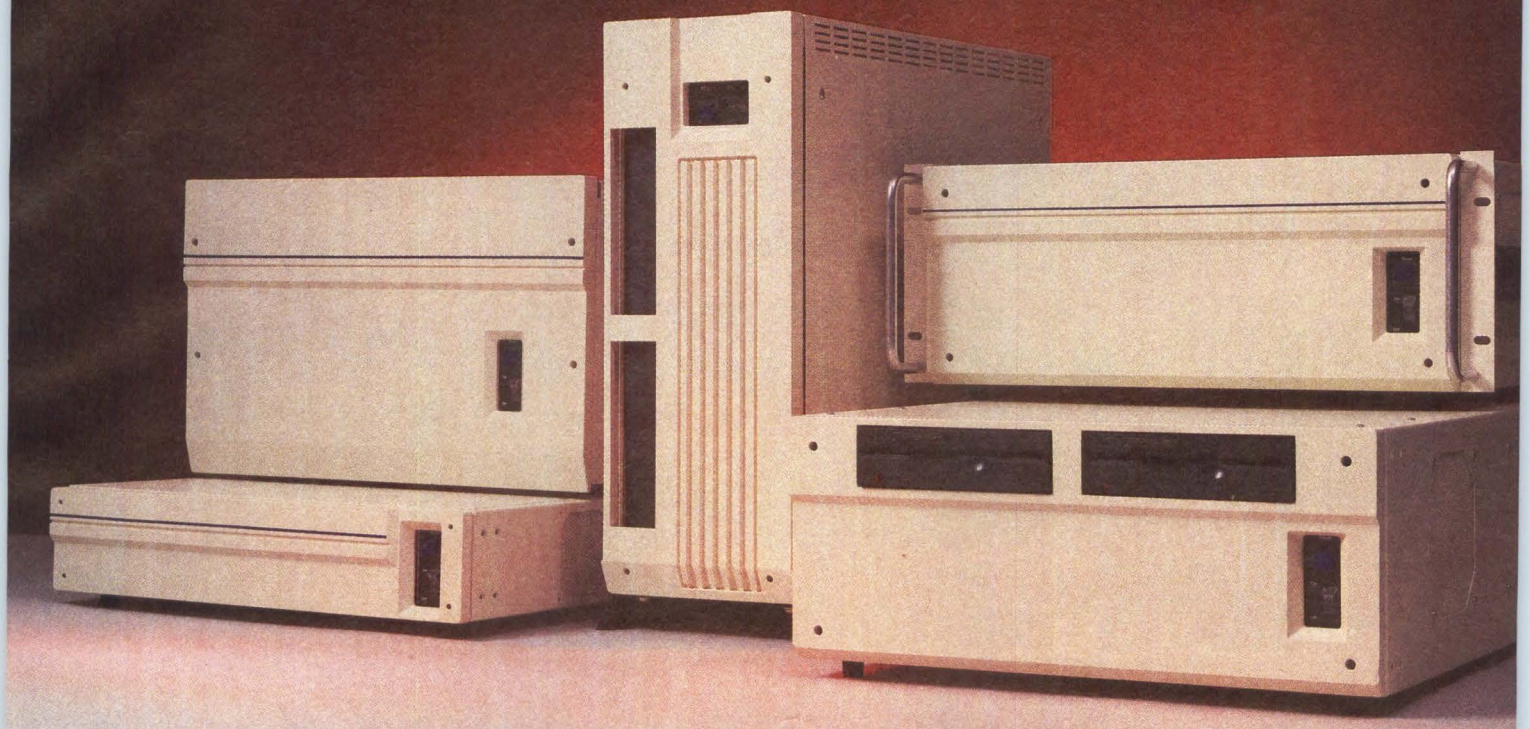

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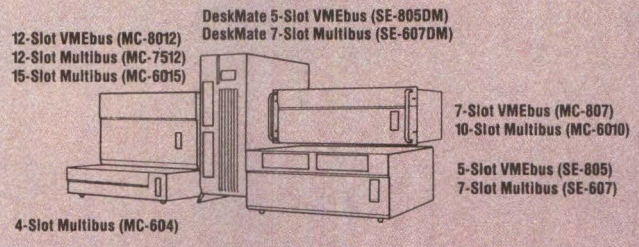

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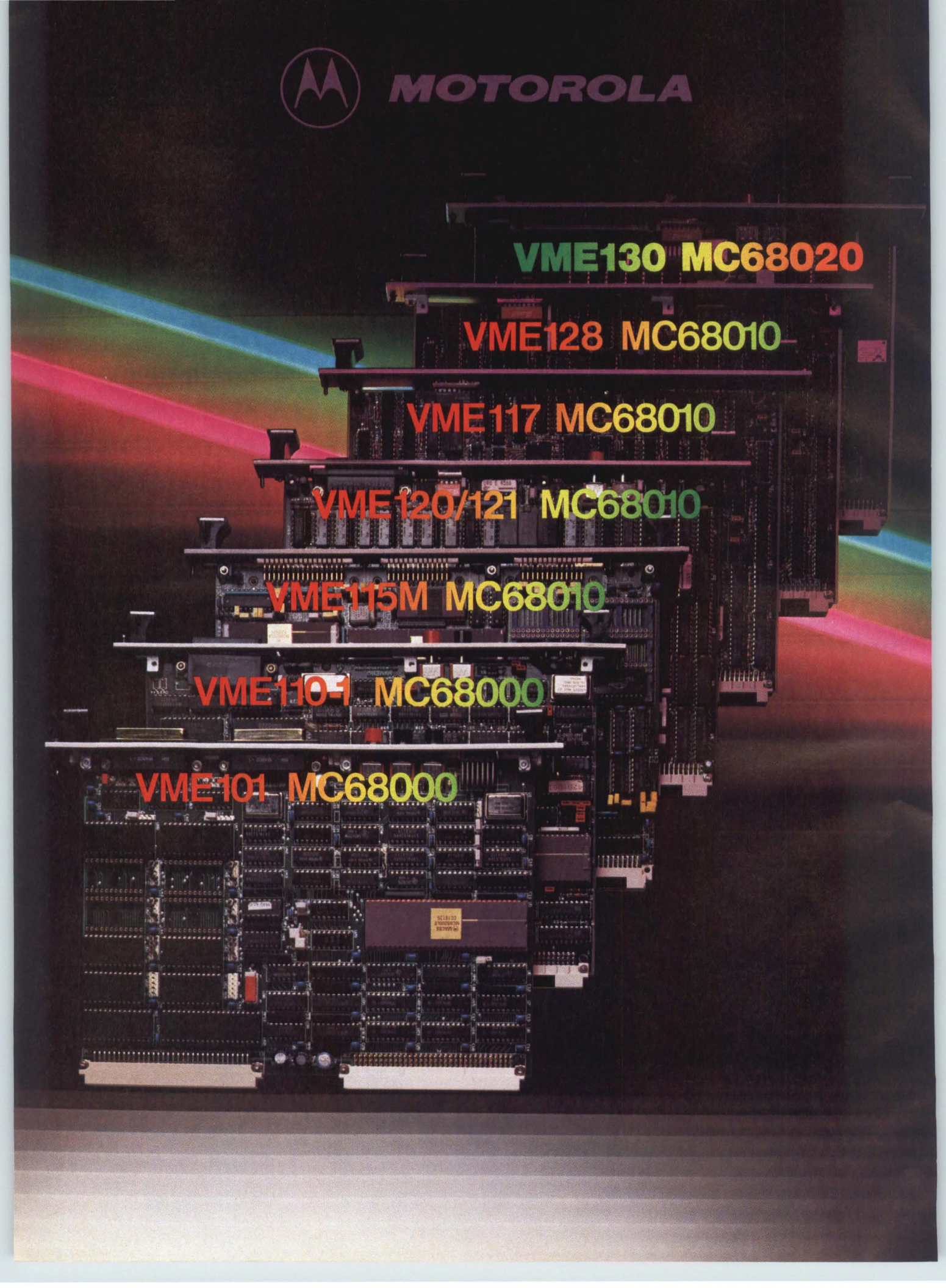
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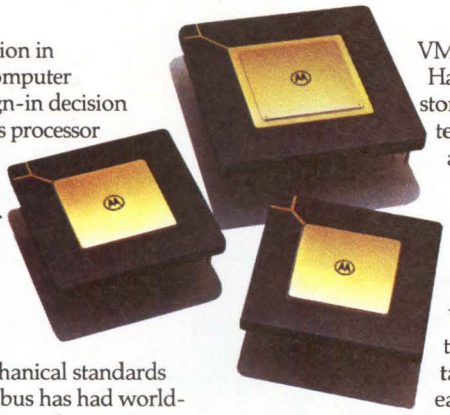

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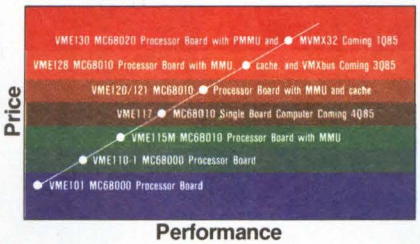

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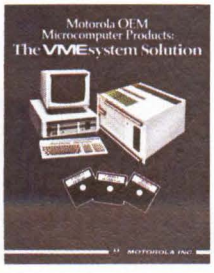

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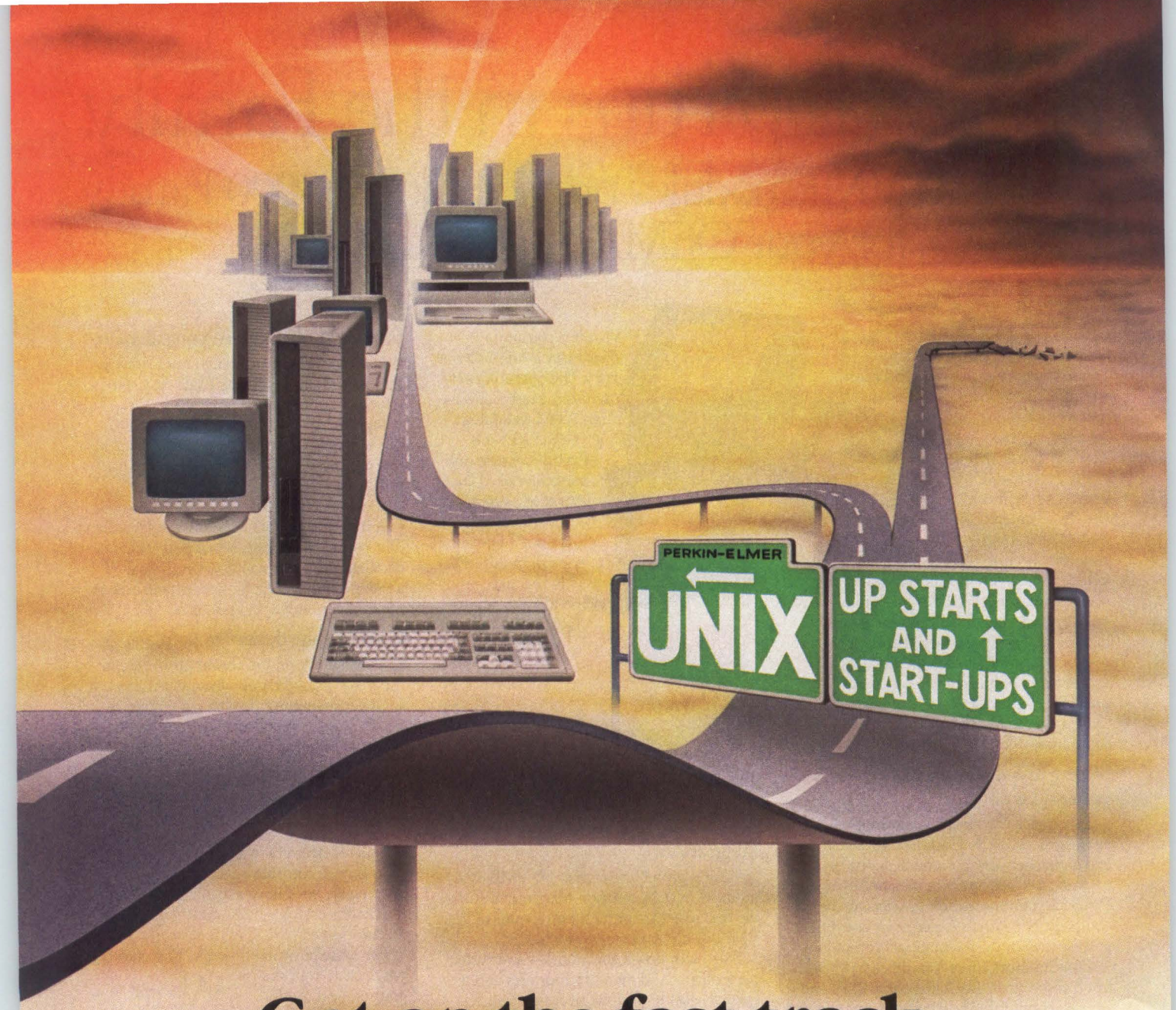

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CIRCLE NO. 37 ON INQUIRY CARD

Taiwanese court gives light fine to Apple counterfeiters

Charles Hintermeister
Taiwan Correspondent

Taiwan's high court has upheld the 1983 criminal convictions of officials of six Taiwanese computer companies charged with counterfeiting the Autostart and Applesoft Basic programs in the Apple Computer Inc. Apple II personal computer.

Taiwan is well known as a center of computer counterfeiters, and the Taiwanese press hailed the convictions as evidence of the government's determination to stamp it out. But the sentences were mere slaps on the wrist. The counterfeiters got six-month jail sentences they won't even serve. Instead, they took the option, standard in Taiwan for jail sentences of less than eight months, of paying a small fine. In this case the fine amounted to 22 cents for each of the 180 days of jail time they were sentenced to serve.

The sentences were announced shortly after another, earlier, computer counterfeiting appeals trial ended in eight- and nine-month jail terms for the owners of Sunrise Computer Co. and Guan Huar Industrial Co. Because both of these firms, which were among the first to mass-produce counterfeit Apples in Taiwan, have reportedly paid substantial damages to Apple, the jail terms were commuted to three years' probation for each of the convicted officials.

The reason for the stiffer original sentences in the Sunrise and Guan Huar cases, says a Taiwanese lawyer, is that the two firms were found guilty not only of counterfeiting software but also of violating trademark law when they distributed exact copies of the Apple II user's manual with their machines.

Counterfeiting still widespread

High-ranking Taiwanese government officials continue to talk about cracking down on commercial counterfeiting, and there's an extensive campaign to educate the public about the evils of counterfeiting. But the problem remains widespread. Taiwan's judicial system is still learning the basics of how to deal with problems of intellectual and industrial property rights.

Few of the convicted officials deny that they were manufacturing so-called "Apple-compatible" systems, but they all claimed, with some justification, that they were not guilty of breaking any Taiwanese law.

Until recently, there was no specific provision in Taiwan's copyright law to protect software. The law mentioned only literary works, music scores, graphic works and recordings as eligible for copyright protection. To help guide the court system, Taiwan's Ministry of the Interior last year devised an interpretation of the copyright law that makes software classifiable as a literary work, and therefore eligible for copyright protection. Lawyers defending the accused counterfeiters argued that, because there was no specific law against counterfeiting software at the time the charges were brought, there could be no convictions.

Defense lawyers also brought up a number of technicalities which they say should have gotten the case thrown out of court. Among them is the fact that, at the time the charges were brought, Apple had not yet registered its copyright with the Taiwanese government and, said defense attorneys, had no legal standing to bring a lawsuit in Taiwan. Prosecuting attorneys countered that, registered or not, Apple had the right to bring suit under the provisions of a 1948 Friendship and Commerce Treaty between the United States and the Republic of China. The treaty, said prosecuting attorney Ted Yang, entitles companies in the two nations to take legal action against each other in the courts of either nation.

Illegal copies *of software priced at about $5 each are displayed over some counterfeit computers in a Taiwanese retail store. Photo: Asia On-Line/Hintermeister.*

Software as literary work

Prosecuting attorneys, in claiming that software is classifiable as a literary work, referred to the Ministry of the Interior's interpretation. They also

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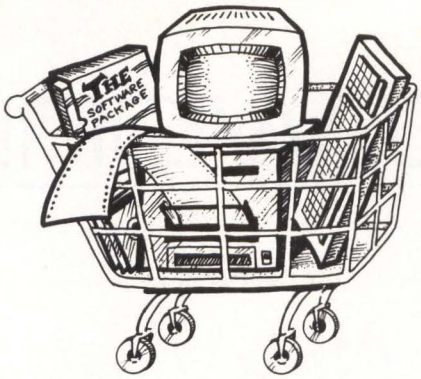

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CIRCLE NO. 38 ON INQUIRY CARD

pointed out that in the United States, software may be classified as a literary work and therefore be eligible for copyright protection.

Appeal to be sought

In spite of the light sentences handed down, several of the convicted officials hope to have a second appeal heard in court. "I haven't broken any law," said Tom Kou, general manager of Pison Science Technique Co., "and I don't want to have a criminal conviction on my record."

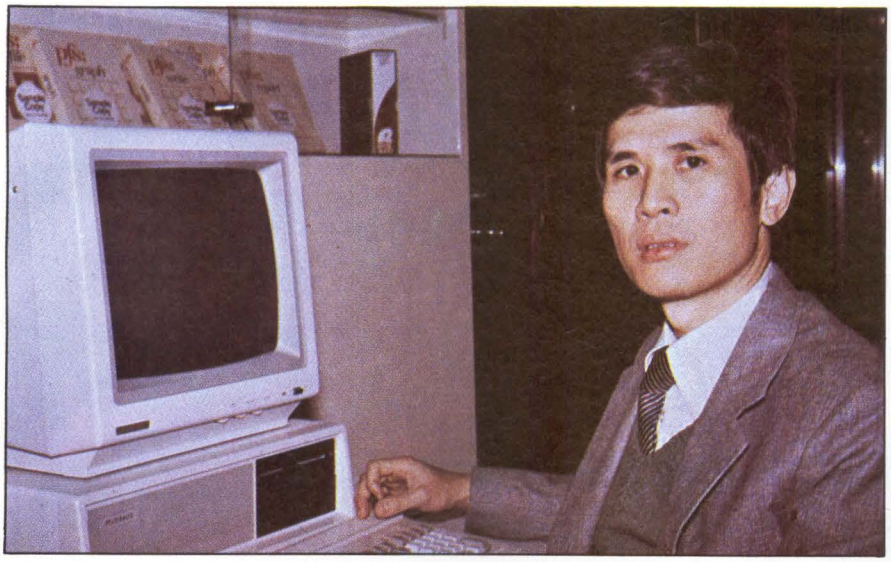
As more complicated computer-related cases reach the courts, lawyers and judges often find themselves struggling with technical terms and concepts unfamiliar to them. Paul Hsu, a senior partner in the law firm of Lee and Li, which represented Apple in the case, says the government may establish a court with specially trained judges to hear cases involving high-technology issues.

If it does not take vigorous steps to eradicate commercial counterfeiting, Taiwan may lose its valuable most-favored-nation privileges in the U.S. tariff laws, under which a wide range of Taiwanese-made products are given preferential tax treatment by the United States. Taiwan's huge trade surplus with the United States, estimated at $10 billion for 1984, is cited by U.S. legislators as the reason for trying to halt counterfeiting in Taiwan of U.S. products. According to one of the defense lawyers, the convictions were brought about more by fear of lost trade privileges than by the merits of the prosecution's case.

Other goods counterfeited

Counterfeit computer products represent a minor part of the counterfeit products that originate in Taiwan. Name-brand textiles are the most frequently counterfeited products in Taiwan, followed by watches, cosmetics and auto parts, according to Taiwan's Board of Foreign Trade.

A revision to Taiwan's copyright law that would create an independent category for software has been given preliminary approval by the country's legislature and is expected to go into



Andrew Chen, *manager of Taiwanese software distributor Multisoft, says only Taiwan's more reputable companies can be expected to obey copyright laws. Photo: Asia On-Line/Hintermeister.*

effect by June. "Calling software a 'literary work' cannot be a long-term solution," says Andrew Chen, manager of Multisoft, Taiwan's first software bank. Literary works differ from software programs in a number of respects, he points out. "There is no time limit for copyright protection for books," he notes, "but this would not be suitable for software, which usually has a product life of only a few years."

"This will be the most advanced software protection law in the world," boasts Victor Cheng, a lawyer with Multitech Industrial Corp. who is part of the committee now formulating the revision. In its present form, however, the proposed revision leaves much room for uncertainty. "The chief problem," Cheng says, "is that, in its present state, the revision does not clearly define what software is."

A more serious problem, however, is that the new law may not be any more effective than the present one. In the view of Multisoft's Chen, only Taiwan's more reputable companies can reasonably be expected to obey the law. Multisoft, the island's first distributor of fully documented, legal English- and Chinese-language software, has run afoul of counterfeiters, admits Chen. Few Taiwanese computer users are willing to pay full price for software when they can just as easily purchase pirated versions for little more than the cost of the disk onto which they are copied. Counterfeit versions of the WordStar word-processing program from MicroPro International Corp., San Rafael, Calif., for example, are openly available at many local computer and book stores for about $5, a fraction of the price in the United States.

Copyright must be registered

One of the chief reasons why Taiwanese police don't arrest the managers of such establishments and confiscate the counterfeit goods, Chen says, is that the original copyright holders never registered with the Ministry of the Interior. He suggests that foreign software firms hoping to market their programs in Taiwan first register their copyrights and then appoint a local agent who will be able to prosecute counterfeiters.

But failure to register is not the only reason that computer counterfeiting goes on in Taiwan. Apple has now registered its copyrights in Taiwan, but counterfeit Apple II computers are still readily available on the local market. "It is very hard to catch computer and

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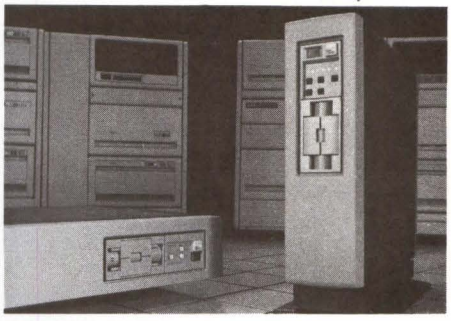

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software counterfeiters and to make the charges stick," says Cheng. He does not believe the government can enforce the revision when it becomes law, despite his enthusiasm for its language.

Most of Taiwan's Apple II counterfeiters have either upgraded to "IBM-compatible" systems or have gone out of business. According to Cheng, there are far fewer counterfeit Apples being made in Taiwan today than there were two years ago.

The reason for this change has more to do with market trends and internal competition than with the legal maneuverings of any of those involved. Few of Taiwan's large computer companies make "Apple-compatible" systems, and those that do generally don't dare export them. The majority of the counterfeit Apples still available on the local market are used in small, garage-type factories and are notoriously unreliable. Taiwanese manufacturers still export significant numbers of counterfeit Apple IIs to places where they believe there will be no customs seizures or other legal difficulties—Hong Kong, the Middle East and Africa. □

OVERHEARD OVERSEAS

Europeans adopt alternative OS as IBM becomes proprietary

Denise Danks
European Correspondent

Concurrent DOS is achieving more success among OEMs and users in Europe than in the United States as a multitasking, single-user and multi-user operating system for IBM Corp.'s PC. European users say the United States has not entirely rejected the system from Digital Research Inc. (DRI) of Pacific Grove, Calif. But they claim Europe has been more forward-thinking than the United States in preparing for a future alongside IBM.

And what is that future? It is one in which the Europeans see IBM increasingly developing its own software, including operating systems and programs such as the TopView windowing software. Concurrent DOS could be established in the marketplace as the compatible, high-performance alternative to TopView running under IBM operating systems in computers configured around the Intel Corp. 80286 processor.

DRI has issued some 100 licenses for Concurrent DOS worldwide. Major European manufacturers have signed for and, more importantly, brought to market 30 to 35 of those licenses. The manufacturers offer Concurrent DOS in addition to MS-DOS from Microsoft Corp., Bellevue, Wash. Those manufacturers include the Ericsson Information Systems division of L.M. Ericsson AB, Ferranti Computer Systems Ltd., Olivetti SpA, Siemens AG, Applied Computer Techniques Plc. (ACT), ICL Plc. and British Telecom Merlin Ltd.

One of the Concurrent DOS enthusiasts among European manufacturers is Martin Healey, research director of Future Technology Systems Ltd., Beith, Scotland, which includes the British subsidiary of Honeywell Information Systems, a Concurrent DOS licensee, among its major OEM customers.

"Concurrent DOS will be the only vehicle for vendors like Honeywell to stay alongside IBM on the multitasking route," Healey declares. "After all, where will the likes of Honeywell go to get an alternative multitasking operating system which will run PC-DOS and TopView programs? Honeywell will have to find a source and Concurrent DOS will be the well-established alternative."

Healey thinks that the United States is at least six months behind Europe in its appreciation of the power and potential of Concurrent DOS. He also thinks that the multitasking of Concurrent DOS makes it more suitable for networking than MS-DOS and PC-DOS.

ACT manager John Upton agrees with Healey that Europe is ahead of the United States with Concurrent DOS. He says that U.S. users think exclusively of the IBM PC and Apple Computer Inc.'s Macintosh. Paul Bailey, DRI's European vice president, also concurs that, "In the United States, the market rapidly polarized into Apple and IBM camps and there was a scramble to make IBM PC clones. Those PC-compatible manufacturers now find themselves [in] difficulties," because of the fierce competition and the existence of too many look-alikes.

Bailey says the market in Europe is more independent, focusing more on performance and innovation than on a pure standard. "There is very little standardization in Europe. In fact, they seem to make it a religion not to [standardize] and this has often made life difficult for them. They see Concurrent DOS as a high-performance system which will differentiate their products from IBM and its compatibles."

But Bailey adds that European companies realize they have to provide compatibility with IBM to satisfy the U.S. customer base. He says: "We developed DOS emulation under Concurrent CP/M and renamed it Concurrent DOS in April 1984. It has made a difference in the United States but not a dramatic one in terms of [competing with] PC-DOS and MS-DOS. But IBM has stepped ahead of the U.S. clone market with TopView and, given that TopView provides the [multitasking] facilities of Concurrent DOS but will not be sold to other computer manufacturers, we believe that Concurrent DOS now provides the only viable environment to compete with IBM."

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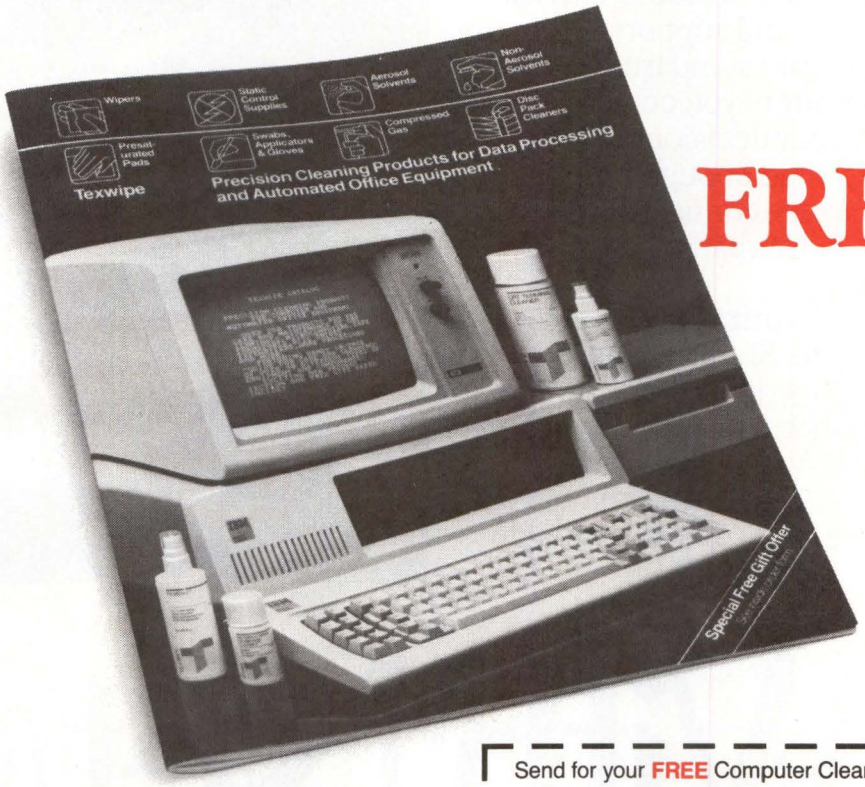

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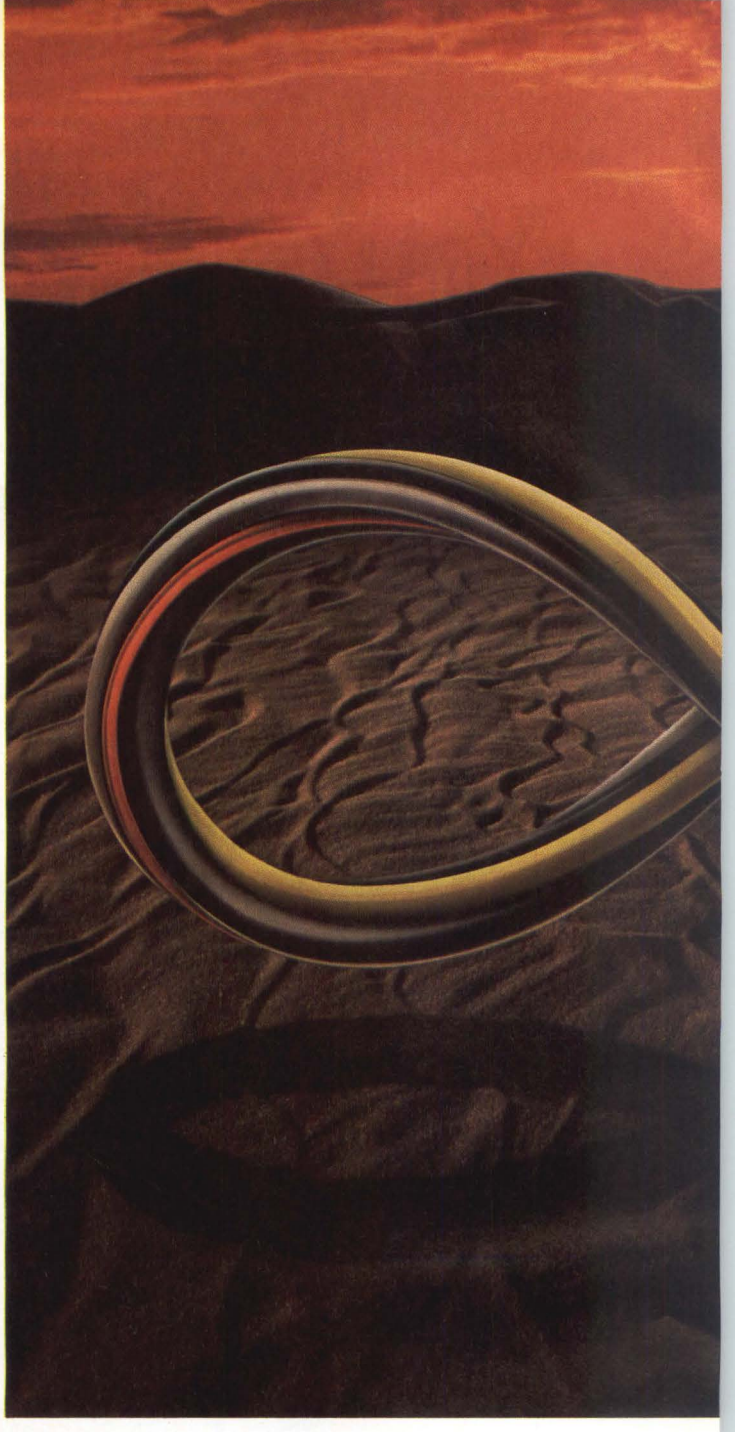

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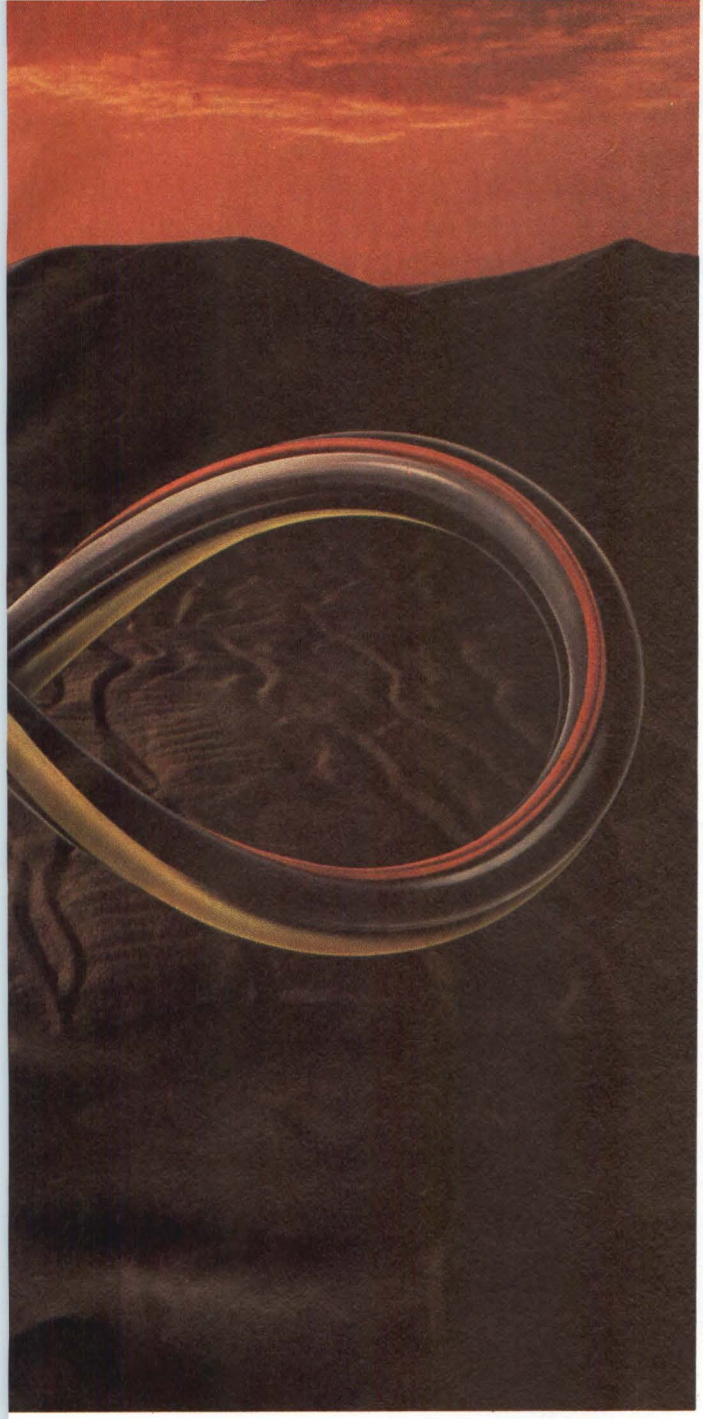

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VENDORS VEER TOWARD VARS, VERTICAL MARKETS

Stiff competition turns many computer-equipment vendors away from retail and direct sales to value-added resellers (VARs) and lucrative vertical markets

David Simpson, Senior Associate Editor

Bumped from retail shelves or forced out of direct sales, hardware and software vendors are jumping into the value-added reseller (VAR) distribution channel with unprecedented vigor. Reasons for the shift range from mediocre retail sales at the low end of the market to the impracticalities of direct sales at the high end. But the vendors have a common goal: survival.

Companies like Apple Computer Inc., Compaq Computer Corp. and IBM Corp. rule the retail arena, but even they are making substantial forays into the VAR channel. Facing more difficult times, manufacturers such as Eagle Computer Inc. and Victor Technologies Inc. have one foot in the VAR channel and one foot in Chapter 11.

In 1984, the sale of microcomputers (single-user and multiuser systems for up to 16 users) through VARs reached approximately $4.3 billion, according to International Data Corp. (IDC), Framingham, Mass. The research company expects this figure to approach $14 billion by 1989. Explains IDC's manager of microservices, Evan Moltz: "The reason for the success of the VAR channel is that it offers a solution that cannot be obtained through the horizontal marketplace."

Erna Arnesen, senior analyst at Future Computing Inc., Dallas, concurs with Moltz and adds that VARs account for 18 percent of all personal computer sales and about 7 percent of productivity software sales. Future Computing pegs the number of personal computer VARs at 4,000, with 5,500 expected by 1987. This compares to

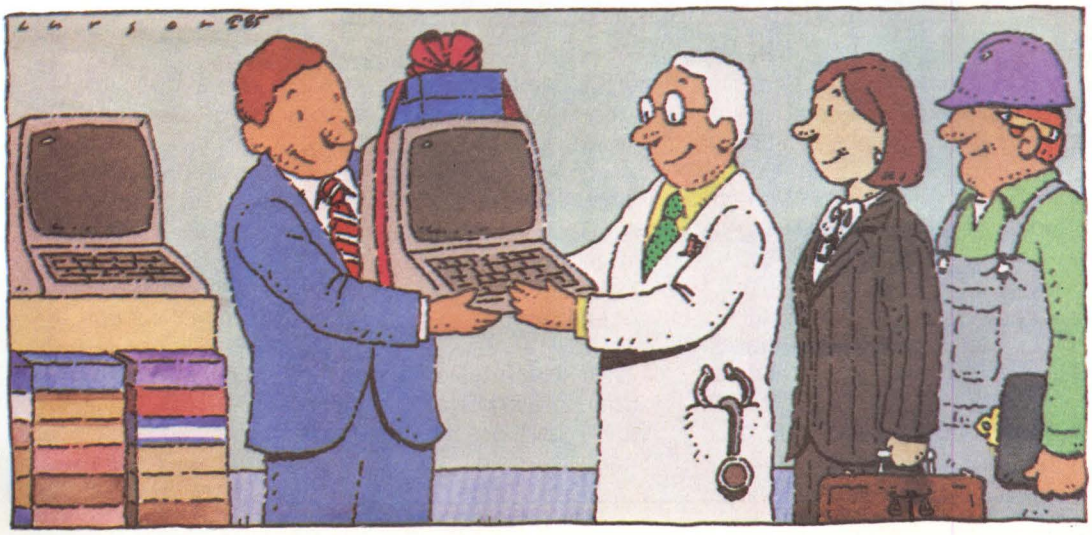
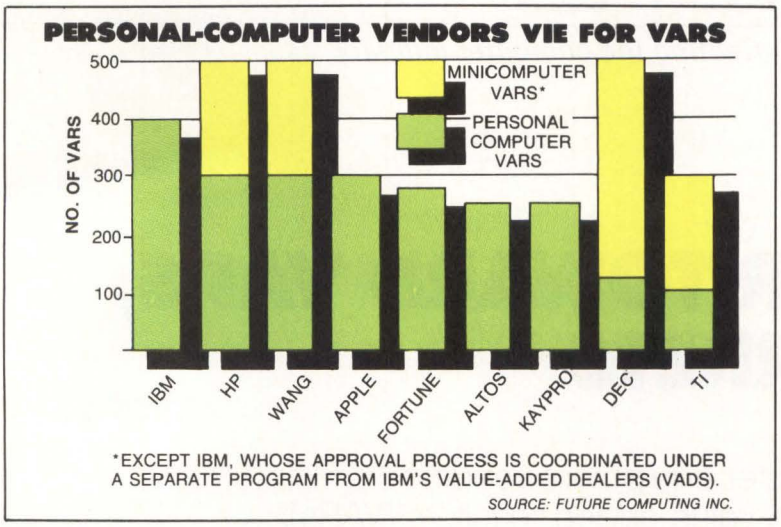


Illustration by Jim Carson

Value-added resellers (VARs) *often target vertical markets, providing complete solutions for specific applications.*



only 1,100 VARs in 1981.

The shift to the VAR channel has been well-documented in the trade press, but one question is still not fully answered: "What does it all mean to the VAR?"

VARs defined

According to Future Computing's definition, a personal computer VAR must meet five criteria: (1) Value must be added to the personal computer, (2) significant effort must be devoted to personal computer-related activity (i.e, at least one person in the company dedicated to the area), (3) a portion of sales must be made directly to an end-user client base, (4) the company can't have a retail storefront and (5) the company must sell some personal-computer product. These guidelines differentiate a VAR from a manufacturer, retailer, distributor or publisher (see "Acronyms clog the distribution channels," below).

Equipment vendors are offering various inducements to system integrators, system houses and other value-adders. These inducements include:

- Equality with retailers in terms of discounts
- Volume commitments from manufacturers
- Hardware support and access to manufacturers' service centers
- Training support and marketing assistance
- Better partnership with the manufacturer in terms of product availability.

As an example of this last benefit, VARs can now get product announcements and the products at the same time as—or even ahead of—retailers. IBM, for instance, supports its value-adders in a variety of ways, including supplying machines for use in shows, providing marketing kits (mailers, prospect lists and suggested telemarketing strategies) and running seminars and classes for resellers. Other support includes an on-line, national, remarketer database for use by IBM field representatives, technical support and on-site training and consulting.

According to Future Computing's Arnesen, IBM controls about 40 percent of the personal-computer VAR channel in terms of total end-user dollars. That represents about 10 percent of its personal computer business.

IDC's Moltz believes that the retail expectations of companies other than Apple, Compaq, IBM and Kaypro Corp. are unrealistically high. The research company contends that only about 20 of the 150 microcomputer vendors have a shot at surviving the next three to four years. The top 10 vendors account for 80 percent of all microcomputer shipments.

Companies with a heavy presence in the VAR

Acronyms clog the distribution channels

If the terms value-added dealer, value-added reseller and value-added remarketer seem confusing, you're not alone. IBM Corp., for example, has its own set of acronyms and distribution-channel classifications. The following definitions should help clear things up.

VAR: Value-added resellers sell systems after adding value in the way of additional hardware or software. VARs often target vertical markets with specific solutions. Unlike retailers, VARs don't have storefronts. VARs include system integrators and system houses.

VAR, IBM-style: IBM uses the acronym VAR to represent value-added remarketers. IBM VARs buy a non-PC-family computer from Big Blue and resell it to an end user after adding software to create a turnkey system.

VAD: A value-added dealer, in a non-IBM sense, meets all of the qualifications of a VAR, except that a VAD has a storefront. Companies such as Hewlett-Packard Co. consider retailers like ComputerLand and Entré to be value-added dealers because some franchises provide nominal support or service.

VAD, IBM-style: Primarily an IBM term, value-added dealers resell products in the IBM PC family. VADs must pass stringent qualification standards. The term includes organizations selling turnkey systems.

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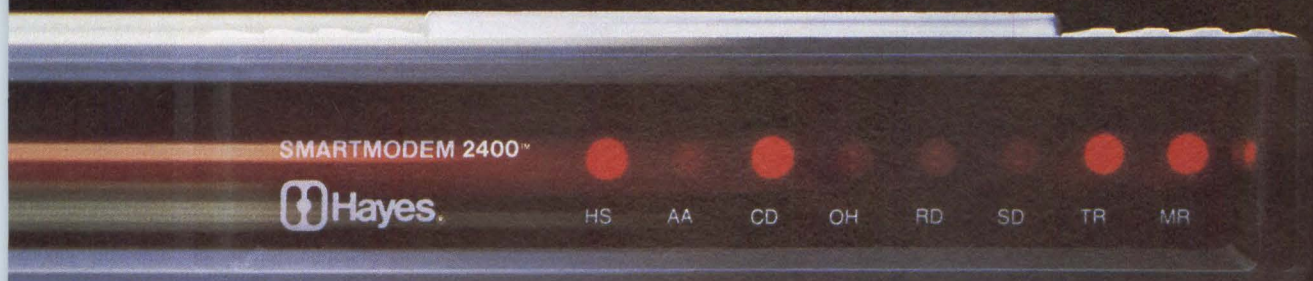

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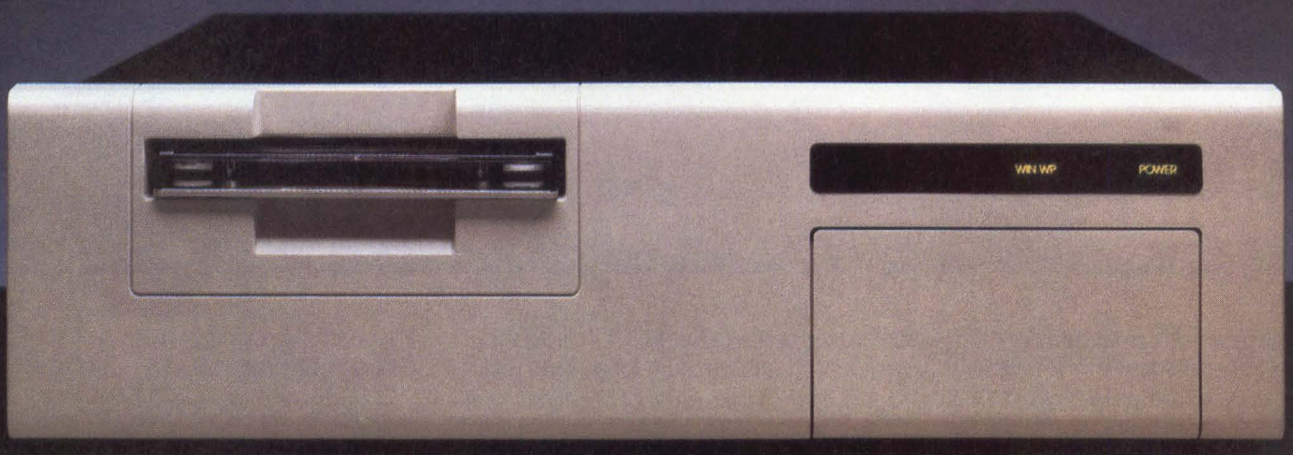

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market can be divided into three categories:

- Small companies with sophisticated multiuser products, such as Altos Computer Systems, Corona Data Systems Inc., Fortune Systems Corp., North Star Computers Inc. and TeleVideo Systems Inc. These companies have previously done business in the retail channel but now consider the VAR channel the primary distribution mechanism.
- Large companies that have traditionally had a strong presence in the VAR channel with minicomputer equipment, such as Data General Corp., Digital Equipment Corp. (DEC) and Texas Instruments Inc.
- Companies with secure retail sales that are targeting the VAR market as a means for greater mass distribution. Those companies include Apple, AT&T, Hewlett-Packard Co. (HP) and IBM, as well as smaller companies such as Compaq.

In 1983, IBM formed the National Distribution Division (NDD), which has responsibility for IBM product centers, its value-added-remarketer channel that supports non-PC small systems and the value-added-dealer (VAD) channel that supports PC-family products. IBM formed the division to bolster non-retail sales and to focus those sales through a single organization.

Apple and Tandy Corp.'s Radio Shack division have had VAR programs for several years, but neither has been particularly successful. Now, both companies are stepping up VAR efforts with new programs. "Apple has a real chance of getting into the office market through the VAR channel," predicts Future Computing's Arnesen.

Apple officials contend that the Macintosh personal computer offers a good path into the VAR market. According to industry analysts,

Honeywell shifts distribution gears

Most of the attention surrounding the market shift from direct sales or retail to indirect or value-added-reseller (VAR) channels focuses on the low end of the market, represented by products like the IBM Corp. PC and the Apple Computer Inc. Macintosh. But medium to large computer companies are also recognizing the abundant lure of indirect distribution channels.

Unlike Digital Equipment Corp., Data General Corp. and, to a degree, Hewlett-Packard Co., Honeywell Information Systems Inc. has a history of being a direct sales company. But 1984 marked the beginning of a concerted effort to increase indirect sales revenues.

Jim Murphy, Honeywell's director of indirect sales operations, attributes the shift to a declining price/performance curve. "In the under-$200,000 range, price/performance has put the technology in the hands of many more people, fostering a tremendous increase in applications. Big companies like Honeywell cannot compete in the creation, maintenance and support of the horrendous demand for specialized applications." Murphy admits that third-party companies that do not have huge overhead costs can provide solutions that are much cheaper and more specific.

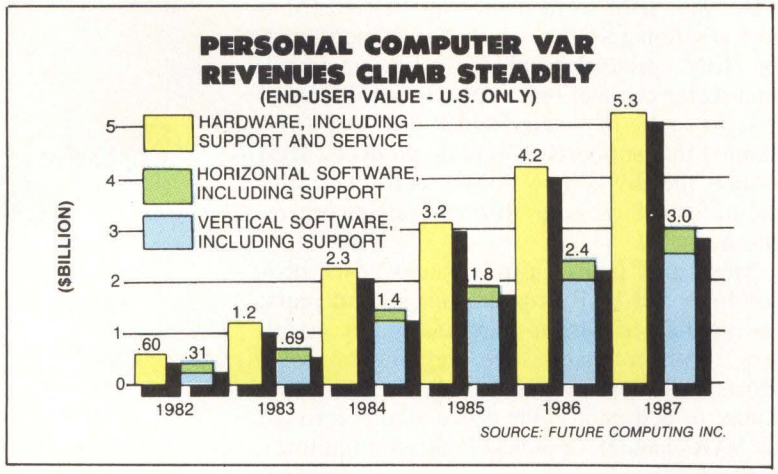
Early last year, Honeywell targeted two groups of resellers: traditional VARs and the emerging "cottage industry" of application writers. To address the cottage industry, Honeywell set up the Manufacturer's Representative Program. The company treats independent representatives as though they were extensions of the Honeywell sales force, chartering them to sell in either a specific geographic area or a vertical-market specialty. Honeywell signed up 130 manufacturer's representatives in 1984 and is aiming for 300 by the end of 1985.

Honeywell gives traditional VARs advance discounts of up to 30 percent. Manufacturer's representatives don't get advance discounts. When the representative sells a system, Honeywell pays him a commission once the end-user customer is satisfied that the system is working.

To bolster the indirect sales effort, Honeywell put an indirect sales specialist (ISS) into each local branch. The ISS' only role is to sell into indirect channels. The key to the program, says Murphy, is that the local branch manager is responsible for both direct and indirect sales.

How does Honeywell minimize competition between those two channels of distribution? The company credits each sales branch for all shipments to its assigned territory. In other words, if one of the indirect channels—VAR or manufacturer's representative—makes a sale, Honeywell gives double credit (for example, to the indirect sales entity and to the direct sales branch in which the sale was made).

Honeywell markets approximately 35 percent of its DPS 6 machines and small business systems through its two indirect sales programs (VAR and Manufacturer's Representative Program). Most of its VARs have revenues in the $25 million to $100 million range. "We're looking for $5 million to $6 million a year from these people," says Jim Murphy. Honeywell's reseller channel revenue grew at about 30 percent during 1984 and the company is aiming for 35 percent to 40 percent growth for 1985.



Revenue flow *through value-added resellers (VARs) is expected to increase at a 56-percent annual growth rate.*

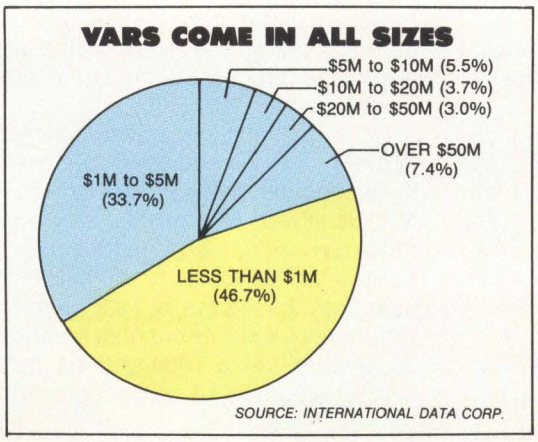
Apple's troubles in the VAR channel have been due to its difficulty in protecting its retailers while wooing VARs, a lack of software for the Macintosh and the perception that the Macintosh is not a business computer.

Most traditional minicomputer vendors have always been in the VAR-OEM business, but the exceptional growth of microcomputers like the Apple II has spurred minicomputer manufacturers to offer competitive low-end products. These companies view the VAR channel as crucial to their success, and all have established VAR channels for their low-end products to complement third-party sales efforts in the midrange.

HP, for example, successfully entered the mainstream personal computer market last year with the HP 150 series and a portable unit. Although HP claims strong retail sales, it has recently restructured its marketing emphasis toward VARs.

According to Jody Ryden, HP's VAR-OEM market manager for the personal computer group, the company recently adjusted its discount schedule to enable small VARs to participate in HP's value-added distribution channel.

Almost half *of the value-added resellers (VARs) have revenues of less than $1 million each. Figures are based on a survey of 3,886 VARs.*



Most of HP's personal computer VARs have annual revenues of under $1 million. Ryden declines to reveal specific discount schedules but adds that they start at 25 percent. Discounts are equitable between retailers and VARs because they are based purely on volume.

Benefits HP VARs enjoy include support mechanisms such as in-field system engineers, loaner systems for evaluation and access to service centers. An end user who buys a system from a VAR can send the system back to HP for repair, contract with HP to have on-site service or have the VAR perform the maintenance after being trained by HP. All HP products are available to the VAR channel. The local OEM sales representative acts as liaison between the VAR and the manufacturer.

Ryden adds that HP works closely with software houses to develop vertical-market packages. In the future, HP might offer those packages under the HP logo, marking a stronger entry into the vertical-market arena.

Putting the squeeze on profits

Discussing the pitfalls of the retail channel, Corona's vice president of sales, George McMurtry, points out, "If you're already discounting to beat the band, what are your profits going to be?" Like most of its competitors, Corona had its share of retail sales a few years ago, but, once IBM was able to deliver PCs in quantity, many microcomputer vendors were shunted aside. For many companies, the only thing left is the value-added channel.

Companies like Corona offer VARs attractive discounts, usually through distributors, and varying degrees of service and support. Corona offers discounts starting at 28 percent. McMurtry notes that "Unless the VAR does over $1.5 million of business, it will behoove him to go through a distributor instead of through Corona" because the distributor's discounts are higher. One service Corona offers is a software directory, which lists VAR software available for sale or exchange to other VARs.

For other companies, the retail channel has been a dismal failure, and the VAR channel is the only hope for survival. After declaring bankruptcy in early 1984, Victor Technologies rebounded late last year with its sights set on the VAR market. The company also began packaging specialized software and is selling directly into vertical markets. Eagle Computer, decimated by IBM's price cuts last year, laid off about a third of its work force and reorganized its distribution strategy to emphasize VARs.

"Vertical markets represent about 80 percent of VAR business," says Future Computing's

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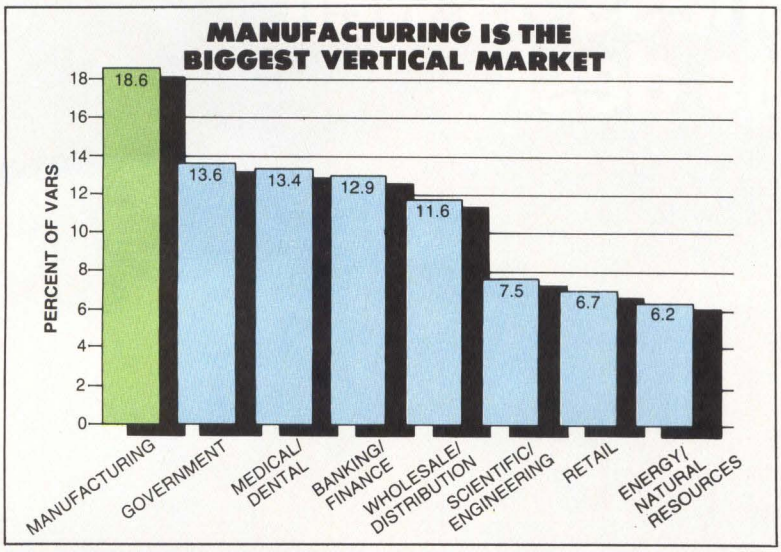
Arnesen. VARs have mechanisms to contact and familiarize themselves with specific businesses, such as the medical or legal professions. VARs often address vertical markets via specialized software, acting as both developers and distributors. Personal computer manufacturers develop and distribute a small amount of vertical market software, but most have not been able to identify and meet the needs of the vertical market arena.



Value-added resellers (VARs) *deal primarily in specialized vertical markets. Sixty-one percent of VARs sell to more than one vertical market, but usually in the same application area.*

Vertical markets range from pet shops and racquetball clubs to hospitals and automobile engine testing plants. The top five vertical markets, according to IDC, are manufacturing, government, medical/dental, banking/finance and wholesale distribution.

One way to appreciate the importance of vertical markets is to look at the flow of venture capital into that area. "We expect vertical market-oriented companies to be one of the next havens for venture capital dollars," says David E. Gold, publisher of *Vertical Market Report*, San Jose, Calif. Gold predicts that well over $10 million in venture capital will flow into vertical markets in 1985. That figure does not include money going into start-ups. □

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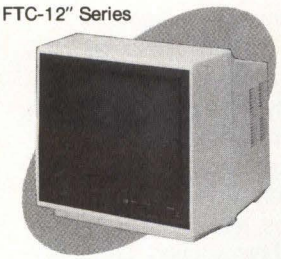

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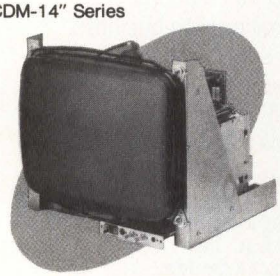

Item \ Versions	RGB Version	NTSC Version	NTSC & RGB Version	IBM PC Compatible only	
12" (CRT Pitch)	FTC-1208-R (0.28mm Dot trio) FTC-1203-R (0.38mm Dot trio) FTC-1201-R (0.47mm Stripe)	FTC-1201-N (0.47mm Stripe) FTC-1200-N (0.63mm Stripe)	FTC-1201-NR (0.47mm Stripe)	FTC-1208-HF (0.28mm Stripe) FTC-1203-HF (0.38mm Stripe)	FTC-1208-W (0.28mm Dot trio)
		PAL Version	PAL & RGB Version		
		FTC-1201-P (0.47mm Stripe) FTC-1200-P (0.63mm Stripe)	FTC-1201-PR (0.47mm Stripe)		
14" (CRT Pitch)	FTC-1455-R (0.31mm Dot trio) FTC-1435-R (0.39mm Dot trio) FTC-1423-R (0.42mm Stripe) FTC-1410-R (0.52mm Stripe)	NTSC Version	NTSC & RGB Version	FTC-1455-HF (0.31mm Dot trio) FTC-1435-HF (0.39mm Dot trio)	FTC-1455-W (0.31mm Dot trio)
		FTC-1410-N (0.52mm Stripe) FTC-1416-N (0.64mm Stripe)	FTC-1410-NR (0.52mm Stripe)		
		PAL Version	PAL & RGB Version		
		FTC-1410-P (0.52mm Stripe) FTC-1416-P (0.64mm Stripe)	FTC-1410-NR (0.52mm Stripe)		
Input Signal Level	RGB Analog RGB plus Intensity RGB TTL	NTSC(PAL)	NTSC(PAL) RGB Analog RGB plus Intensity RGB TTL	RGB plus Intensity / RGB TTL	
Applications, Others	IBM PC • PC jr. Apple IIc, IIe •	IBM PC • PC jr., Apple IIc • IIe, Commodore C-64		H.F. 25kHz	Scanning Doubler

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CDM-1203-PC	12"	0.38mm Dot trio
CDM-1201-PC	12"	0.47mm Stripe
CDM-1455-PC	14"	0.31mm Dot trio
CDM-1435-PC	14"	0.39mm Dot trio
CDM-1423-PC	14"	0.42mm Stripe
CDM-1410-PC	14"	0.52mm Stripe

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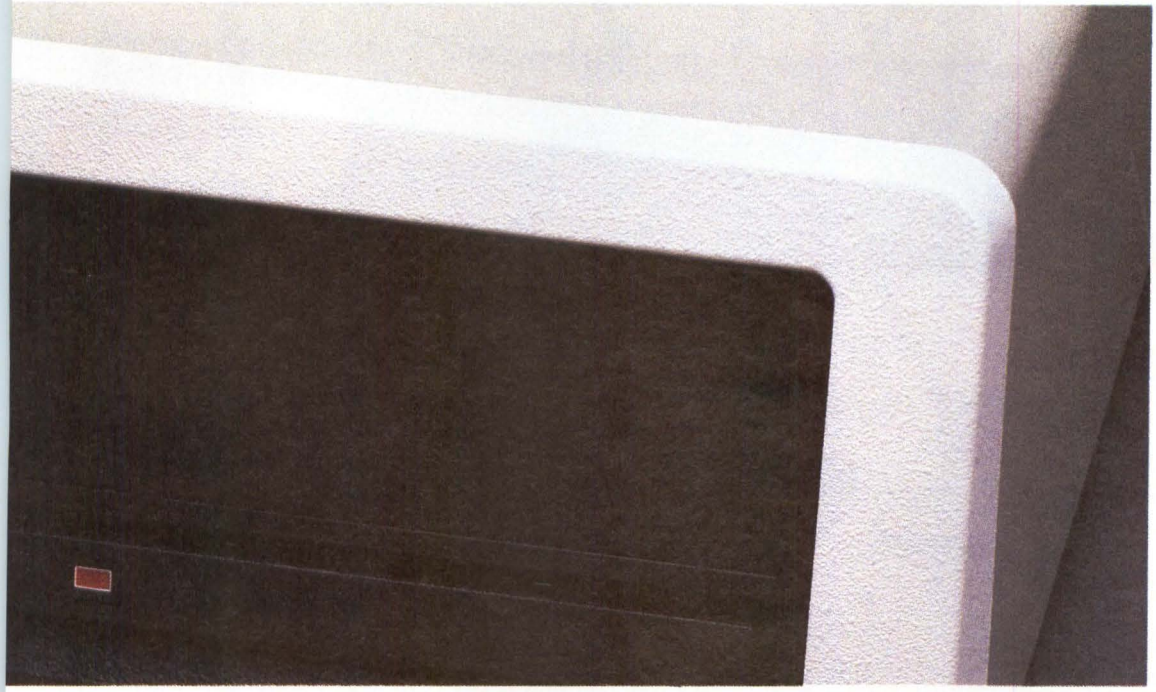

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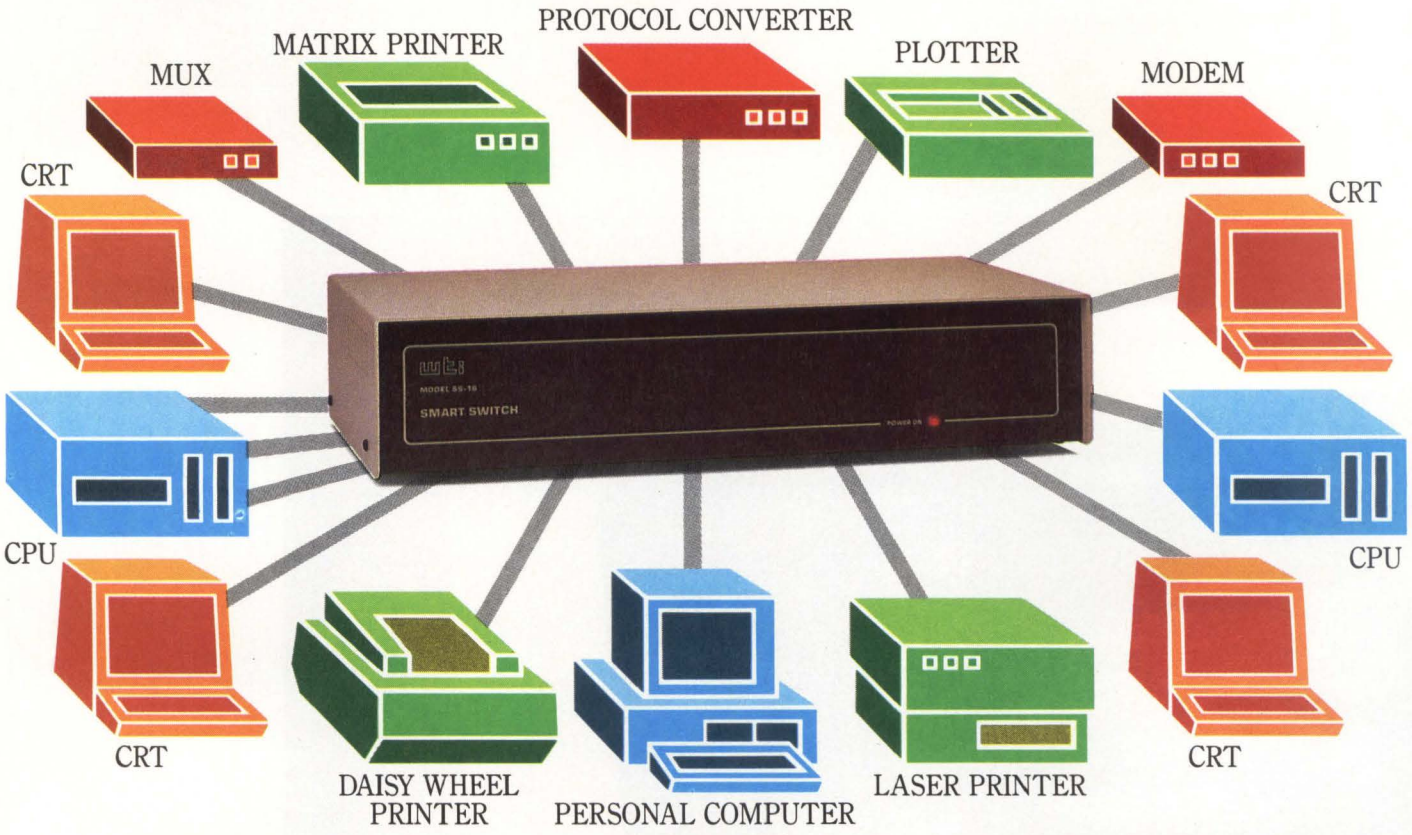

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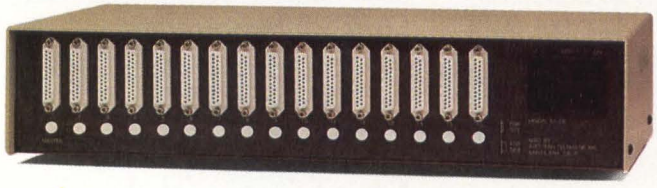

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COMPUTER STANDARDS: THE JURY IS STILL OUT

Computer manufacturers resist implementing a common computer network architecture

Keith Jones, European Editor

The Open System Interconnection (OSI), a set of standards being defined by the International Standards Organization (ISO), aims at facilitating communication among computers from different manufacturers across any type of network. But doubts prevail as to the degree of commitment computer manufacturers have when it comes to implementing OSI standards in place of their own proprietary network architectures.

Donald Toombs, a European associate of The Yankee Group, Boston, notes that vendors promote proprietary architectures to ensure the continued sale of their terminals and network equipment to the vendors' captive users. Based on this reasoning, Toombs believes that European vendors will offer only a degree of compatibility with OSI. Connection to OSI networks will be made via gateways, as opposed to full implementation.

Toombs' view is echoed by Richard Amster, director of data communications at The Yankee Group. He believes that U.S. manufacturers that express wholehearted support for OSI are merely paying lip service to the standards and are unlikely to modify their architectures enough to be totally OSI-compatible. Amster suggests that the dominance of IBM Corp.'s proprietary Systems Network Architecture (SNA) is a key reason for the U.S. government's promotion of OSI. He points out that 70 percent to 80 percent of major U.S. corporations implement SNA and, as a result, the government perceives IBM as a monopoly.

If competing vendors want to penetrate IBM installations, they must implement SNA on their equipment. The government's backing of the non-proprietary OSI helps IBM's competitors gain a greater market share.

Major users of SNA such as General Motors Corp. and Boeing Corp., encourage the government's initiative, according to Dr. John F. Heafner, head of the systems and network architectures division at the National Bureau of Standards (NBS), Gaithersburg, Md. The NBS is the main government agency promoting OSI. Heafner observes that most computer users want the multinetworking environment that OSI offers.

In a scenario similar to one in the United States, authorities in Europe are pressuring IBM to make concessions to the OSI lobby. The Brussels-based European Commission, which runs the Common Market, last year persuaded IBM to publicly state its commitment to OSI.

As a result, IBM has reportedly promised its European users support for selected functions of OSI on its mainframes. The company plans to start testing a product this year. Functional changes will be made at layers four and five, the transport and session layers, respectively, of the OSI model. IBM reports that work on the sixth and seventh layers, presentation and applications, will continue for some years.

IBM has reportedly promised its European users support for selected functions of OSI on its mainframes

European manufacturers commit to OSI

In contrast to IBM's cautious approach toward OSI, 12 of the largest European computer manufacturers have issued a joint statement expressing ardent support for the standards and their intentions to implement OSI on their computers. ICL Plc., London, one of the largest vendors in this group, says that its proprietary architecture, Information Processing Architecture (IPA), can implement OSI standards. Jacques Stern, chairman of Groupe Bull, Paris, also among the 12,

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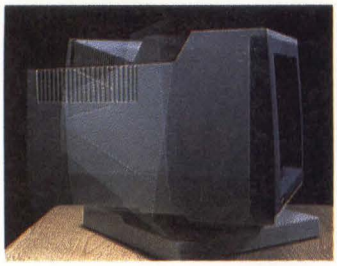

Lexidata's monitor enclosure design features a unique tilt and swivel movement with smooth and easy operation. All monitor connections and peripheral power supplies are located in the enclosure's base.

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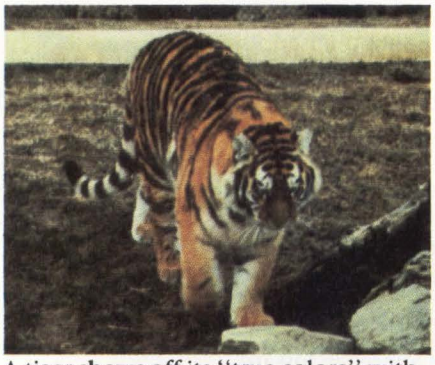

A tiger shows off its "true colors" with the LEX 90 True Color display system from Lexidata.

LEX 90's SimulRes enables the designer to mix theory with reality by allowing the simultaneous display of a wire-frame model with the real-life product. (Courtesy of PDA Engineering)

The extraordinary solid modeling display capability of our patented SOLIDVIEW™ technology is available in a 640x512 version. And for petrochemical applications, there's GEOVIEW,™ a three-dimensional geological interpretation package.

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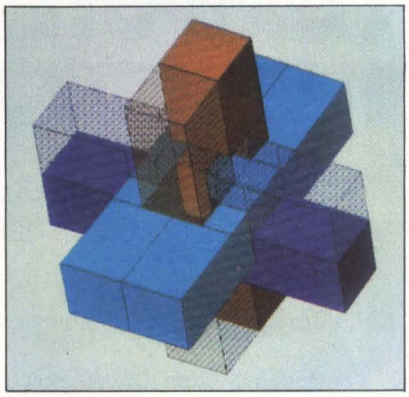

SOLIDVIEW, Lexidata's patented technology for the display of solid models, is available as an option on selected LEX 90 display processors. Its translucent shading pattern allows you to see inside your solid model.

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also declares his company's commitment to OSI: "The only way to benefit from technological advances and render the distributed data-processing market more dynamic is by providing a basic communication structure that guarantees the user freedom to choose his suppliers."

Groupe Bull and Honeywell Information Systems, Brentford, England, the computer division of Honeywell Inc., Minneapolis, have cooperated on a proprietary architecture known as Distributed Systems Architecture (DSA). According to Robert Mills, a communications consultant with Honeywell in England, compatibility between DSA and OSI exists within levels one through five of the OSI model. Mills notes that these DSA functions are being implemented on Honeywell's minicomputer and microcomputer products, as well as its mainframe systems.

Another minicomputer supplier, Digital Equipment Corp. (DEC), will change some protocols in DECnet, the company's proprietary network architecture, to OSI standards, according to Patrick Chevęaux, marketing specialist with DEC, Valbonne, France. But, Cheveaux adds, some application layer functions will remain specific to DECnet.

Honeywell's Mills points out that the absence of a network management component is currently one of the major shortcomings of OSI. DSA, on the other hand, provides this set of facilities, he adds.

Richard desJardins, head of the ISO subcommittee working on the upper layer of OSI standards, acknowledges that network management is one of the most important issues to be resolved before OSI can provide users with a complete service. Peter Kenny, director of software technology at LDR Systems Ltd., Aldershot, England, a company specializing in OSI software, believes that the lack of network management facilities is a "huge deficiency" of OSI. IBM emphasizes that SNA is "rich in network management functions," providing security, administrative and diagnostic features, and a directory service.

LDR's Kenny believes that future OSI management functions, which will be decentralized, may be better suited for large networks than is SNA. He notes that OSI, in contrast with SNA, does not require the central control of a mainframe, because OSI was defined in an era of highly intelligent workstations and local area networks. An ISO working group examining network management standards is reportedly

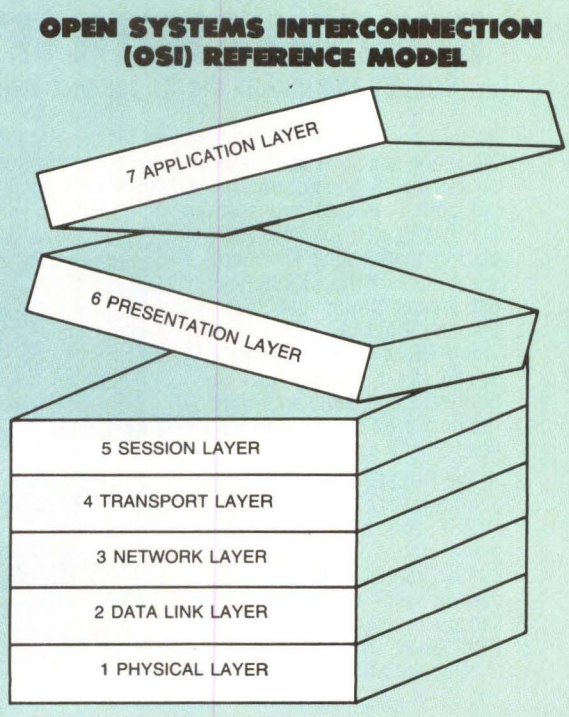
Twelve of Europe's largest computer manufacturers have expressed ardent support for standards

Building an OSI network standard

Open Systems Interconnection (OSI) is a seven-layer model first envisioned for networking by the International Standards Organization in the late 1970s. The lowest layer, or physical, defines the electrical characteristics needed to transmit bits of data across a communications path. Moving upward, the data-link layer deals with framing the bits that make up a message and with error correction. The next level up, the network layer, handles the routing of a message across and between the networks over which a message has to pass. It includes the X.25 protocol widely used in packet-switched networks. The transport and session layers are concerned with such functions as multiplexing messages over the one connection and synchronizing the exchange of data.

Standards for the two highest layers, presentation and application, are reportedly at an advanced stage of definition and are expected to become technically stable this year.

The presentation layer provides negotiation of a common syntax for the transfer of data between programs on different computers. The application layer selects appropriate service for user application processing and also manages the interfacing of user applications with other OSI layers.



U.S. manufacturers are paying lip service to OSI standards and are unlikely to sufficiently modify their architectures

making progress on a directory service, one network management feature.

Virtual Terminal Protocols (VTP) is another OSI feature that still requires study. VTP defines standard protocols that can be accepted by all types and brands of terminals. The work toward VTP has been slow because of the variety of available terminals. Christopher Makemson, chairman of the VTP panel with the British Standards Institution, London, explains that ISO has defined several classifications of terminals, which include basic, forms, graphics and mixed mode. Makemson says that standardization work is currently confined to the "basic class" of terminals— simple, glass, teletype units.

OSI efforts prevail

Despite issues and obstacles regarding OSI, efforts to help computer vendors implement the protocols and services defined by OSI are under way. The NBS has proposed a worldwide network, called Catnet (short for concatenated, or linked, network) to assist vendors in making their private subnetworks more compatible with the OSI model.

According to NBS' Heafner, more than 30 companies have expressed interest in Catnet, which will be financed and run by group participants, not NBS. Interested companies include IBM, DEC, Hewlett-Packard Co., Intel Corp. and Motorola Inc., all of which participated in a demonstration of OSI functions at last summer's National Computer Conference in Las Vegas. Heafner hopes to see European involvement in Catnet. □

Interest Quotient (Circle One)
High 468 Medium 469 Low 470

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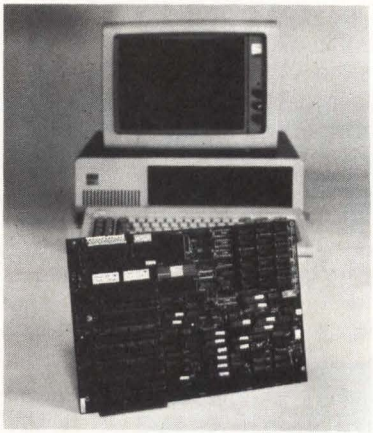

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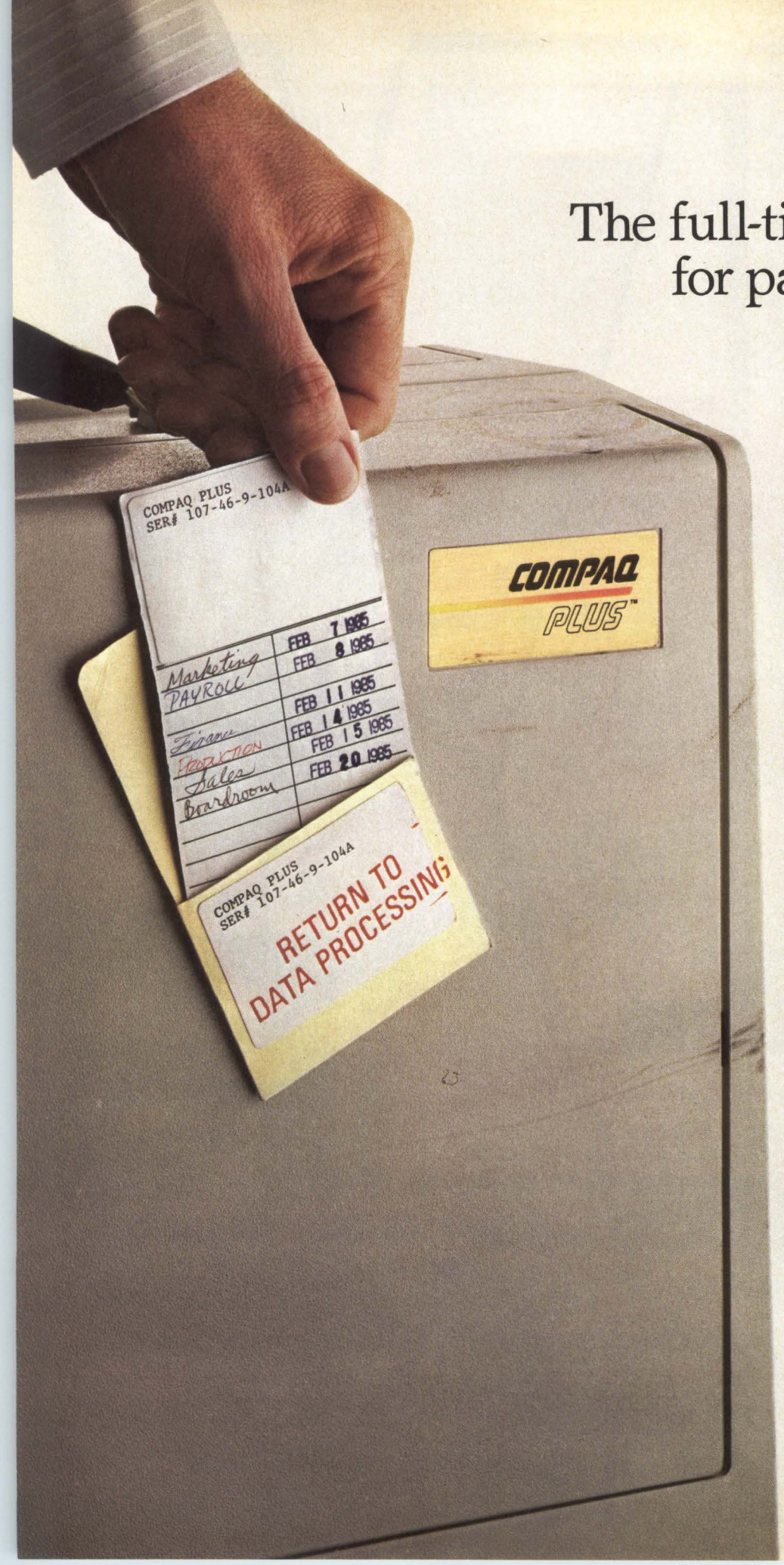

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PC NETWORK OUTPERFORMS UNIX

Novell provides multiuser functionality using file-server operating system

C.A. Harshman, Reliable Data Systems Inc.

Early last year, Reliable Data Systems Inc., a systems house and software supplier in Los Altos, Calif., began considering the feasibility of supplying large-scale, full-featured, multiuser business systems software on the IBM Corp. PC and work-alikes. Reliable had adapted Mini-Computer Business Applications (MCBA) Inc.'s integrated packages, written in COBOL, from minicomputer and superminicomputer environments to run under UNIX. So one solution would seem to have been to run the integrated packages under UNIX on the PCs.

However, after examining current offerings of UNIX on the PC and the PC/XT, Reliable concluded that the UNIX versions were inadequate because they did not provide enough processing power, and, consequently, response time to users was too long. Reliable also found that the UNIX products could typically support only two or three users at a time and could execute only a limited number of applications simultaneously because of space limitations.

As an alternative to UNIX, Reliable considered the possibility of running the software on a network of PCs. One reason for considering this approach was that, according to Reliable's projections, configurations of networked PCs will soon become commonplace in the company's target market—organizations grossing $1 million to $50 million in revenues. In addition, with networking, Reliable would be able to add significant computing power at each node as the network expanded and the number of users grew.

Nevertheless, the networked approach might involve some disadvantages. For one thing, Reliable had to consider whether the architecture of networked PCs would be adequate in multiuser facilities, particularly when users required shared-file support. Networked PCs might also degrade performance, especially in applications calling for fast file-access response time. The company wanted to ensure that users on the networked system would have access to all the features and functions of the software that the UNIX system would offer, without simplifying or pruning the source code. Thus, the network users would see no difference from UNIX in the service at their terminals. Reliable had satisfied this condition in its previous UNIX port and wanted to preserve uniformity across the product line.

Response to functions requiring only local CPU service within the PC was immediate.

File-server software is key

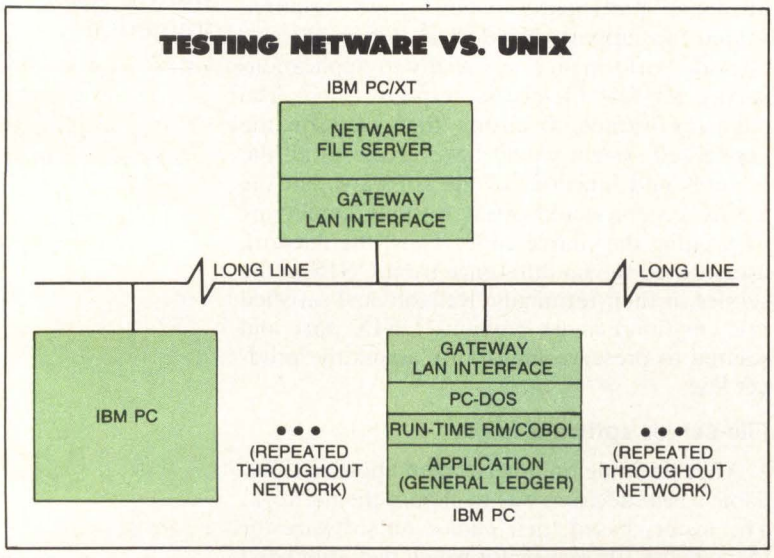
After deciding on a networked approach, Reliable's next decision was to choose the network. The testers based their choice on software for the network file server, for which they stipulated five essential criteria:

- support of full COBOL multiuser facilities
- file- and record-locking
- adequate backup/restore facilities

- expandability of disk storage
- user-dependent file-access controls

After a survey of available systems, Reliable chose the Novell Inc. NetWare file-server operating system as the software that best met all of the criteria (MMS, May 1984, Page 161). Via Novell's modified run-time version of Ryan-McFarland Corp.'s RM/COBOL, NetWare accepted the current embedded file-control commands in the application code without further modification. In addition, the NetWare system is available on all major networks—Corvus Systems Inc.'s Omninet, Davong Systems Inc.'s ARCnet, Gateway Communications Inc.'s G-Net, 3Com Corp.'s EtherLink, Nestar Systems Inc.'s PLAN 2000, Novell's Netware/S, Orchid Technology Inc.'s PCnet and Proteon Associates Inc.'s proNet—which would allow Reliable to give customers their choice of network hardware.

To test the network approach, Reliable chose MCBA's general ledger package, which consists of 2½M bits of source code and can support as many as 10 users at once. Although the general ledger package had been ported from a minicomputer to a Motorola Inc. 68000-based UNIX system, Reliable had to perform a substantial amount of additional work to bring the package up under the PC-DOS/NetWare/RM/COBOL environment. In addition to revising file names and extensions, Reliable had to rewrite a collection of routines to replace the system-service routines in the original environment—an approach used in Reliable's previous UNIX ports. Similarly, a convenient extension in the run-time RM/COBOL allowed the addition of duplicate extensions to the run-time library for the PC-DOS environment. After completing these revisions, Reliable performed extensive testing, using detailed scenarios, to complete this phase.



Reliable used an IBM PC/XT running NetWare for the file-server hardware *to test the network of PCs and, for workstations, IBM PCs running PC-DOS. The network hardware was Gateway's 1.2M-bit-per-second (bps) linear LAN.*

Testing the network

The testers used an IBM PC/XT running NetWare as the file-server hardware and, for workstations, IBM PCs running PC-DOS. The network hardware was Gateway's 1.2M-bit-per-second (bps) linear local area network (LAN). To perform the tests, the testers first ensured that the networked PCs preserved all the functionality of UNIX in the single-user mode. The testers expected that to be the case because no source-code changes were permitted. The testers then went on to the multiuser mode, with special attention to file- and record-locking protection. The tests revealed that a user sitting at the networked PC terminal would have difficulty distinguishing whether he was using UNIX or NetWare.

Reliable also found response times to be good. Response to functions requiring only local CPU service within the PC was immediate, and the time for functions requiring file service depended on the amount of data transfer required. Response time for simple transfers, such as storage or retrieval of accounting data, was a fraction of a second, and larger transfers, such as program-module loading, took 1 to 2 seconds—comparable with response times for UNIX. Adding users up to the limit of Reliable's test configuration of four nodes did not significantly affect response times. This is because response time degradation is gradual until a system reaches either the saturation point of network communication bandwidth or the limit of disk accesses.

The NetWare monitor provided a real-time indicator of the file-server machine's percentage of use. For the test, the indicator showed a utilization range of 5 percent to 10 percent per user, depending on the user's activity level. Adding users caused the percentage to increase. With four users, the indicator hovered at around 30 percent. With this information, the testers extrapolated that six to eight users would be a safe load for the PC/XT file server. Faster machines, such as the PC-AT or Compaq Computer Corp.'s Deskpro desktop computers, and higher-speed networks could handle more users.

In comparing the PC network to UNIX, Reliable's testers found the network approach to be better, although a comparison of the two approaches for multiuser applications would re-

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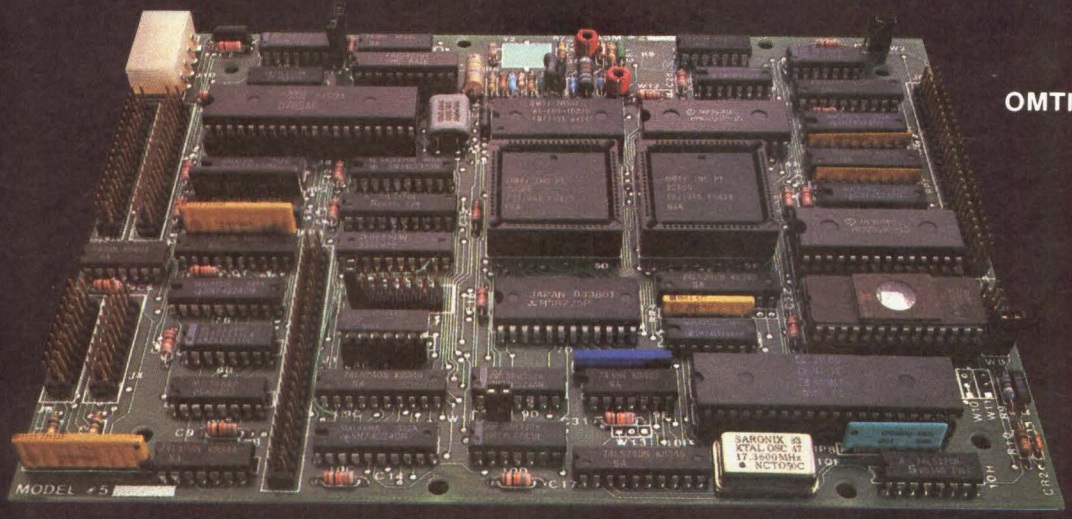

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quire a more thorough analysis of program and data traffic. Among the results, the testers found that, as more users sign on to UNIX, the two major system resources—CPU time and file-access I/O handling—must be allocated and shared. This reduces the availability of those resources to current users. With the network approach, users must share only the file-service resources because the additional node supplies its own CPU. Thus, each additional user of the network adds more CPU resource.

As a result, the network behaves as a single-user system at each node with a full processor devoted to each user, except for data file-access functions, which the network provides via the shared file server. Therefore, an increase in file traffic as more users sign on can degrade the system's performance, but an increased computational load cannot.

Another advantage of using the network involves file-server resources. NetWare provides a cache system that further enhances performance—a technique not available on standard UNIX.

Reliable found UNIX and its tools unsurpassed for the creation of integrated software packages. UNIX's facilities, such as "make," "sed" and "sh," greatly speed conversion and help support ongoing maintenance. For end users, however, the simplicity of DOS and the growing wealth of software that runs under it is appealing. The test case proved that a network of PCs is viable for large-scale software applications. Large-scale programs can run in a multiuser environment without sacrificing function or performance using networking and NetWare. Thus, networks allow companies to begin with simple applications, such as word processing and spreadsheets, and expand gracefully up to very large full-function business software.

Looking at the future

On the basis of the results achieved in the test case, Reliable will begin to supply MCBA's accounting and manufacturing support packages on a variety of networks, thus providing users with a fully integrated line of business software. In addition, users can employ network technologies other than NetWare that would work with corresponding performance. Without changing software, users could employ technologies with data-transfer rates of 200K to more than 10M bps. Future broadband technologies promise even further extension, and the technology to link diverse networks is now emerging.

Reliable predicts that UNIX and DOS will grow more similar. Software companies are now beginning to supply sophisticated file-server software that offers much of the multiuser appeal of UNIX and utilities that add some of the UNIX tool-kit functions to DOS. Meanwhile, they are extending UNIX to interface to LANs, and shared file-storage and file-transfer facilities are emerging.

Users can also obtain multiple file servers that provide effective data backup. Reliable also expects transparent data backup on a duplicate file server to become available soon, thus affording a degree of protection from data loss that UNIX does not yet provide. □

The simplicity of DOS and the growing wealth of software that runs under it is appealing.

C.A. Harshman is founder and president of Reliable Data Systems Inc., Los Altos, Calif., an MCBA software distributor for UNIX and PC-network-based systems. Harshman was formerly consultant to Centigram Corp., Sunnyvale, Calif., for systems product development.

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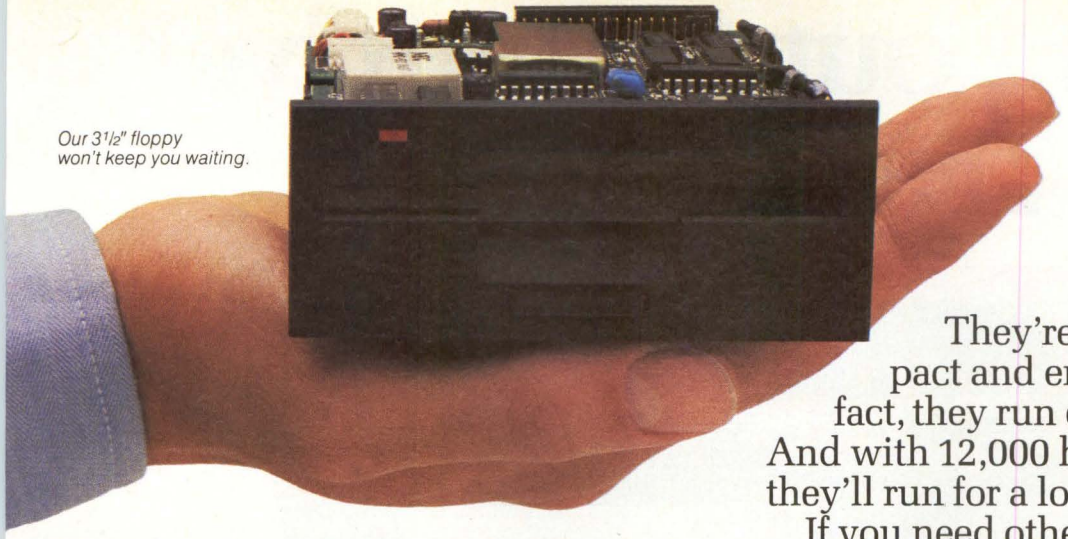

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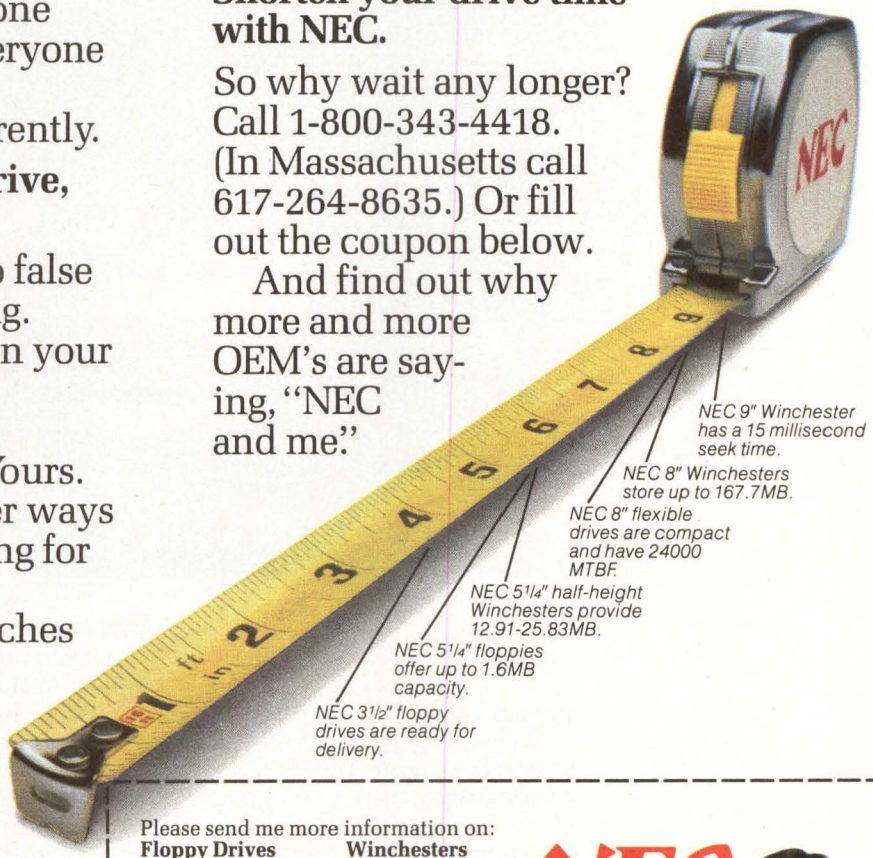

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A 160M-byte fixed disk drive solves problems that an 8-inch Winchester couldn't handle

George Kunstadt, Alpha Data Inc.

In 1983, electronic engineering and computer science company Cheshire Engineering Corp., Pasadena, Calif., faced a problem of overburdened equipment. Although business was going well for the fledgling computer game developer —with three games on the market within 18 months of start-up in 1982—the computer system the company had chosen couldn't handle increased demands. As a result, the company, which was working on two more games, the real-time control software for a videotape recorder/animation controller and several other applications, had to turn away potential business.

Cheshire's system comprised a Digital Equipment Corp. (DEC) PDP-11/23 minicomputer, an 8-inch, 20M-byte model 880/20 Winchester disk drive from Data Systems Design (DSD) Inc. and a Cipher Data Products Inc. floppy disk drive backup. This configuration, although inexpensive and reliable, lacked adequate speed and performance.

Cheshire employees tested the system to track down the problem. The results showed that the system's weakest component was its disk drive. With 10 employees working on the system, often simultaneously, the drive could not always respond to the heavy load of requests. The system would "clog up" while doing payroll and other financial work, halting programming, editing and word processing. Otherwise, "the drive seemed to rattle along all day, spending most of its time seeking files rather than retrieving them," says Cheshire software design engineer Larry Zwick.

Using a 50-head, 160M-byte Atlas fixed disk drive *from Alpha Data, Cheshire Engineering claims to improve user response rate by 70 percent over the company's previous, 8-inch Winchester-based system.*

As a result, the company began looking for a higher performance, higher capacity disk drive. At the time, says Cheshire president and cofounder Shal Farley, the Atlas fixed disk drive from Alpha Data Inc., Chatsworth, Calif., was the highest capacity and fastest drive for the money on the market. "The only other one that we considered was the Fujitsu Eagle [10½-inch, 474M-byte Winchester]," he says. But the Eagle was selling for $12,000 compared with the Atlas'

$8,000 price tag, so Cheshire purchased the Atlas.

The Atlas has 50 read/write heads—instead of the 10 or fewer typical on more conventional fixed disk drives. As a result, it responds two to five times faster than conventional mass-storage devices in a high-demand, multiuser environment, claims the company. The drive employs three disks, or platters, on which float the 50 moving heads and four clock heads driven by a rotary actuator. The heads can be stepped to 160 cylinders, or 8,000 tracks. In contrast, other mass-storage drives typically employ 10 heads and must step to 800 cylinders. The Atlas can write or read 1M byte of data almost instantaneously without head movement and has an average on-line access time of 18 msec under normal demand conditions.

When a user turns on the Atlas, it automatically comes up to speed, resets itself, initializes its counters and immediately begins to read or write. Its electronic circuits are packaged on printed circuit boards that can be changed easily. The electronic circuits are designed to simplify the controller interface; thus, the disk performs many functions conventionally performed by the controller or formatter. In addition, the drive's components are enclosed in a sealed, shock-mount, suspended head/disk assembly that prevents the entrance of contaminants, allowing the drive to operate in dusty environments with widely fluctuating temperatures without the need for air conditioning or filtering.

Drive speeds programming

The Atlas' 50-head configuration works better than a 10-head system because the 50 heads radically reduce the amount of arm movement the drive must make. This enables the drive to accommodate 70 percent more user requests than the Winchester had accommodated (see "Fifty heads are better than 10," below). In contrast, the Winchester that Cheshire previously had used caused the computer to become "disk-bound"—overloaded with disk commands —especially when Cheshire programmers wanted to use the system for their main task of programming.

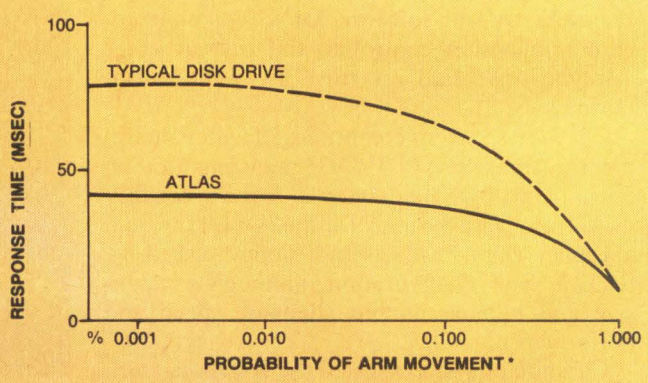
In developing programs, each Cheshire programmer must access the disk drive hundreds of times a day. With the old system, this could be time-consuming because of long disk access time. More important, this time increased as more users made requests, causing a frustrating

Fifty heads are better than 10

The main difference between the Alpha Data Inc. Atlas drive and other drives of similar capacity is that the Atlas employs 50 heads. This is important because most computer transactions require disk access; thus, disk speed significantly affects computer transaction speed.

On most disk drives, a moving element, such as an arm or a sliding carriage, carries several heads across the disk surface to cover every available track on all surfaces. A typical disk structure might include three platters, totaling six surfaces, of which five might be used for data recording. If two heads service each of these five surfaces, the total number of heads would be 10. With 10 heads, the moving elements must traverse only half the available radial disk space to cover the entire recording area.

For a storage-module-device drive, a track typically has a capacity of 20K bytes. This means that a drive with 10 recording heads can read or write 200K bytes of data without head movement. Access to data beyond the 200K-byte limit requires movement of the 10-head assembly to the next requested 200K-byte cylinder, followed by a search along the track until the desired sector appears under the recording head. At



*COMPUTED AT 18 REQUESTS PER SECOND

SOURCE: ALPHA DATA INC.

A comparison of the Atlas drive's *response time with that of a typical storage-module-device drive shows that the disk request will result in head movement. The Atlas' response time is typically 60 percent of the SMD drive's response time. The curve is plotted for a moderate rate of 18 requests per second.*

wait for computer operators and programmers.

To program for Cheshire, a programmer first writes a block of code, called a module. It might, for instance, describe the pictures and graphics for a computer game. The programmer then tests the program by assembling the module on the main system, translating what he has written to machine-readable form. The Atlas disk drive performs this assembly function at least two times faster than did the DSD drive, claims Cheshire. Next, the programmer links the module to the other modules in the program. Finally, the programmer down-loads the modules to the development system.

Cheshire programmers must also debug the programs they write. The Atlas drive's fast response time aids in the debugging chore because it allows programmers to debug on a one-bug-at-a-time basis. With the old drive, a response delay of 20 seconds to 10 minutes forced programmers to "save" errors for debugging all together at the end of the program. Saving errors, in turn, meant lost time and caused programmers to lose their concentration.

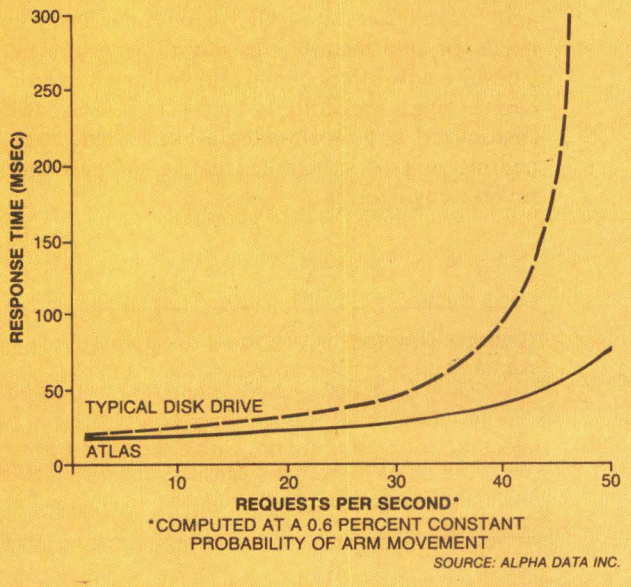
Cheshire ran some tests to measure the performance improvement of the Atlas drive over the old drive. Programmers developed a program to count the requests the computer made and inserted that program into the point in the operating system at which requests are made. Using a timer board, they measured how much time the computer spent waiting for the disk drive to transfer data. The previous Winchester disk took an average of 70 msec per transfer, whereas the Atlas disk averaged 16 to 20 msec, depending on how many employees were using the system at once.

The testers made the same measurement during the backup operation that saves each day's work. Because this operation involves large chunks of data, it requires greater disk movement than most other operations. The testers found the old disk's average transfer time to be 134 msec, while the Atlas required 22 to 24 msec.

The tests at Cheshire also revealed that roughly 40 percent of the requests made to a time-sharing system are for only 1K byte of data. The disk drive takes the same amount of time to find an address, regardless of the length of the block of data in question. As a result, requests for short data blocks necessitate fast access.

Another test result showed that the previous disk drive hadn't kept up with the streaming tape

The Atlas drive's fast response time aids in the debugging chore because it allows programmers to debug on a one-bug-at-a-time basis.



As the request rate rises *to about 40 per second, the response rate of the typical storage-module-device drive increases dramatically, while that of the Atlas rises only slightly.*

this point, reading or writing can begin, typically at 1M byte per second.

Thus, the average elapsed time from the instant the computer makes a request for the disk until the data is read is a total of access time, rotational latency time, data-transfer time and the time that this request must spend waiting in the queue before an operation can begin. Based on the likely assumption that the disk will be busy at the time this request arrives, the total elapsed time can vary from 20 msec to a few seconds.

At a request rate of 40 per second, the 50-head Atlas achieves a response time of approximately 40 msec because the heads can be stepped to 160 cylinders, containing 8,000 tracks. It speeds execution time because it reduces by five the need to perform stepping at all. A conventional disk, on the other hand, becomes so overloaded with requests that it cannot keep up with them. For every 40 new requests, it completes only 11. As time goes on, the queue becomes longer, the response time becomes longer, and the computer becomes hopelessly "disk-bound." Under the same high-volume demand conditions, the Atlas shows only a moderate increase in response time.

drive that had been used for daily backup. Although the company employees considered the tape drive slow, they were surprised to find that the Winchester was even slower. The Winchester's slowness caused the tape drive to make several mechanical starts, stops and repositionings during backup to accommodate the pace of the Winchester. Although much larger in capacity than the Winchester, the Atlas can transfer a larger amount of data to the backup unit in the same amount of time, according to Cheshire vice president Will McCown.

Although much larger in capacity than the Winchester, the Atlas can transfer a larger amount of data to the backup unit in the same amount of time.

The tests also revealed that the new drive excels in handling the increasing number of employees using the system. As in most other time-sharing systems, the CPU lacks sufficient memory to handle all users' requests at once. To solve the problem, the computer usually saves the information of active users and copies inactive users' requests from memory images on the disk. When inactive users again become active, they often have to wait for the computer to access the information from the drive. The DSD drive took 0.10 second to access this information, which can become prohibitive when 10 users are using a system at once. The Atlas drive, on the other hand, takes 30 msec.

Cheshire estimates that using the Atlas drive yields a time savings of 5 percent to 10 percent per day per employee compared to the DSD drive and that the Atlas costs less. As a result, the company can propose lower bids on contracts and still increase its profit margin. In a recent hypothetical test, Cheshire found that it could charge customers about 5 percent less than it had previously for a 13-week, 500-hour project while maintaining a 5 percent greater profit margin.

Planning for the future

Cheshire has upgraded its PDP-11/23 system to a 16-bit DEC PDP-11/70, which has more memory than the PDP-11/23. The PDP-11/70 is connected to the staff members' terminals—10 DEC VT101-compatible model CIT 101 terminals from C. Itoh Electronics Inc. But company executives plan to expand the company, and they will continue using the Atlas disk drive because it can support as many as 20 users. Moreover, the company will begin to focus on applications other than computer games.

"Two years ago, electronic games were hot," says McCown. "But now the market is changing. With the time and dollar savings we are achieving [with the Atlas], we can continue to develop and branch out into other areas meeting the needs of our clients." In addition to games, Cheshire now offers digital and analog electronic engineering, specialized digital logic systems, customized large-scale-integration design, engineering support software, creative software and reverse-engineering. □

George Kunstadt is president and founder of Alpha Data Inc., Chatsworth, Calif. Previously, he was director of engineering at General Precision Singer Librascope. Kunstadt holds a B.S. in electrical engineering from City College of New York and an M.S. from the Massachusetts Institute of Technology.

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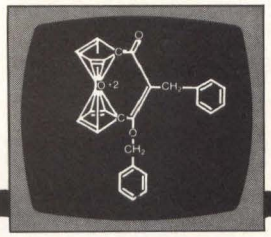

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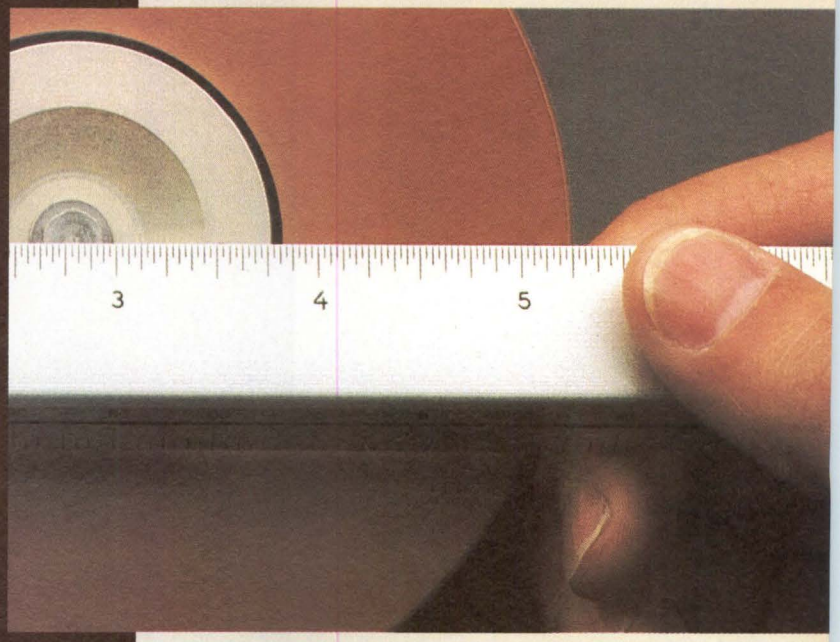

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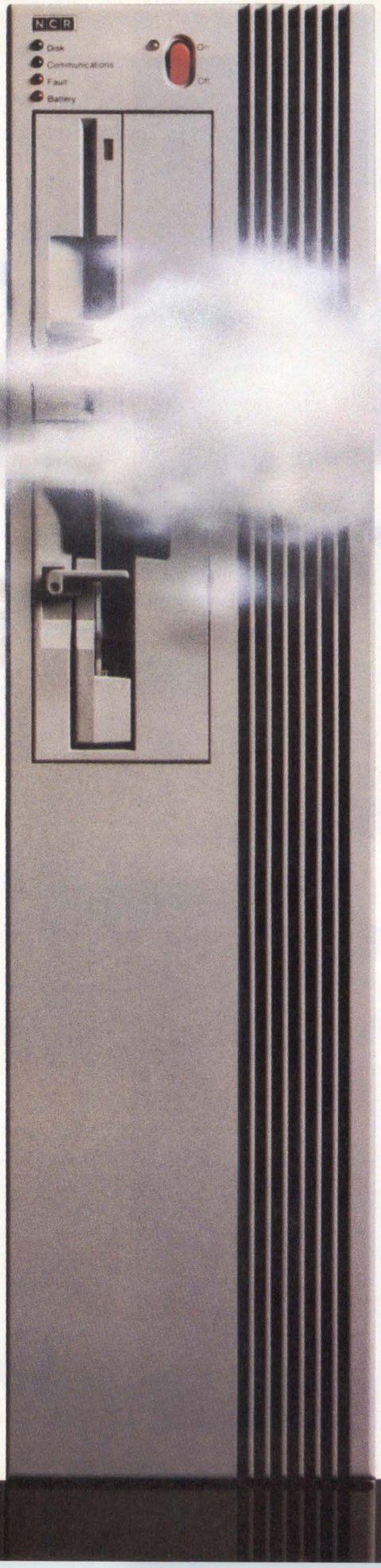
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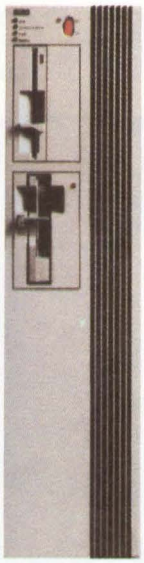

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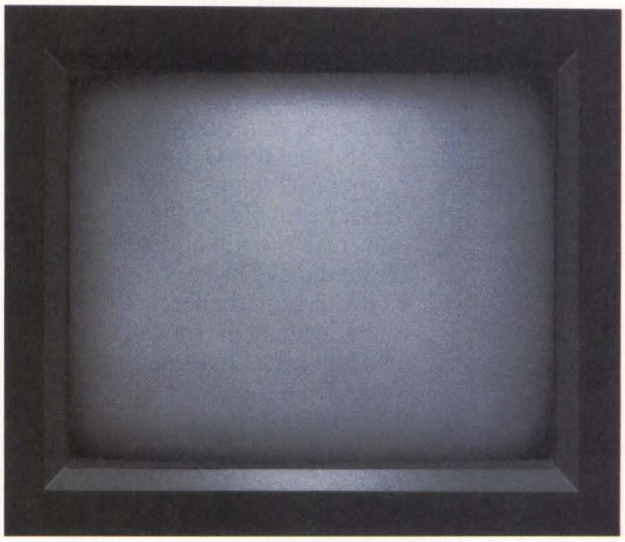

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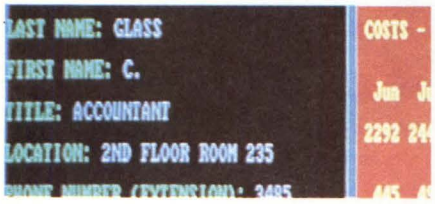

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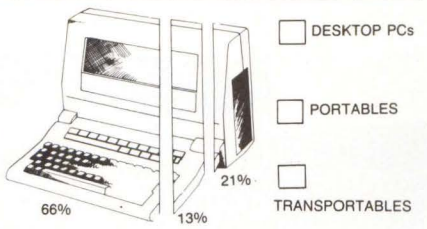

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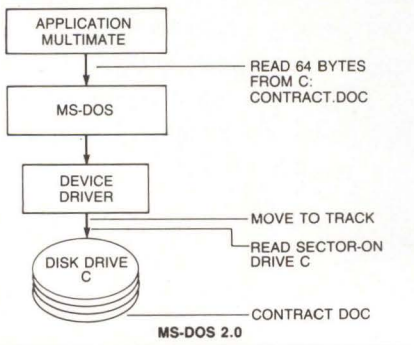

Creating a LAN look-alike p.159

INTEGRATED SOFTWARE: ENVIRONMENTAL SOFTWARE OPENS SYSTEM WINDOWS 115

Multifunction, integrated software packages such as Framework and Symphony may soon be upstaged by environment managers, which offer an enhanced level of integration. But don't expect a major battle between software giants Digital Research, IBM and Microsoft.

TRANS/PORTABLES: NEW PORTABLE COMPUTERS BETTER AIMED AT MARKET 135

Many manufacturers of transportable/portable computers have ignored market needs, resulting in hundreds of millions of investor dollars lost, years of wasted labor and warehouses full of unsold inventory. Recent introductions, however, indicate that manufacturers are beginning to respond.

PC PERSPECTIVE: SYSTEM INTEGRATORS EXPLOIT PC COMPATIBILITY 147

Integrators who haven't moved to exploit the PC infrastructure (hardware configured for the PC bus and software that runs on PC-DOS or MS-DOS) may be missing an excellent opportunity for profit.

SYSTEM ARCHITECTURE: 'LAN IN A BOX' PROVIDES MULTIUSER SYSTEM 159

One approach to supplying multiuser capabilities is a multiprocessor that looks like a LAN to software. This PC-compatible system dedicates a microprocessor to each user and is accessed via inexpensive terminals.

PROCESSORS: PROCESSOR BOARD HANDLES VIRTUAL MEMORY 173

This Z8000-based board boasts demand-paged virtual memory, a 10-MHz clock, a Multibus interface with iLBX extension and a powerful state sequencer that handles processor cycles.

SYSTEM ARCHITECTURE: FOUNDATION MODULE SIMPLIFIES INTEGRATION 183

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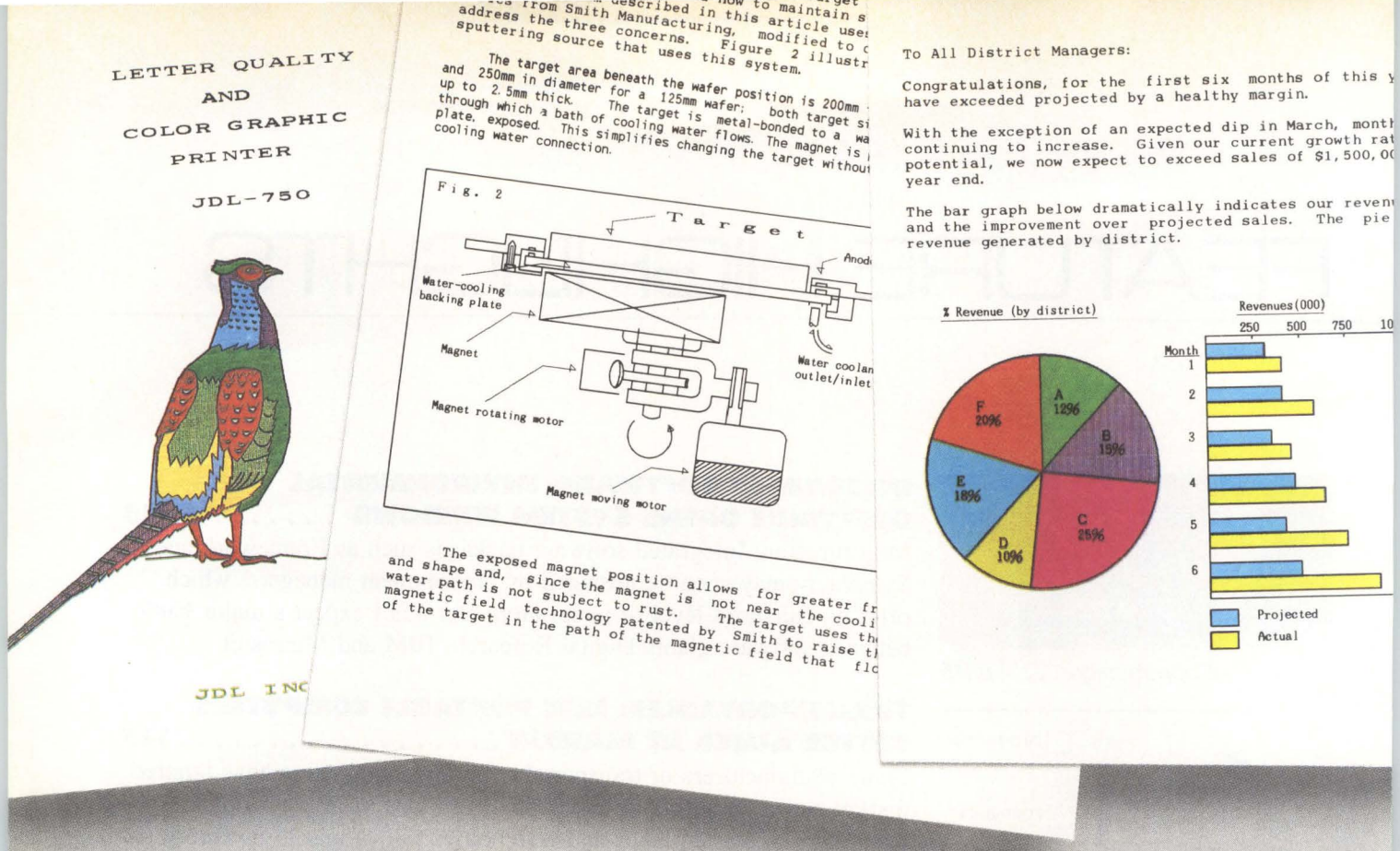

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ENVIRONMENTAL SOFTWARE OPENS SYSTEM WINDOWS

Operating system shells promise to please end users while opening up new windows of opportunity for system integrators

Carl Warren, Western Editor

Environment managers, or shells, are the latest trend in system software. They function as system supervisors, encompassing portions of the operating system, and as links to diverse applications.

Shell environments provide a standard interface to the rest of the system; an understandable and easy-to-use presentation interface for the user; and the ability to move, or transport, data from one application to another. This last element, say industry observers, will have a positive effect on the system as a whole because transporting data requires common data structures.

As with many new-generation software products for graphics and networking, a common level interface and the sharing of data among applications are becoming important factors. Problems arise, however, on what is meant by "standard," and whether one vendor's solution will prevail.

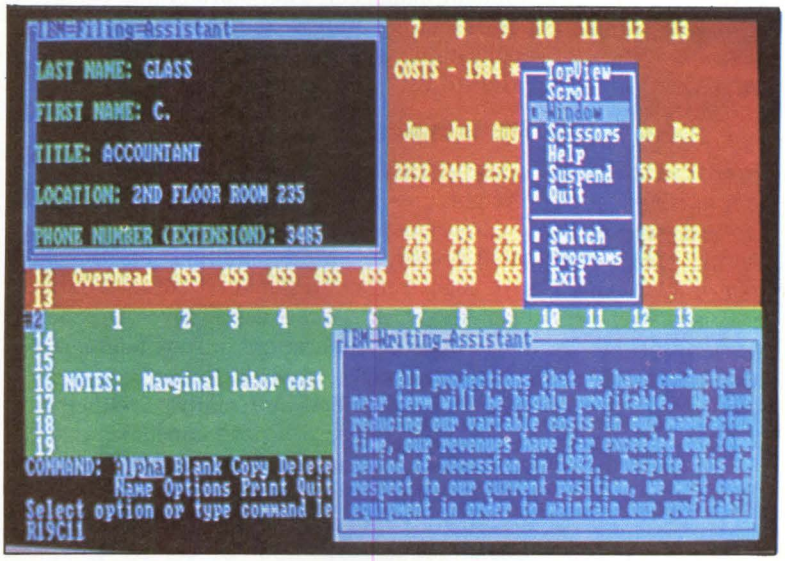

Fig. 1. IBM's TopView *is a character-oriented, rather than graphics-oriented, environment manager. TopView displays multiple windows and supports concurrent operation of multiple applications.*

No war on the horizon

If you're expecting a major battle between such software giants as Digital Research Inc. (DRI) with its Graphic Environmental Manager (GEM), IBM Corp. with its TopView and Microsoft Corp. with its MS-Windows, it isn't going to happen. Although these companies are establishing some of the ground rules for handling the system environment, what is clear to developers and end users alike is that no single method is wanted.

Furthermore, system integrators find that application requirements are more important than a common interface. As a result, many opt for the alternative solution of slipping a "sleeve" over the application to simplify use. A sleeve is a piece of software that maintains pointers to on-line applications and provides pipes to move data from one application to another and from system device to system device.

Functionally, sleeves closely resemble envi-

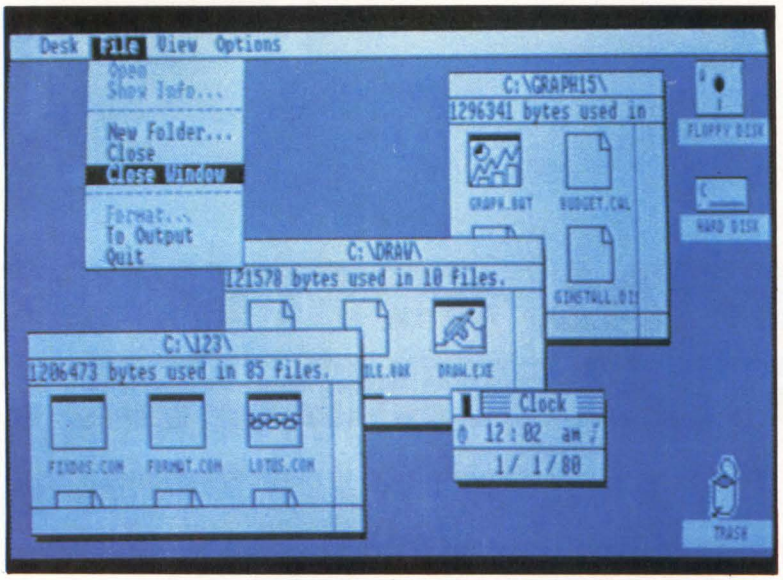

Fig. 2. Digital Research's GEM *gives the appearance of an Apple Macintosh to the IBM PC. GEM is a single-tasking, graphics front-end for applications and the operating system. Disk and file operations are denoted by icons selected by a mouse.*

ronment managers. They sidestep the complexities of the operating system and, frequently, the application. The goal is to make the system easier to use.

Shells bypass multifunction packages

Multifunction software vendors may be brought up short by the enhanced integration level promised by environment managers. "The trend is away from the multifunction package," says Jean Yates, president of Yates Ventures, Palo Alto, Calif. Yates sees a movement back to single-purpose applications linked under an environment manager, or shell.

A study published by Creative Strategies International, San Jose, Calif., concludes that the new operating environments offered by shells will undermine the need and reduce the market for integrated software packages such as Ashton-Tate's Framework and Lotus Development Corp.'s 1-2-3 and Symphony.

Environment managers, says the report, offer users the ability to combine several diverse applications under a single environment. Users can thus choose the desired mix, rather than being pinned to a specific metaphor prescribed by the integrated-software vendor.

"Primarily, what people want," says Bonnie Digrius, director of the microcomputer software industry group for Creative Strategies, "is word processing and spreadsheet—single-purpose, but tied together in some way." Stephen A. MacDonald, vice president of marketing at Adobe Systems Inc., Palo Alto, Calif., contends that ease of integration is what is wanted. "System people want to be able to draw on a library of functions, such as printer drivers, and not have to worry about creating them. To us, that's where the value of fully integrated environment managers comes in."

Market projections are sketchy

Because the market for environmental management software is only about a year old, projections are sketchy at best. Analysts are predicting a large share of the market will go to IBM's TopView, and possibly an equal amount to DRI's GEM.

Mary Ellen Dick, research analyst for Software Access International, Mountain View, Calif., maintains that environment managers are still too technically difficult for most users, or are at least perceived to be. "The environmental managers [such as TopView or MS-Windows] require a lot of work to set up and use. There's no single keystroke solution there, and that's an inhibiting factor toward their acceptance."

Software Access surveyed 8,000 households, 4,300 of which were random samples that didn't necessarily have computers. The others were known users. The company found that none of the households surveyed had any plans to purchase an environment manager. The survey revealed that most wanted a simple, two-function solution that combined a spreadsheet with graphics or with a database.

Andrew Czernek, director of marketing for Zenith Data Systems, Glenview, Ill., says that the market is looking for a consistent user interface, not complex solutions. "This is something Wang [Laboratories Inc.] and Digital Equipment [Corp.] have been saying for years: Keep the user interface consistent. The environment managers are one way of handling the problem."

In Billerica, Mass., Honeywell Information Systems Inc.'s manager of microcomputer systems, Gary B. White, says that environment managers ideally should provide support to link the broadest possible range of applications. "The software strategy that lets OEMs and system integrators do that will be the one that wins," states White.

IBM may set the stage

IBM's TopView (Fig. 1) is a single-user, multitasking, environment manager. TopView is an event-driven supervisor that permits applications to operate in both foreground mode (i.e., dominating the screen) or in background mode (i.e., not necessarily displayed). The application that has control of the display buffer is the one that gets updated.

The TopView environment is character-oriented rather than graphics-oriented. As a result, TopView detractors see it as not very functional because more and more applications use graph-

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ics. But TopView's chief architect, Ross Cook, defends his product by pointing out that 70 percent of IBM PCs have monochrome displays, and, according to IBM's studies, 90 percent of the applications are character-oriented. "We do support graphics, but they can't be windowed in TopView since they take over the display buffer. What we do is store the TopView environment until the graphics application is finished," explains Cook.

TopView runs the environment until another piece of software takes over. Thus, a variety of applications, IBM claims, can operate in a TopView environment.

That may be about as far as IBM's willingness to share may extend. For example, TopView isn't for IBM-compatibles because it relies heavily on the interrupt structure of the PC and PC-AT to function properly.

Even with industry pundits predicting a market takeover by TopView, software developers remain divided. To date, more than 250 independent software vendors (ISVs) and value-added resellers (VARs) have taken advantage of the

REPRESENTATIVE ENVIRONMENT MANAGERS AND SHELLS

Product/ Company	Memory/ K Bytes	Application shell	O/S extension	Systems	Price ($)	Multitasking	Notes, features, options
A-TO-Z INTEGRATED SYSTEM **Digital Equipment Corp.** 146 Main St. Maynard, MA 01754 (617) 897-5111 **Circle 413**	512	•	•	VAX PDP-11	400	•	multiuser operating system extension for PDP family, RSX operating systems and VAX systems; open architecture which can be built upon by system OEMs and VARs
ABILITY **Xanaro Technologies Inc.** 321 Bloor St. East, Suite 321 Toronto, Canada M4W169 (416) 927-8369 **Circle 424**	256	•	•	see notes	495		requires color monitor and bit-mapped graphics; combines word processor, database manager, communications; written in C language; transportable to most systems
APX CORE **Application Executive Corp.** 600 Broadway, Suite 4C New York, NY 10012 (212) 226-6347 **Circle 410**	48	•	•	MS/PC DOS based on 8088/8086	95	•	multiwindowed, character-oriented; operates with monochrome monitor; comes with utilities to assist in tailoring programs such as Lotus 1-2-3; supports data import and export functions
CONCURRENT PC DOS GRAPHIC ENVIRONMENT MANAGER (GEM) **Digital Research Inc.** 60 Garden Court P.O. Box DRI Monterey, CA 93942 (408) 649-3896 **Circle 414**	256 128	• •	• •	MS/PC DOS based on 8088/8086 same	295	•	supports CP/M-86, PC-DOS functions, windows, menus; requires at least two floppy disk drives; works with color, monochrome and bit-mapped graphics; includes communications; supports multiple users OEM product price varies; graphics front-end for DOS; single-tasking only
DESQ **Quarterdeck Office Systems** 1918 Main St., Suite 240 Santa Monica, CA 90405 (213) 392-9851 **Circle 420**	256	•		MS/PC DOS based on 8088/8086	399		single-tasking, single-user shell; allows data import and export between applications; some graphics packages may need tailoring to environment
DOS COMMANDER **Applitek, care of:** **Connecticut Software** 30 Wilson Ave. Rowayton, CT 06853 (203) 838-1844 **Circle 411**	16	•		MS/PC DOS based on 8088/8086	79.95		essentially a shell for DOS—speeds up DOS functions; can be used with monochrome or color displays; although character-oriented, uses graphics adapter to enhance display in color mode

TopView tool kit. For the most part, all admit that TopView is easier to interface to than is Microsoft's MS-Windows. But according to one major developer, who asked to remain anonymous, applications run much more slowly (reportedly 40 percent more slowly) in the TopView environment than in MS-Windows. The developer attributes the slowness to an extra filter, which he feels doesn't offer much advantage.

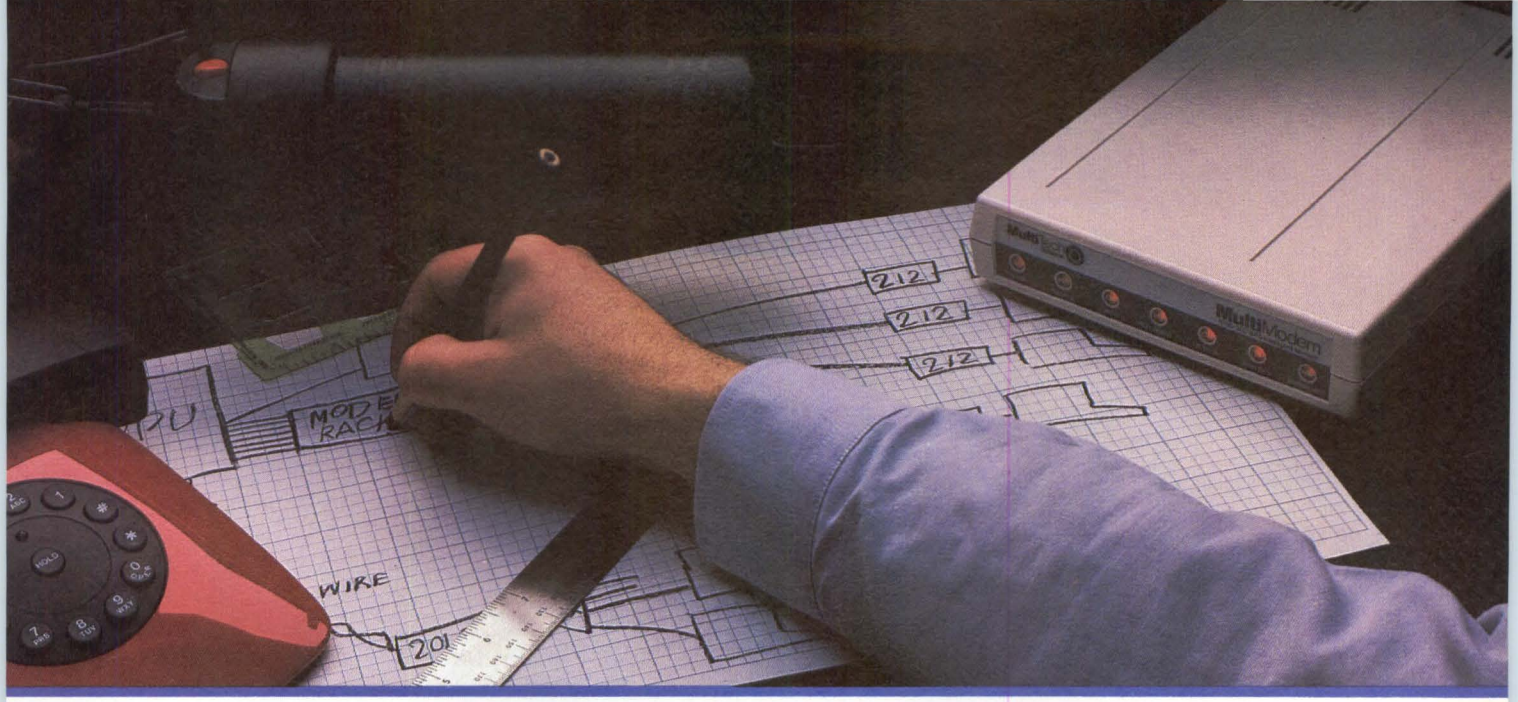
Application developers may find that developing for TopView is not easy. The IBM TopView tool kit guide lists some critical "don'ts." For example, the use of BATCH files (files that execute DOS commands en masse) are incompatible with TopView. This may be critical to some applications that rely on the DOS BATCH facility to perform various functions. In addition, TopView can't use some critical system vectors that handle DOS calls and allow the termination of an application while keeping it in main memory. Because of these inconsistencies, graphics applications using the proposed virtual device interface (VDI) drivers can't be run with TopView resident. However, TopView is expected to be available this month, and most developers assume IBM will solve these problems.

Simple may be best

To keep pace with the needs of software developers and end users, DRI developed the GEM. Unlike TopView, GEM isn't multitasking. Rather, it's a graphics front-end for

REPRESENTATIVE ENVIRONMENT MANAGERS AND SHELLS

Product/ Company	Memory/ K Bytes	Application shell	O/S extension	Systems	Price ($)	Multitasking	Notes, features, options
DOSEASE **Software Solutions Inc.** 30 Bic Drive Milford, CT 06460 (203) 877-9268 **Circle 423**	68	•		MS/PC DOS based on 8088/8086	66		menu-driven system will transport ASCII files; uses basic DOS utilities for file functions
DOSSHELL **XTC Handcrafted Software** P.O. Box 902 Santa Barbara, CA 93102 (805) 967-7837 **Circle 425**	note	•	•	MS/PC DOS based on 8088/8086	70		can only be used with hard disks; uses DOS command BATCH files to segment hard disk and established directories
DUNSPLUS **Dunsplus Inc.** 187 Danbury Rd. Wilton, CT 06897 (203) 762-1212 **Circle 415**	256	•	•	MS/PC DOS based on 8088/8086	1,700		provides menu shell around DOS and application; comes with PC DOS 2.0, Multimate word-processing, Lotus 1-2-3, communications, 3270 emulation; allows 43 other applications to be combined; supports data import and export functions
METAWINDOWS **Metagraphics Software Corp.** 444 Castro St., Suite 400 Mountain View, CA 94041 (408) 438-5352 **Circle 417**	128	•	•	MS/PC DOS based on 8088/8086	150		OEM window shell; uses mouse or keyboard for cursor movement
MS-WINDOWS **Microsoft Corp.** 10700 Northrup Way P.O. Box 97200 Bellevue, WA 98009 (206) 828-8080 **Circle 418**	note	•	•	MS/PC DOS based on 8088/8086	note		currently a single-tasking, single-user package with tiled windows; undergoing extensive re-design, dropping in size from 320K bytes to under 128K bytes; will use mouse pointers, windows and provide data-transport functions
1 DIR **Bourbaki Inc.** 431 Main St. P.O. Box 2867 Boise, ID 53701 (208) 342-5849 **Circle 412**	0	•		MS/PC DOS based on 8088/8086	95		menu shell that handles DOS functions; allows creation of multiple menus that can be nested and celled by each other



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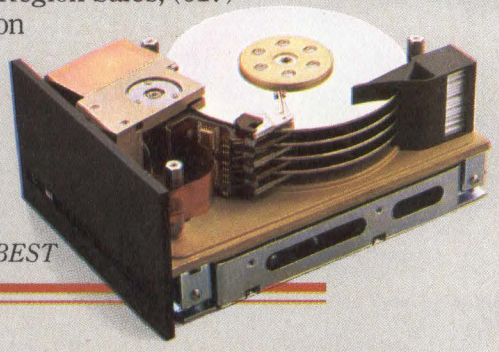

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applications to aid inexperienced users.

William J. Higgs, DRI's GEM product line manager, says GEM aims at the presentation graphics market, a different market segment from that of TopView or MS-Windows, and possibly shouldn't be compared. But others disagree. Independent software engineer Robert Anton Byers, for one, sees GEM as a solid alternative to the more complex solutions offered by Microsoft and IBM. "Getting the job done is far more important than a complex interface," says Byers.

GEM uses icons, or pictures, to replace MS-DOS and PC-DOS commands (Fig. 2). For example, pictures of disks represent storage, and trash cans represent a way of erasing information. Screen operation is similar to that of Apple Computer Inc.'s Lisa and Macintosh personal computers, but is supported by the power of the IBM PC.

To handle peripherals and graphics properly, GEM also uses VDI graphics drivers, which were recently endorsed by IBM to link to all applications and peripherals.

Even though GEM is an extension of the operating system, it is primarily a single-task solution. Thus, only one application can run at a time. As a result, unlike TopView and, reportedly, MS-Windows, applications tend to run at normal speed and aren't impeded by errant system calls. Users can quickly move from one application to another using the icon-based menu system.

Because GEM is primarily a front-end package, it requires only 128K bytes of RAM. By contrast, Microsoft's MS-Windows demands 340K bytes in the current version. The newer version is expected to need less than 128K bytes, according to a company spokesman.

Taking a similar tack as IBM and Microsoft, DRI also offers a developer's tool kit. Because the package is classified as a presentation graph-

Environment managers, or shells, are the latest trend in system software.

REPRESENTATIVE ENVIRONMENT MANAGERS AND SHELLS

Product/ Company	Memory/ K Bytes	Application shell	O/S extension	Systems	Price ($)	Multitasking	Notes, features, options
SIMPLEX **Quest Research** 214 N. River Ridge Circle Burnsville, MN 55337 (612) 894-7752 **Circle 421**	128	•	•	MS/PC DOS based on 8088/8086	245–695		object-oriented shell taking the place of DOS; windows, menus and variety of applications and development tools provided; price includes Quest applications; virtual memory and device functions built in
SMARTSTAR **Signal Technology Inc.** 5951 Encina Rd. Goleta, CA 93117 (805) 683-3771 **Circle 422**	note	•	•	VAX		•	series of "smart" applications making use of VAX Information Architecture; windows, virtual memory and virtual device drivers used; pricing for MicroVAX version is $700 per module
TOP VIEW **IBM Corp.** Entry Systems Division P.O. Box 1328 Boca Raton, FL 33432 **Circle 416**	128	•	•	IBM PC/XT AT and jr	149	•	full-function, character-oriented manager only for monochrome screens; uses interrupt structure to handle tasks and support varied applications
USI-WINDOW MACHINE **Amber Systems Inc.** 1171 S. Saratoga-Sunnyvale Rd. San Jose, CA 95129 (408) 996-1883 **Circle 409**	12	•		MS/PC DOS	59.95		language-binding for all Microsoft languages plus Borland International Inc.'s Turbo Pascal and various COBOL and C compilers; maintains 64K-byte buffer for virtual screens used by applications; character-oriented
VISI ON **Visicorp** 2895 Zanker Rd. San Jose, CA 95134 (408) 946-9000 **Circle 419**	256	•	•	MS/PC DOS based on 8088/8086	495		single-tasking, single-user software; requires major modification to applications; supports mouse pointers; allows use of other Visi software

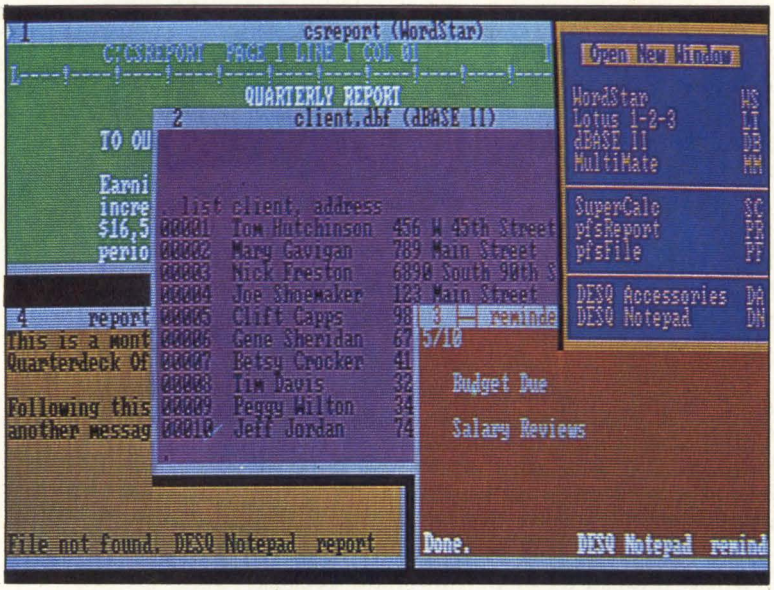
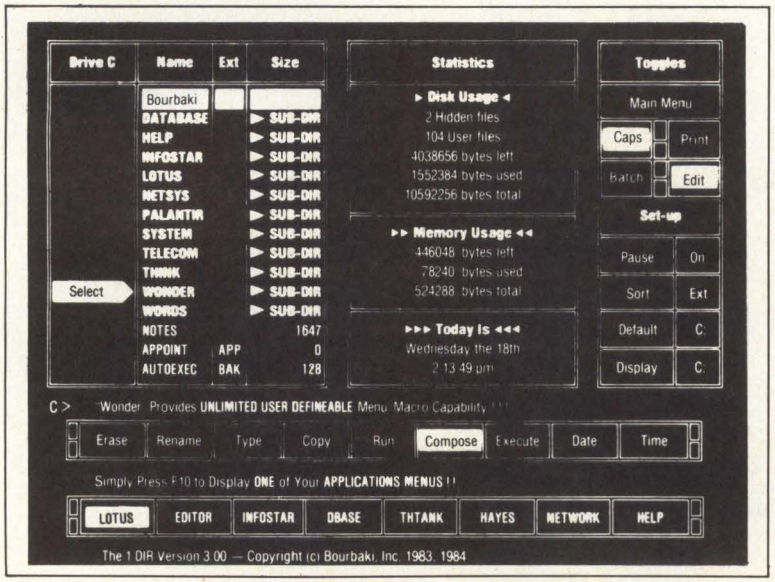


Fig. 3. Quarterdeck's DesQ *serves as a sophisticated "sleeve" that surrounds both the operating system and the applications. DesQ employs overlapping windows and manages inter-application communication.*

Fig. 4. Bourbaki's 1 DIR *takes the place of the DOS standard prompt and hides the complex operation of the operating system from the user, while providing a menu-driven selection display.*



ics system, DRI provides GEM Draw for creating presentation graphics and GEM Wordchart for designing such things as organizational charts.

DRI expects to offer a concurrent version of GEM this year. According to Tom Byers, DRI's marketing manager for application environments, "What we are shipping [GEM shipments began in February] is a single-task version, something we call the MAC-mode. We aren't trying to be all things to all people, and are establishing a firm base to build on."

DRI isn't without developer support. An estimated total of 300 ISVs and VARs have latched onto GEM and are expected to begin shipping soon.

Microsoft waits in the background

An estimated total of 400 ISVs and VARs support Microsoft's MS-Windows. Characterized by Jean Yates as mediocre, the much-touted environment manager has been plagued by development and delivery slippages.

MS-Windows faces other problems, among them speed of applications. But Microsoft designers are aware of the problems and expect to solve the difficulties, including shrinking the memory demands, by the next release cycle, expected this fall.

Using device-independent drivers conforming to the proposed VDI standard, MS-Windows provides a convenient method of handling a barrage of peripherals. The functionality of windows, however, comes from the common link interface that removes the software developer from the complexities of the hardware. Like TopView and GEM, MS-Windows is an extension of the operating system and supports the cliché of the electronic desktop.

Unlike the other packages, MS-Windows uses a tiled approach to windowing. Each application is shown in a window that abuts the next, allowing as many as eight displays of windows. The windows all appear active, but only become so when pointed to. The tiling method tends to require more memory than overlapping windows, however, so new releases are expected to use the overlapping approach.

Microsoft is also preparing to support multitasking and concurrent operation. Ultimately, the package is expected to work in tandem with MS-DOS 3.1, which supports Microsoft's Networks 1.0. Thus, a fully supervised environment can be created.

What many in the industry have been wondering, due to the lateness of the Microsoft product, is whether anyone will still want to support MS-Windows. Zenith's Czernek says the product

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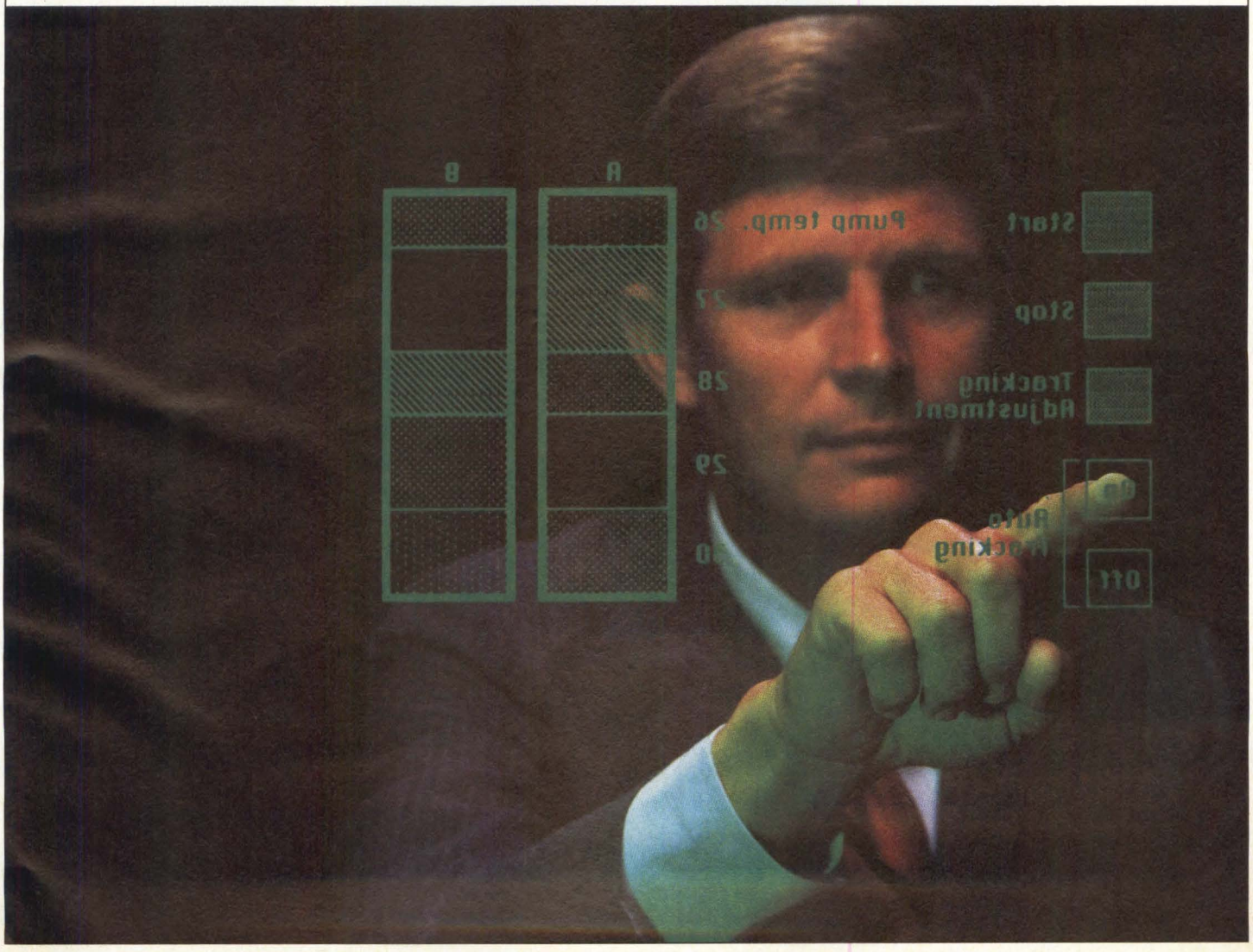

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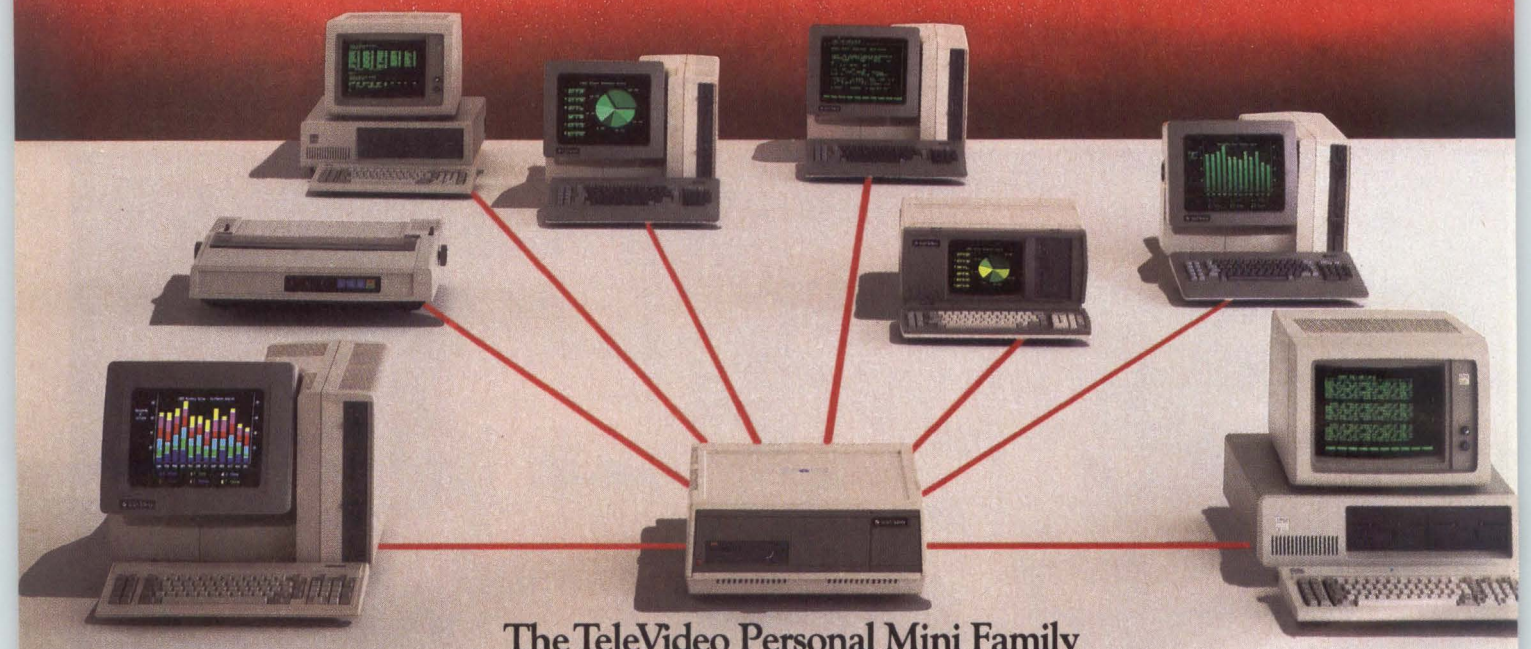

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has been a disappointment but plans to offer it eventually. Honeywell's White, however, says that his company is fully behind Microsoft and expects MS-Windows to be the ultimate winner of major market share.

Perspectives change with applications

Because all applications do not require the same degree of integration, approaches other than those offered by DRI, IBM and Microsoft are equally viable. Some integrators are finding that the command-language capability in MS-DOS, PC-DOS and UNIX makes it possible to develop workable application shells. In practice, the DOS shells can be used to create selection menus and establish PATH directions for locating an application.

Some developers of vertical market applications, such as Query Computing Services, Redondo Beach, Calif., find that developing application-specific front-ends in a high-level language serves most of their needs. Company president Steve Bostwick says that, because of the diversity of the applications he deals with, no single solution is workable. "Each application has to be addressed on an ad hoc basis. That doesn't mean we ignore tools that help us build a solution; it just means that we don't lock ourselves into a single way of doing things," says Bostwick.

One company that has been on the leading edge of environment manager development is Quarterdeck Office Systems. Its DesQ product (Fig. 3) lets users choose what they want.

DesQ is based on a high-level query language that Quarterdeck president Terry Myers describes as similar to LISP. Artificial-intelligence techniques embodied in the product let it "learn" application characteristics. As do other products, DesQ makes generous use of overlapping and pop-down windows. And, like GEM, MS-Windows and TopView, DesQ supports mouse pointer devices.

DesQ was the first environment manager to be shipped, but has met with less-than-spectacular market acceptance. Some analysts, such as Creative's Bonnie Digrius, believe it was premature: "Basically, the industry wasn't ready for it."

Even so, system consultant Phil Lieberman, president of Los Angeles-based Lieberman and Associates, thinks Quarterdeck is on the right track. "The use of artificial-intelligence techniques that 'teach' an application to an environment has a lot of potential," he says.

All the environment managers share a common element: a pointing device for users.

The mouse is most favored for moving the pictures around on the display screen. IBM recommends use of the mouse and supports both optical and mechanical versions, but also supports keyboard arrows for those who prefer them.

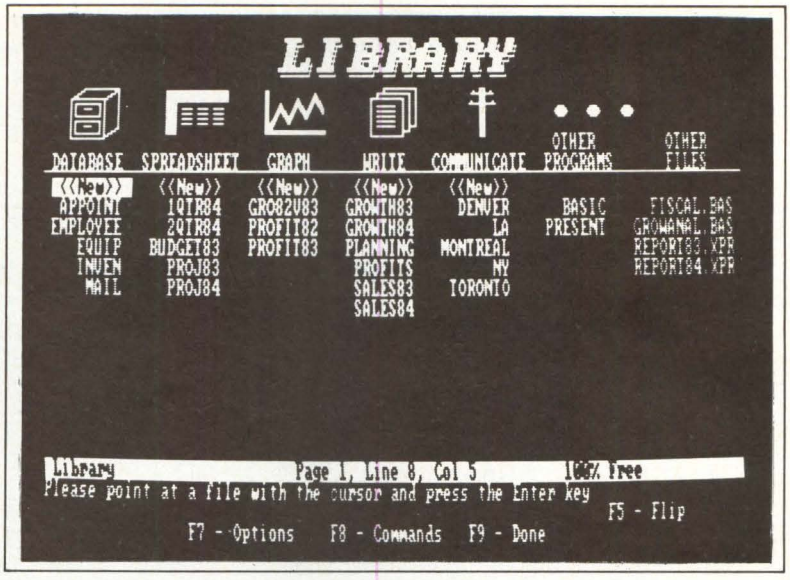


Fig. 5. Xanaro Technologies' Ability *takes the tack that simple is best, using icons to represent various functions, with a menu below each item. Ability uses the PC's arrow position and function keys to assist in making application choices.*

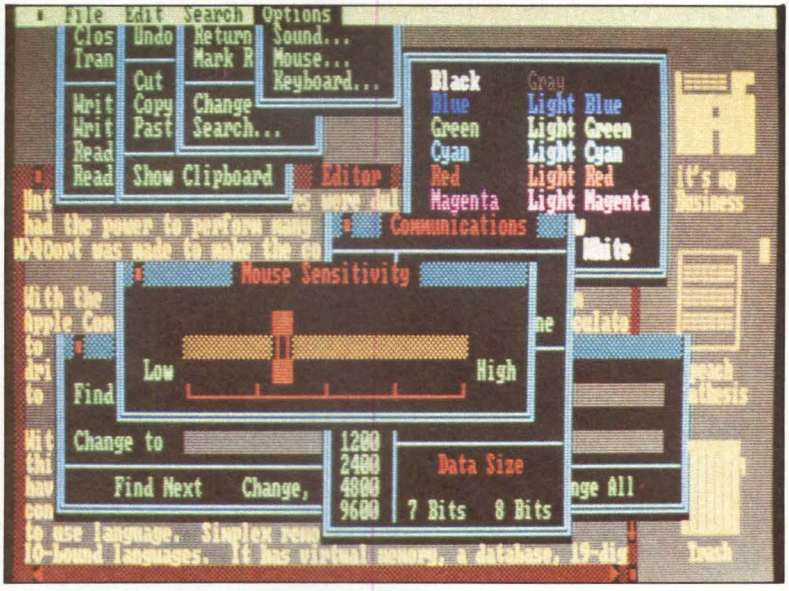


Fig. 6. Quest Research's *Simplex environment manager comes with a database manager, an editor and a set of application-development tools that allow VARs and end users to create vertical-market application templates.*

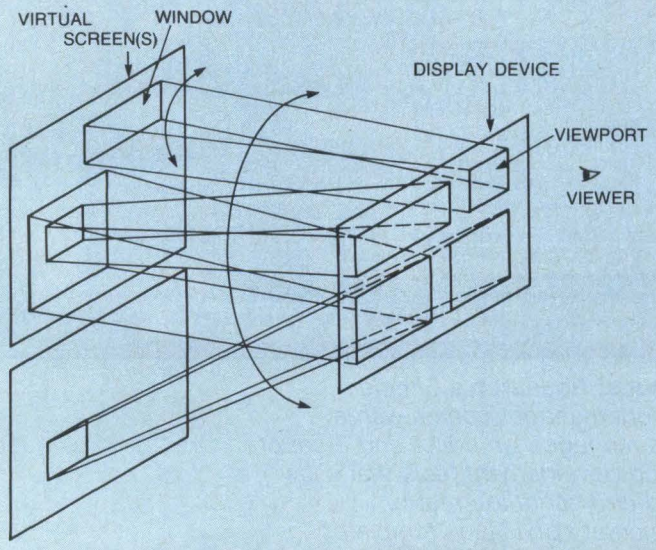
Not everyone is planning on tacking on software from the big three. A number of companies are offering solutions of their own. One company that is taking advantage of the basic capabilities of the IBM PC software architecture is DUNSPlus, a subsidiary of Wall Street investment giant Dun and Bradstreet. According to Kathy Groll, company marketing manager, DUNSPlus tried to create a total work environment that integrated the necessary software. "We aren't a TopView or an MS-Windows. We provide an overall supervisor that combines up

Looking into the window environment

The concept of using bit-mapped display screens and mouse pointer devices for creation and manipulation of graphics isn't new. The technique was developed by the Xerox Corp. Palo Alto Research Center (PARC) in 1973 and was known as SuperPaint, from which Apple Computer Inc.'s MacPaint was taken. What is new, however, is the combination of graphics front-ends with the operating system to create an environment manager, or shell.

Windowing is a basic tool that uses such underlying techniques as pop-up menus and single-screen viewing, while controlling multiple contexts, or applications. Essentially, the screen is made up of the actual display screen and a virtual screen. The windows, also called viewports, show a copy of the information in the virtual screen area.

Each window has its own coordinate system, specified by the application, or, in the case of environment managers, the manager window supervisor. These windows can be adjusted in size and can be made to overlap. The overlapping effect is achieved by allowing display windows to share virtual memory.



In windowing, *the screen consists of the actual display screen and a virtual screen. The windows, also called viewports, show a copy of the information in the virtual screen area.*

The notion of the "current window" simplifies not only the window interfacing but also the understanding of windowing itself. In operation, such as with IBM Corp.'s TopView, the current window is that which, at any instant, dominates the screen display buffers and contains the active application. This is true until another window is made active, typically by pointing to it with a mouse.

Because the viewports share a virtual memory buffer within the sytem, many windows can be made to appear to have control over the screen.

While an application requires full use of the display buffers and full attention from the graphics primitives, only one window is displayed. This is the case in using a package such as Lotus Development Corp.'s 1-2-3, which uses all the display facilities of the IBM PC and thus pushes everything else aside, placing them in the system heap.

Since the graphics front-end adds a user-pleasing interface, it seems only natural that multitasking should also come into play. Currently, however, only a few packages, such as Application Executive Corp.'s APX Core, Digital Research Inc.'s GEM and IBM's TopView, support multitasking operations. This is achieved by sharing time with the microprocessor to allow applications in the background to run. The notion of the current window is still preserved, and background applications may still be shown on the display screen but not updated until made current.

As with the sharing of window space in the memory for display purposes, multitasking also requires the sharing of many resources on the system. Specifically, all the applications must share processor registers and system memory. Hence, special areas of memory are preserved for stacks and heaps to keep track of the application status.

The proposed virtual device interface (VDI) standard would provide the necessary tools for handling the interface tasks. And, in the case of the IBM PC, the interrupt structure of the processor is used to manage swapping applications in and out.

Because the process is so new, multitasking environment managers tend to slow operations. However, more powerful microprocessors such as the Intel Corp. 286 and Motorola Inc. 68020 and 68032 can handle tasks at higher speeds.

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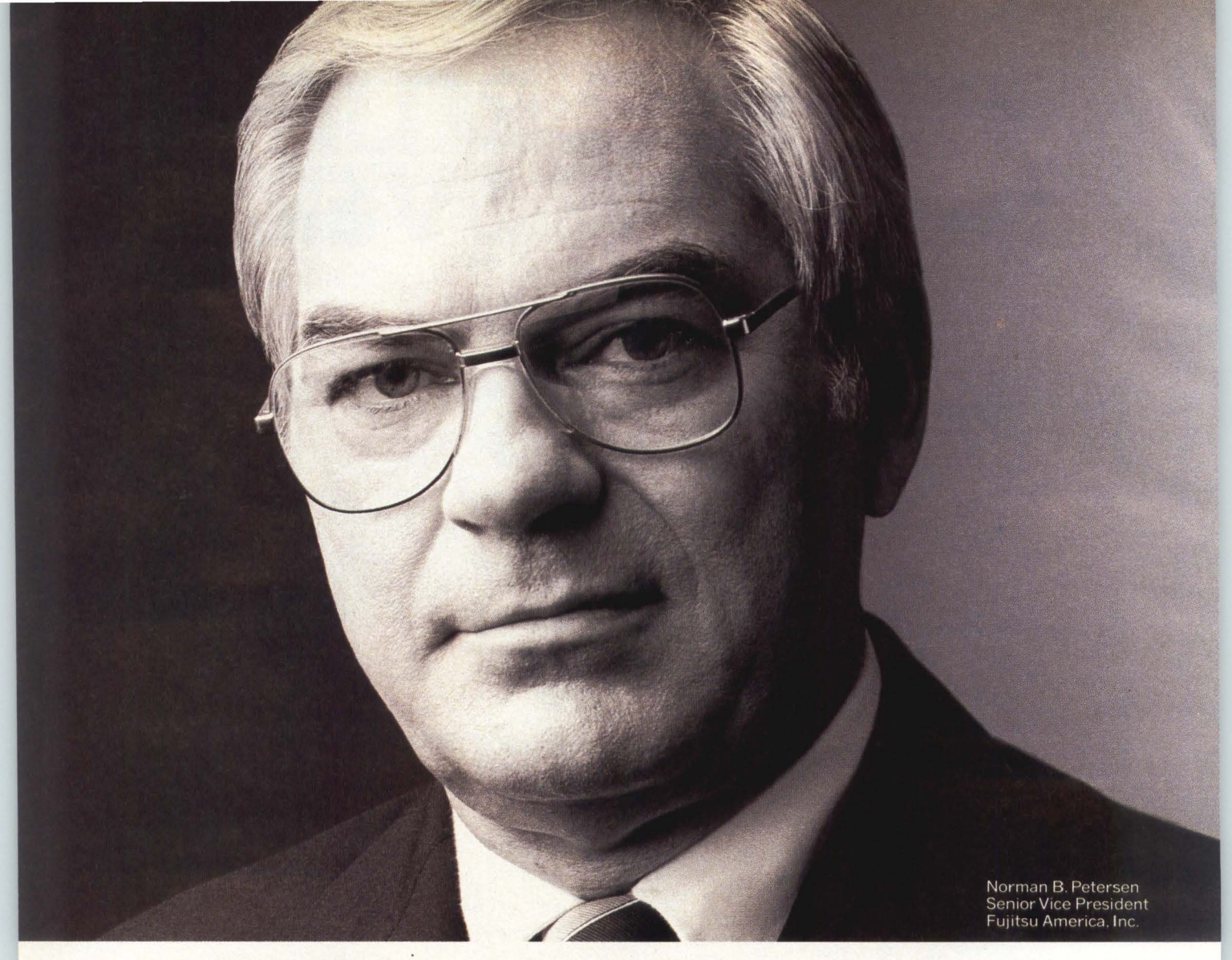

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Senior Vice President
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MODEL	M2322	M2333
CAPACITY (MB) Unformatted	168	336
AVERAGE POSITIONING TIME (msec)	20	20
TRANSFER RATE (KB/sec)	1229	2458
INTERFACE	SMD	SMD
POSITIONING METHOD	Rotary Voice Coil	Rotary Voice Coil

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to 43 different applications." To allow full use of the data, DUNSPlus provides utilities that handle inter-application data transfer and formatting.

Jeffrey W. Hulton, vice president of Access Technology Inc., South Natick, Mass., contends that what will determine the real usefulness of environment managers is their ability to translate data files for use by all system entities. "What people in the office want is common data. It doesn't matter what spreadsheet they're using; they just want to know that they can use the available information, regardless of what software created it," says Hulton.

Making use of the DOS command functions and BATCH file capability, Bourbaki Inc.'s 1 DIR (pronounced "wonder") serves as a front-end by encasing the operating system and using BATCH files to call applications (Fig. 4). The menu-style front-end is manipulated by using the IBM PC arrow keys to locate applications, thus eliminating the need for the user to locate applications.

Taking a similar approach, but adding a spreadsheet, a database manager, word processing, graphics and communications—all folded into a menu-driven environment—is Ability, developed by Xanaro Technologies Inc. (Fig. 5). Another company that has taken an innovative approach is Application Executive Corp., with APX Core. This package, like TopView, provides a multiwindow, multitasking environment for users of the IBM PC and compatibles. APX Core comes with a series of utilities that enable it to work with such products as Lotus 1-2-3 to ensure proper operation in a windowed environment. APX Core also provides a powerful block-transfer function. Thus data can be transferred task-to-task without special conversions or system utilities.

Quest Research Inc. expects to enjoy a share of the environment manager market with Simplex (Fig. 6). Simplex stands out due to the number of functions it offers. Simplex offers windows, a consistent interface to applications and mouse support, but Simplex also combines communications, word processing and database management. And, unlike any of the other packages, Simplex comes with a complete development language and development tools so that ISVs and VARs can build specialized vertical-market applications. □

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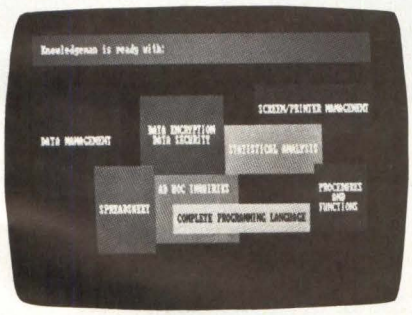

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KnowledgeMan offers sophisticated security features. Unauthorized access to data is next to impossible, thanks to password checking, thousands of access code combinations and data encryption.

So your secrets are safe with KnowledgeMan.

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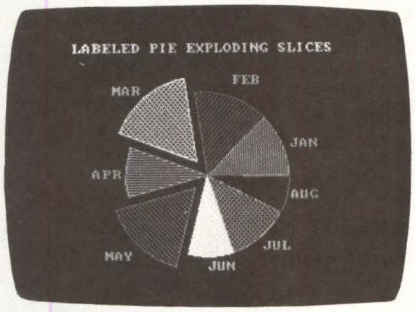
To add yet another dimension to KnowledgeMan's capabilities, you can get fully-integrated options like K-Graph, an extensive business graphics facility that



lets you plot information in a variety of colorful graphs, charts and diagrams. For text processing, the K-Text option lets you incorporate data into written documents quickly and easily. Or, create highly-polished, full-color customized forms with K-Paint, our forms painting option. To short-cut the keyboard, put the K-Mouse option to work.

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NEW PORTABLE COMPUTERS BETTER AIMED AT MARKET

Ignoring clear indications of what transportable-portable computer users want has cost manufacturers dearly, but signs are the message is getting through

Gene R. Talsky
Contributing Editor

Two factors that dominated the computer industry's transportable-portable market segment in 1984 continue to exert an influence in 1985. The first is that never before had what can be called the trans/portable market made its voice so clear, while being so stubbornly ignored by the industry. And the second is that more manufacturers have begun to heed user demands by applying advanced technology and packaging techniques in emerging trans/portable systems.

The cost of not meeting the demands of the market has been the loss of hundreds of millions of investor dollars, the waste of years of labor and warehouses full of unsold inventory. The lesson has been hard on both established companies and start-ups.

In retrospect, the trans/portable market has been predictable. When Adam Osborne introduced the first portable computer in 1981, it set off a wave of buying that many attributed to the need for portability. In reality, the Osborn I sold simply because it was the first full-capability CP/M computer system bundled with extensive application software for under $2,000. Unfortunately, Osborne Computer Corp. was losing money on every sale and eventually was forced into a Chapter 11 federal bankruptcy, from which it emerged in 1984.

In 1982, Teleram Communications Corp. introduced the first battery-operated, full-function CP/M system. Priced at $3,000, it met market resistance. When Tandy Corp. introduced its Model 100, with limited editing and calendar functions for under $1,000, it sold large volumes during most of 1983. But, after the first wave of buyers, sales fell to a trickle and didn't increase significantly, even in response to price reductions to less than $500. Epson America Inc. and NEC America Inc. also offered attractive products, only to find that the market for inexpensive, limited-function, battery-powered systems was quickly saturated.

Compact packaging, *dual disk drives, a 25-line, 80-column liquid crystal display and MS-DOS and CP/M-86 distinguish International Quartz's 9242 transportable.*

Compaq Computer Corp. did set sales records with a relatively compact product in 1983. However, much of its success was due to an ability to deliver true compatibility with the IBM Corp. PC at less cost during a period when PCs were difficult to obtain. Compaq's strong commitment and loyalty to its dealer base enabled it to maintain growth through 1984. Nevertheless, the product's transportability is marginal at best.

A pioneer in upright design, *the Morrow Pivot portable also offers dual 5¼-inch disk drives, a CMOS 80C86 processor, a calculator and clock function keys.*

The early success of Osborne and Tandy led many market research firms to project phenomenal growth for the trans/portable market in the '80s. Thus encouraged, more than 150 manufacturers developed trans/portable systems. Few efforts succeeded. Some companies ran out of money before they could bring their products to the market. More failed because their systems did not meet market expectations—they found neither distribution channels nor buyers. Even IBM learned that the market will reject inadequate products. Examining some of 1984's failures proves illustrative.

$100 million+ marketing lessons

Gavilan Computer Corp., armed with venture investments that reportedly totaled more than $31 million, racked up the most widely publicized failure of 1984. In the aftermath it's easy to conclude that its product and marketing strategies were the reasons for the downfall. Apparently Gavilan didn't believe that MS-DOS was the de facto standard operating system for personal computers, so it developed its own. Gavilan didn't believe existing word processors, spreadsheets and other applications were satisfying market needs, so it developed its own. Gavilan also determined that a new, state-of-the-art, touch panel for cursor movement and menu selection would meet the demands of the market, but it ignored the full impact of development and production costs.

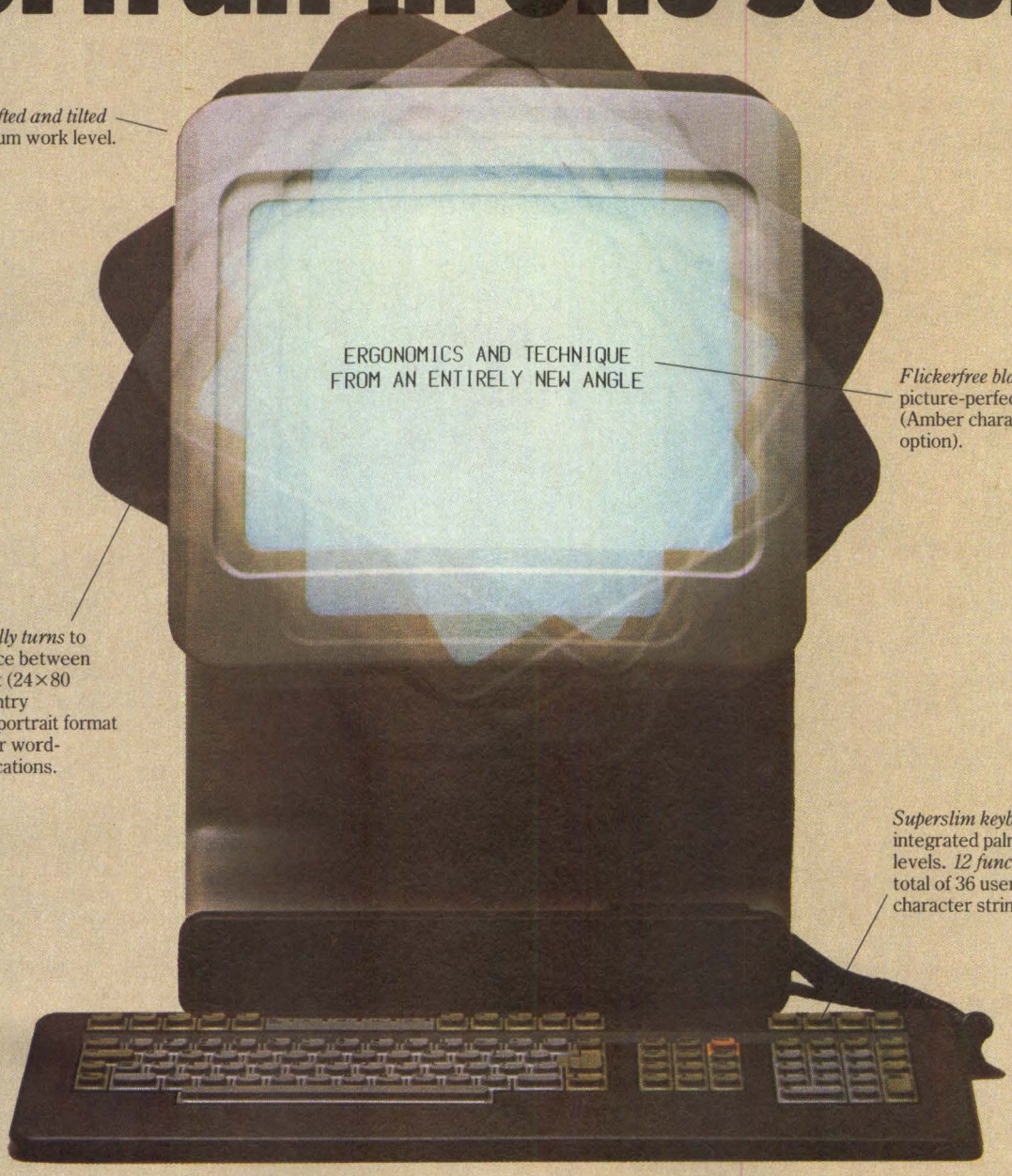
However, Gavilan was among the earliest to recognize the need for integrated disk storage. Unfortunately, the company was premature in selecting first 3- and then 3½-inch drives. Gavilan came to recognize its problems with product strategy and began to take corrective steps. For one thing, it offered an MS-DOS option—but it was too late. As to marketing, Gavilan bypassed established distribution channels in favor of value-added resellers (VARs), who are fewer in number, less well-established in trans/portable markets and who are more difficult (more costly) to identify and contract.

Convergent Technologies Inc.'s Workslate and the Xerox/Sunrise 1800 series exemplify the result of what might be referred to as myopic development programs. Convergent failed to recognize the market's long history of rejecting non-standard keyboards and limited displays and functionality. It offered all those drawbacks for $1,500, competing with Tandy's Model 100 and NEC's 8200 portables at half that price. Xerox

WHAT ADVANCED PORTABLES DO AND DON'T OFFER

Manufacturer, model	Advanced features	Required to meet market needs
Data General/One	dual 3½-inch disks; 25 line × 80 column LCD; MS-DOS and CP/M-86; expansion chassis	IBM-compatible 5¼-inch disk drive(s); improved LCDs
Hewlett-Packard HP110 The Portable	CMOS 80C86; RAM Disk; ROM MS-DOS; ROM applications	removable storage; 25 line ×80 column display; video/CRT interface; parallel interface
Micro Office RoadRunner	friendliest software operating environment; RAMdisk and RAM cartridges	25 line x 80 column display; 16-bit IBM-compatible processor; 5¼-inch disk drive(s)
Morrow Pivot	CMOS 80C86; dual 5¼-inch disk drives; single-key modem; calculator; clock function keys; upright packaging	25 line × 80 column display; detachable keyboard; video/CRT interface
Quadram Datavue 25	25 line × 80 column LCD; 5¼-inch disk drive; detachable infra-red keyboard, upright packaging	video/CRT interface; second integral disk drive
TIME. Office Computers (Ex: Dulmont Magnum)	80186; ROM MS-DOS; removable ROM and RAM packs	25 line × 80 column display; 5¼-inch disk drive(s); U.S. distribution and support
Zenith ZP 150	Microsoft ROM-based HH-DOS; Microsoft ROM-based applications; expansion chassis	5¼-inch disk drive(s); 25 line × 80 column display; ROM cartridges (instead of components); video/CRT interface

From landscape to portrait in one second



Screen can be *lifted and tilted* to ensure optimum work level.

Flickerfree black characters for picture-perfect performance. (Amber characters available as option).

The screen actually turns to give instant choice between landscape format (24×80 char.) for data-entry applications and portrait format (72×80 char.) for word-processing applications.

Superslim keyboard with integrated palmrest and two tilt levels. *12 function keys* give a total of 36 user-definable character strings.

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What do these popular micro printers have in common?

Access
Apple
Atari
Burroughs
C.Itoh
Commodore
Coleco
CPT
Cromemco
Digital
Epson
Hewlett Packard
IBM
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Corp. and its defunct spin-off, Sunrise Co., asked too much for too little with predictable results.

Bytec-Comterm Inc. reportedly lost $48 million trying to market its IBM-PC clone, which included some nice hardware and software features in an attractive package. Unfortunately, its Hyperions wouldn't keep running, which quickly closed off reseller channels and sealed corporate doors. Otrona Corp., one of the earliest to appear after Osborne, offered advanced engineering in an outstanding and compact CP/M package. It developed a loyal cult of dealers and users for its innovative Attaché system. However, the initial PC-compatible offering appeared patched together and didn't impress. Then, new management led the company away from its advanced technology philosophy, resulting in the model 2000, which was perceived as just another PC clone, albeit in more attractive clothing. At that point, the company failed.

Market needs are clear

Such real-world case studies should serve as warning signs. But more companies continue to offer products that ignore the market's less-than-subtle directions.

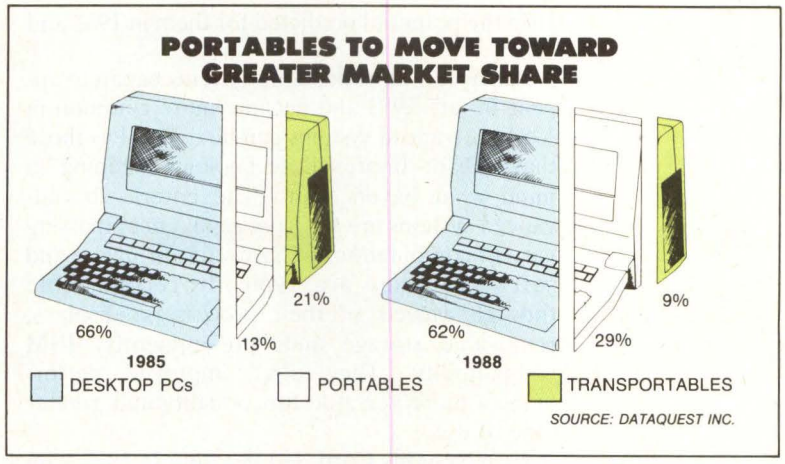
These include clear indications that:

- Full displays such as 25 lines by 80 columns are mandatory
- Liquid crystal displays (LCDs) are marginally acceptable and interfaces for all display options, including RGB (red, green, blue) are required for extended use
- Integral, removable storage that is PC-compatible is required
- Would-be buyers doubt that a 5-pound computer offers the same capabilities as a desktop unit.

Integral, removable storage is essential because, while application software is becoming more readily available on 3½-inch disks, users have a substantial amount of copyrighted software on 5¼-inch media. Business files developed on personal computers are almost universally stored on 5¼-inch disks and will continue to be updated on existing desktop systems in that format.

Doubts about the functionality of the hand-carried portables are not being effectively addressed by current promotional campaigns that ignore the lessons of the past five years. Manufacturers are still promoting features (5 pounds, 10-hour battery operation, 720K-byte disk drives, etc.) rather than benefits.

Finally, pricing is critical. The market has not been willing to spend $3,000 for a battery-powered system that it doesn't regard as a full-function personal computer, when a "real" desktop IBM PC is readily available for as little as $1,500.



It is apparent that the marketplace is driving product design, marketing strategy, pricing and distribution. Buyers have refused to cooperate with the industry pundits who, too early, predicted monumental sales of trans/portable systems, without due regard to market realities. Real opportunities do exist for companies with products that meet all or most of the market's demands. Indications are that sales of advanced trans/portable systems should begin to realize in

WHAT ADVANCED TRANSPORTABLES DO AND DON'T OFFER

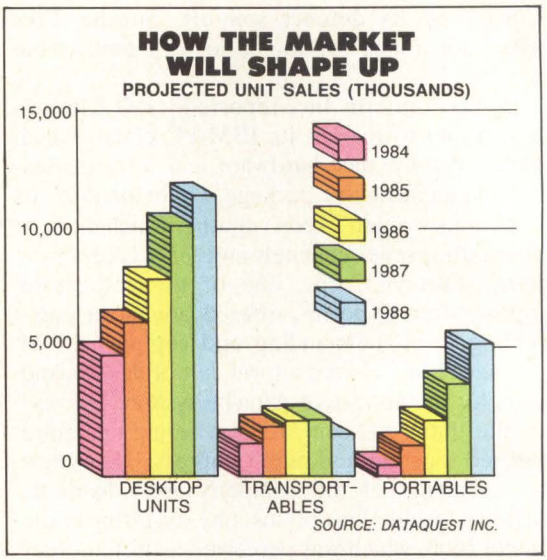
Manufacturer, model	Advanced features	Required to meet market needs
ACT Apricot Portable	80186; 25 × 80 LCD; voice recognition; infrared keyboard; mouse; advanced MS-DOS front-end environment	standard keyboard layout, size and keys; articulating display; IBM-compatible 5¼-inch disk drives; greater IBM-PC compatibility
Grid Systems Compass	8086 & 8087; bubble memory; electro-luminescent display; expansion chassis; application software; compact packaging	integrated removable storage, more competitive pricing, greater IBM-PC compatibility
International Quartz 9242	80186; dual 5¼-inch disk drives; 25 × 80 LCD; MS-DOS & CP/M-86; expansion chassis; compact packaging	distribution and support
STM Portable Personal Computer	80186; 25 × 80 LCD with electroluminescent backlight; compact packaging	greater IBM-PC compatibility, articulating display
Visual Technology Commuter	dual 5¼-inch disk drives; 25 × 80 LCD; compact packaging	U.S. distribution and support

1985 the potential predicted for them in 1983 and 1984.

Advanced trans/portable systems began to appear in late 1983 and became more common in 1984. Advanced systems can be defined as those that deliver improved technology, keeping in mind what buyers want. The criteria for advanced systems are far from rigid, encompassing various combinations of hardware, firmware and software. They are typically recognizable through aspects of their processors, displays, removable storage and, pre-eminently, IBM compatibility. They offer improved performance, more versatile functionality and greater ease of use.

Grid Systems Corp. led the field in 1982 with its 8086-based system, which also included an 8087 processor chip, offering phenomenal performance at that time. However, buyers must still pay a premium for Grid's advanced engineering and performance. In 1984, led by STM Electronics Corp., with its 80186-based system, a number of manufacturers, including Hewlett-Packard Co. (HP), Morrow Designs Inc. and TIME.Office Computers of Australia, offered either 8086 or 80186 processors in their trans/portables. TIME.Office acquired Dulmont Electronics Systems PTY. Ltd.

Intel Corp.'s 8088, although lacking in horsepower, enabled volume delivery of low-cost portable computers. Pricing became the primary competitive factor when Seequa Computer Corp., following Osborne's lead in the Z80 CP/M market, offered PC-compatible systems with the 8088 and substantial bundled software at low cost. It competed successfully until IBM reduced its prices for the PC and PC/XT after the introduction of the PC-AT. However, the 8088 offers limited performance and expansion capability and does not qualify as advanced.



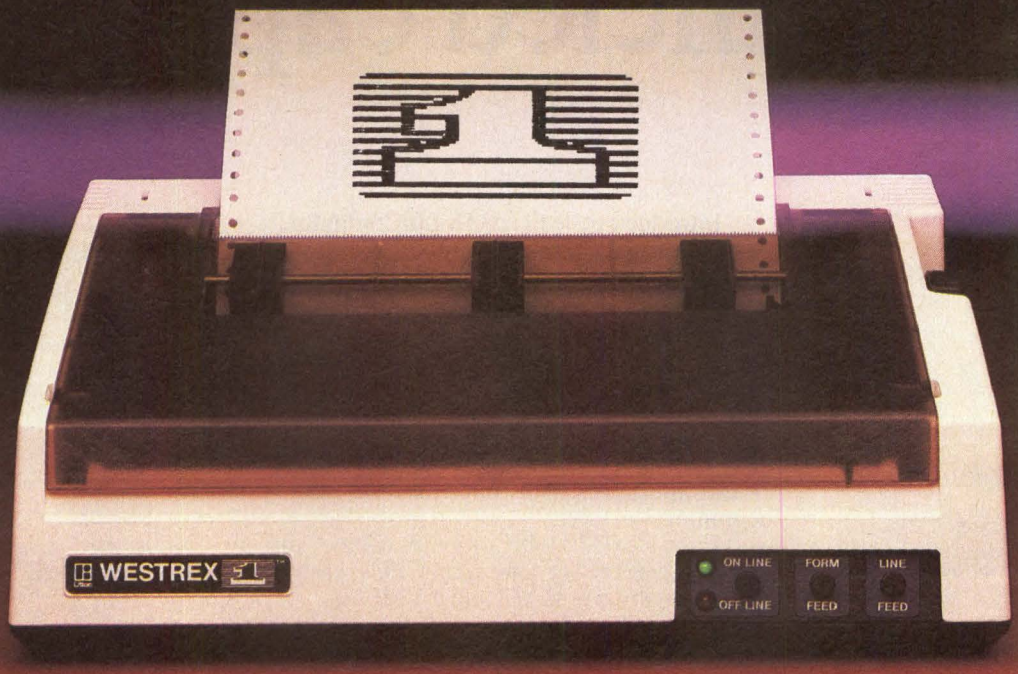
Three who eliminated 'A>,' User Enemy No. 1

Micro Office Systems Technology Inc. Roadrunner: This 5-pound portable was the first clamshell design. It also was the first CP/M-compatible system to incorporate firmware and software to provide text editing, calendar and scheduling, telephone directory and autodial, spreadsheets and other applications without the end user's ever having to confront A>. (It never appears on the screen.) Solely with the use of function keys, users quickly home in on whichever operations they wish to perform and load the files on which they wish to perform them. They can even change the baud rate for the modem and the RS232 port without ever touching anything except function keys. Additionally, a separate HELP key provides ready access to instructional information. This is the only system that truly enables a novice to use a computer without opening the manual.

Hewlett-Packard Co. Series 110 Portable: HP has incorporated its Personal Application Manager (PAM) software in ROM on its 8086-based portable system. Originally introduced with the HP 150 desktop personal computer, PAM offers users the ability to move from application to application with menu selections. However, PAM is best suited for experienced computer users. The action required and the support are not always self-evident. However, it is a major improvement over confronting the A>.

Zenith Data Systems ZP 150: This is the first system based upon Microsoft Corp.'s HH-DOS, which is resident in ROM. It also includes modified versions of Microsoft Word and Multiplan, as well as communications, calendar and scheduler functions, which can be initiated in a window concurrently with applications. While Word and Multiplan are two of the more capable office tools, they are also more difficult to learn and to use. They diverge from the single-command line structure standardized by VisiCalc, using instead cursor-selected commands from several lines of options on the bottom of each screen. Zenith uses HH-DOS to narrow those optional commands down to a single line. However, instead of selecting commands with function keys, users must still move the cursor to the command or type it. Although users never see the villain A>, they need to understand Microsoft's command structure in order to use the software. Undoubtedly, HH-DOS is a step in the right direction.

In a one-to-one comparison, Westrex-One.



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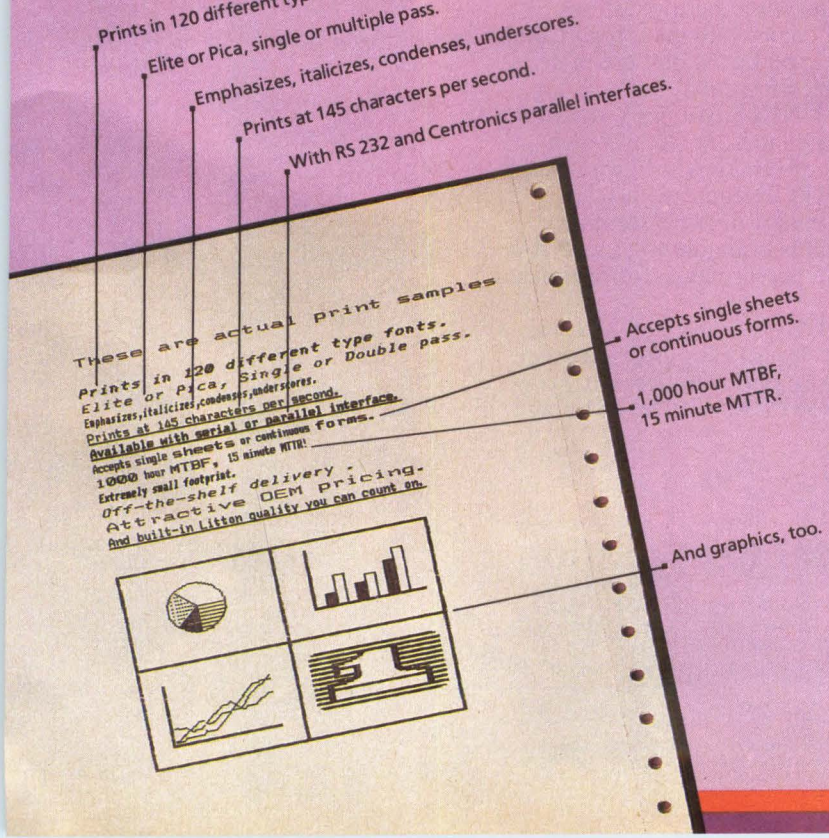

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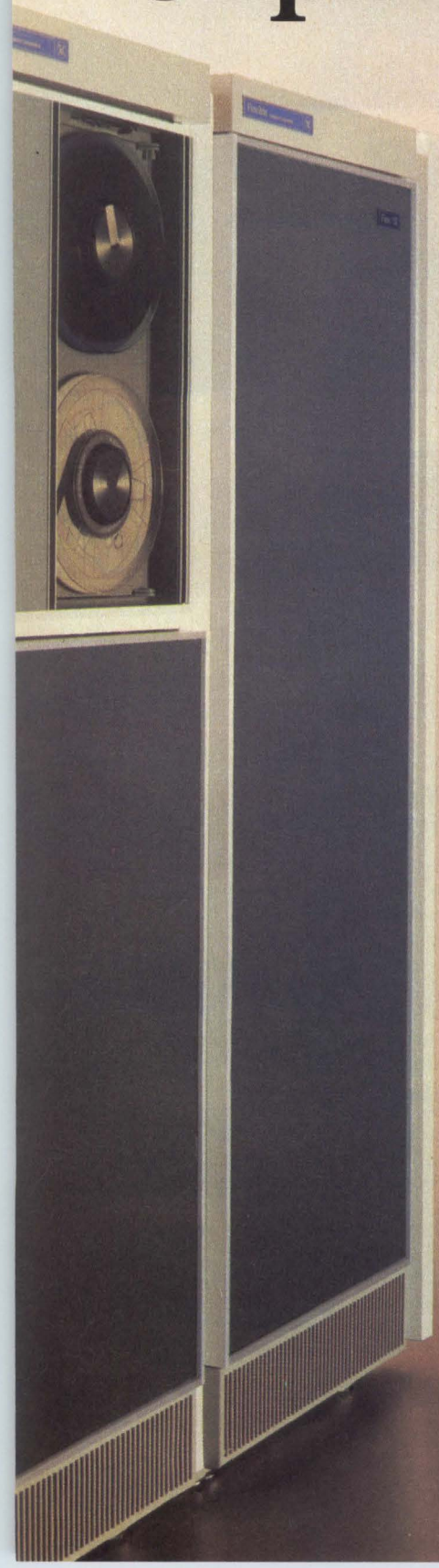

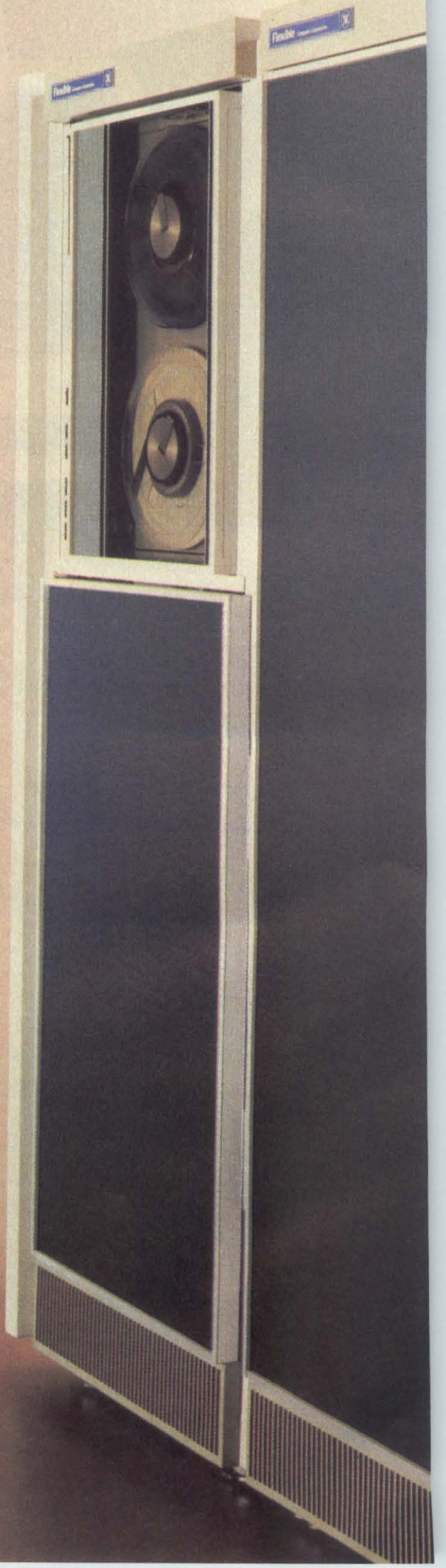

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New products must offer faster, more powerful processors.

Although LCDs now are vastly improved over those used earlier in wristwatches and calculators, and are still improving, they remain one of the two primary deterrents to broad market acceptance of portables. Except for Grid with its electroluminescent display and Strategic Technologies Inc.'s PC Traveler, which uses a gas plasma, flat-panel display, portable computers employ LCDs. STM is the only company that has adopted a dual-technology display, backlighting its 25-line-by-80-column LCD with an electroluminescent panel, enabling a visible display in bad (or no) lighting. Development of electrophoretic panels and gas plasma continues, but they remain costly and require too much power for battery-operated systems.

Lack of compatible removable-storage devices represents the second primary deterrent to broader acceptance of portables. Until IBM validates 3½-inch drives by incorporating them in both desktops and portables, that format will remain in relatively limited use. When included in portables such as the Data General Corp. (DG) Data General/One, 3½-inch drives must be able to interface with 5¼-inch drives through standalone disk drives or an expansion chassis, or with other systems through local-area-network, direct-cable or RS232 interfaces.

Requiring users to buy external 5¼-inch disk drives causes the price for HP 110s, Data General/Ones or Zenith Data Systems' ZP 150 portables to increase to well above the cost of dual-drive desktop systems. The alternative is to use such portables in conjunction with a desktop microcomputer, minicomputer or mainframe computer. Such a product strategy limits wide general acceptance in small-business markets.

PC compatibility remains the primary criterion for buyers considering alternative systems. Compaq's success is due in great measure to its compatibility strategy. Interestingly, IBM itself does not offer 100-percent compatibility throughout its personal computer lines, from the PCjr to PCs and PC/XTs and now the PC-AT. Although Compaq's DeskPro line offers advanced capabilities, its portable line does not reflect such innovation. Hardware and software compatibility with PCs and broader availability, aided greatly by the inadequacies of IBM's portable offering, helped Compaq to attain its record-breaking sales levels in 1984. Undoubtedly, the company will introduce more capable and innovative Compaq trans/portables in 1985.

Japanese systems, including Sharp Electronics Corp.'s 5000, Sord Computer of America Inc.'s IS-11 Consultant, NEC's PC-8401A and Epson's PX-Geneva offer excellent capabilities at low prices. Unfortunately, except for the Sharp 5000, they fail to address U.S. business practice, which currently centers around Microsoft Corp.'s MS-DOS operating systems.

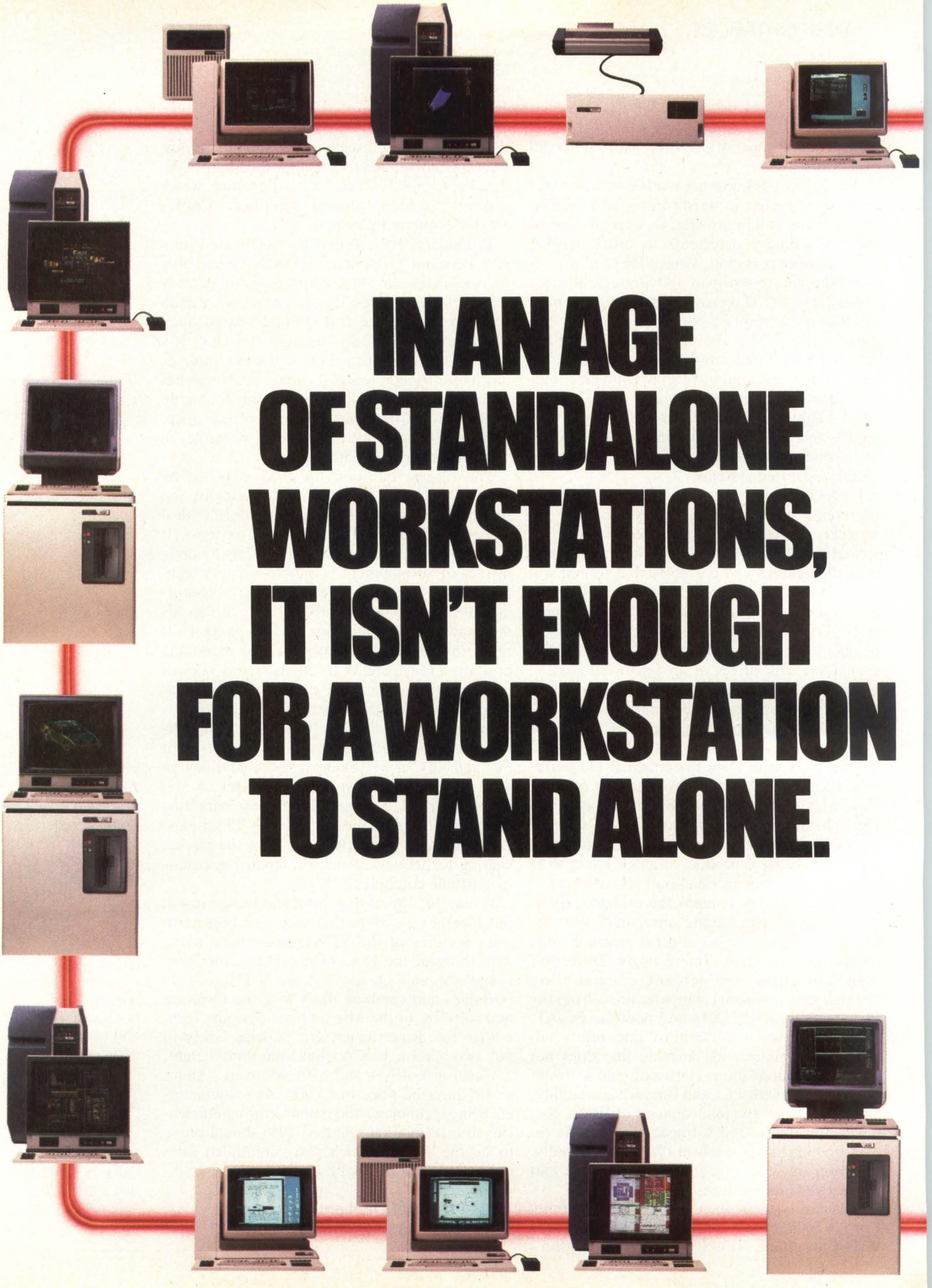
In January, HP released its 68000-based Integral Personal Computer, a UNIX system that incorporates an electroluminescent display (MMS, January, Page 31). Also this year, Zenith plans to release the first portable based upon Microsoft's HH-DOS. Although HH-DOS is a step in the right direction, it doesn't offer as much user friendliness as it could. Tandy also has released its Model 200, a disappointing follow-up to the Model 100, which, because of low price, remains the most successful "lap" portable, in spite of limited functionality.

The biggest question for 1985 is posed by IBM's "clamshell" system. Undoubtedly, no other company has IBM's expertise in the critical technologies for advanced portable systems. It has flat-panel, plasma display systems, a long history of development in bubble-memory technology and proven expertise in removable-storage devices. However, IBM rarely brings its most advanced technology to the market. It relies instead upon its unchallenged marketing position and capability to attain record sales of products that offer little technological innovation. The company's current portable PC is inadequate, providing less than 100-percent software and hardware compatibility with its own PCs and XTs, as well as expansion limitations. In spite of its reported volume purchases of 3½-inch disk drives, it is not in IBM's best marketing interests to validate the HP, DG and TI formats. Once again, in 1985, IBM will have the market waiting for its newest microcomputer release—its portable computer.

It may be hoped that someone this year will put together a system that takes the best hardware features of the STM transportable along with those of the Data General/One, the Morrow Pivot and Quadram Corp.'s Datavue 25 portables and combine them with the firmware and software of the Micro Office Systems Technology Inc. Roadrunner. Or, perhaps Grid will put two Canon U.S.A. Inc. one-third height, 5¼-inch disk drives and batteries in its systems and reduce the price to $3,000. As manufacturers bring technology and manufacturing efficiencies to meet market realities, 1985 should prove to be the year in which past, unfulfilled sales projections will finally be realized. □

Interest Quotient (Circle One)
High 480 Medium 481 Low 482

Gene R. Talsky is president of Professional Marketing Management Inc. (PROMARK), Old Lyme, Conn. His company provides strategic planning, business development and marketing planning services for hardware, software and services companies. He has held management positions with IBM Corp., Computer Sciences Corp. and Informatics General Corp. and has started four successful companies.



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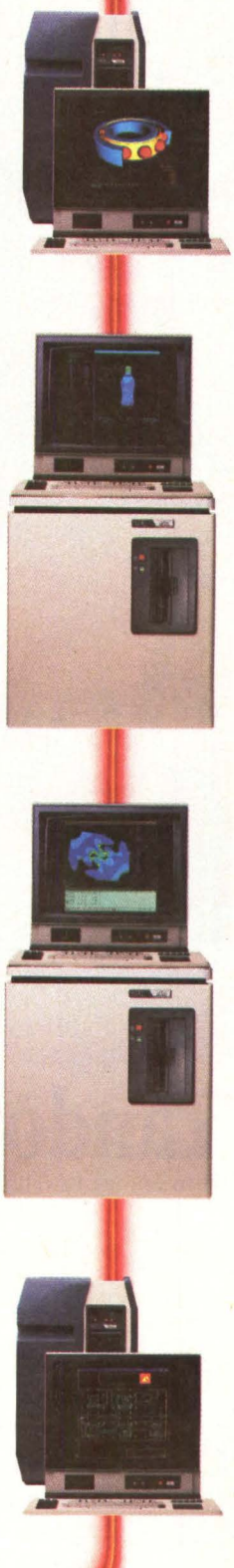

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SYSTEM INTEGRATORS EXPLOIT PC COMPATIBILITY

Hardware and software infrastructure surrounding the IBM PC proves ideal for system integration

Rick Dalrymple, Senior Editor

Like a snowball that grows as it rolls downhill, the August 1981 introduction of the IBM Corp. PC set off a flurry of activity by vendors other than IBM. That flurry has now grown into an avalanche of hardware and software products for the PC. The true magnitude of the infrastructure building around the PC is just now being revealed. Those system integrators who have not been analyzing how to exploit this infrastructure (hardware configured for the PC bus and software designed to run either on PC-DOS or MS-DOS operating systems) may be missing an optimum opportunity for product profitability.

A major portion of the infrastructure, the networking of PCs and PC-compatibles, has recently been outlined in announcements from Microsoft Corp. and Intel Corp. Microsoft has announced that it is ready to ship Networks 1.0, the software that implements IBM's PC Network (MMS, February, Page 47), and Intel has announced its new 82588 single-chip local-area-network (LAN) controller, a device that Intel expects to be used in network interfaces for both the PC Network and Starlan.

Integrators who have not been monitoring the full activities of the IEEE 802.3 committee will find that Starlan, implemented with unshielded, twisted-pair telephone lines, is one of two lower cost "modified Ethernets" now under subcommittee review. The other is Cheapernet, which uses the less expensive RG58 coaxial cable typically found in public address systems (MMS,

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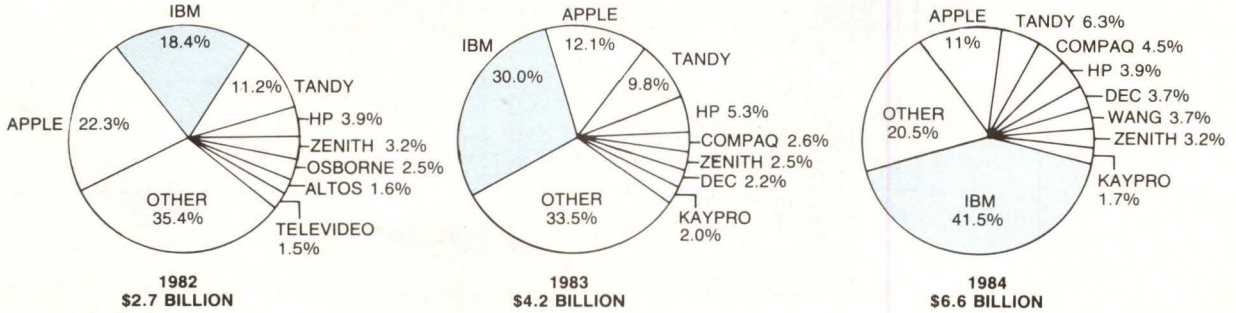


SOURCE: FUTURE COMPUTING INC.

System integrators are free to build networks that are compatible with PC Network but configured with hardware and software from vendors other than IBM.

January, Page 74).

Since Microsoft's Networks 1.0 can be purchased independently and can use network interfaces from vendors other than IBM, system integrators are free to build networks that are compatible with PC Network but configured with hardware and software from vendors other than IBM.

IBM's open-system approach to the PC Network is consistent with its previous open-architecture policy for the PC. In the case of the PC, IBM benefited greatly from an outpouring of software and hardware products that made the PC the world's most versatile computer. Early enthusiasm for the PC Network portends that a new outpouring, one of networked, multiuser application software, will soon appear.

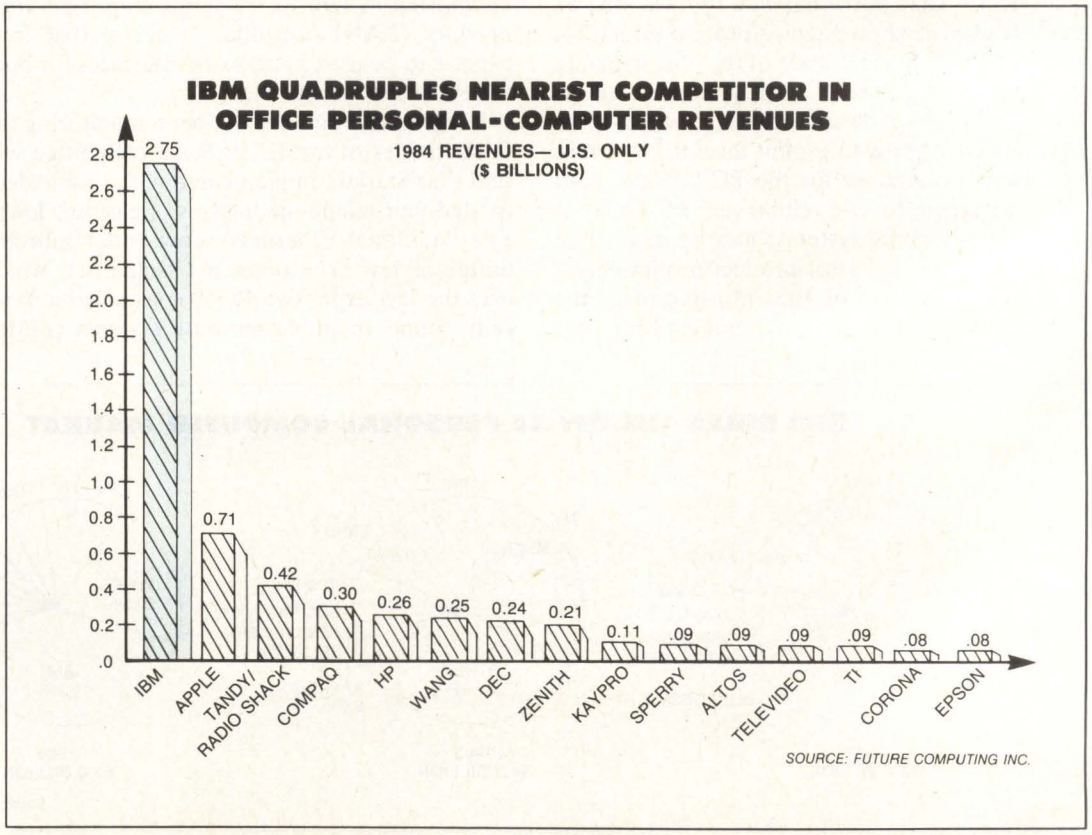
Confusion surrounding LAN standards has also largely been cleared. There will be several standards for LANs (MMS Communications Digest, Feb. 15, Page 59). And this month, Intel will explain how its corporate strategy for LANs will allow the various emerging standards to be connected in configurations of "backbone" and "local" networks.

Although it is not exactly clear how application-software developers will exploit the capabilities of Microsoft's Networks 1.0 or how the various LANs will interconnect, it is clear that PC-compatible products will connect to the PC Network and that ways will be found to connect the PC Network to other LANs. That means that sometime in the near future system integrators can expect to find off-the-shelf LANs that will match well with multiuser application-software packages that include the necessary networking software.

PC sets de facto standards

But the introduction of software for PC Network is only the most recent reason why the PC has set de facto standards for workstations in the office, on the engineering bench, inside the factory and even in the lab.

Some of the other reasons are that, soon, more hardware add-in and add-on products and application software will be available for the PC than for any other computer. This trend makes it easy to see why the PC has become the world's most emulated computer. (So far, nearly 60 manufacturers claim that their computers are PC-compatible.) And finally, because PC compatibility is so desirable, there are now companies that will help system integrators build their own custom-configured PC-compatible computers (OEMtek Inc., San Jose, Calif., and Personal



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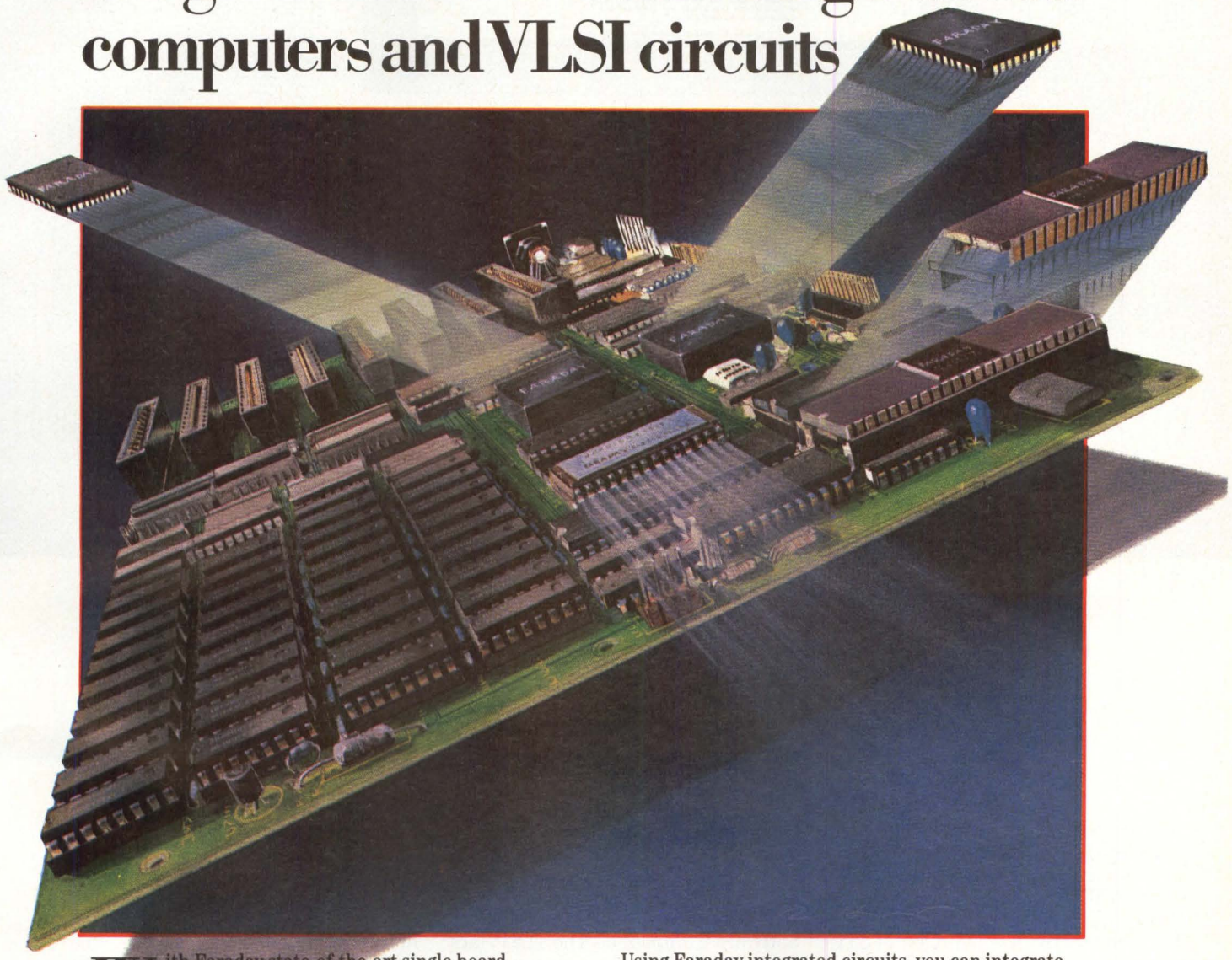

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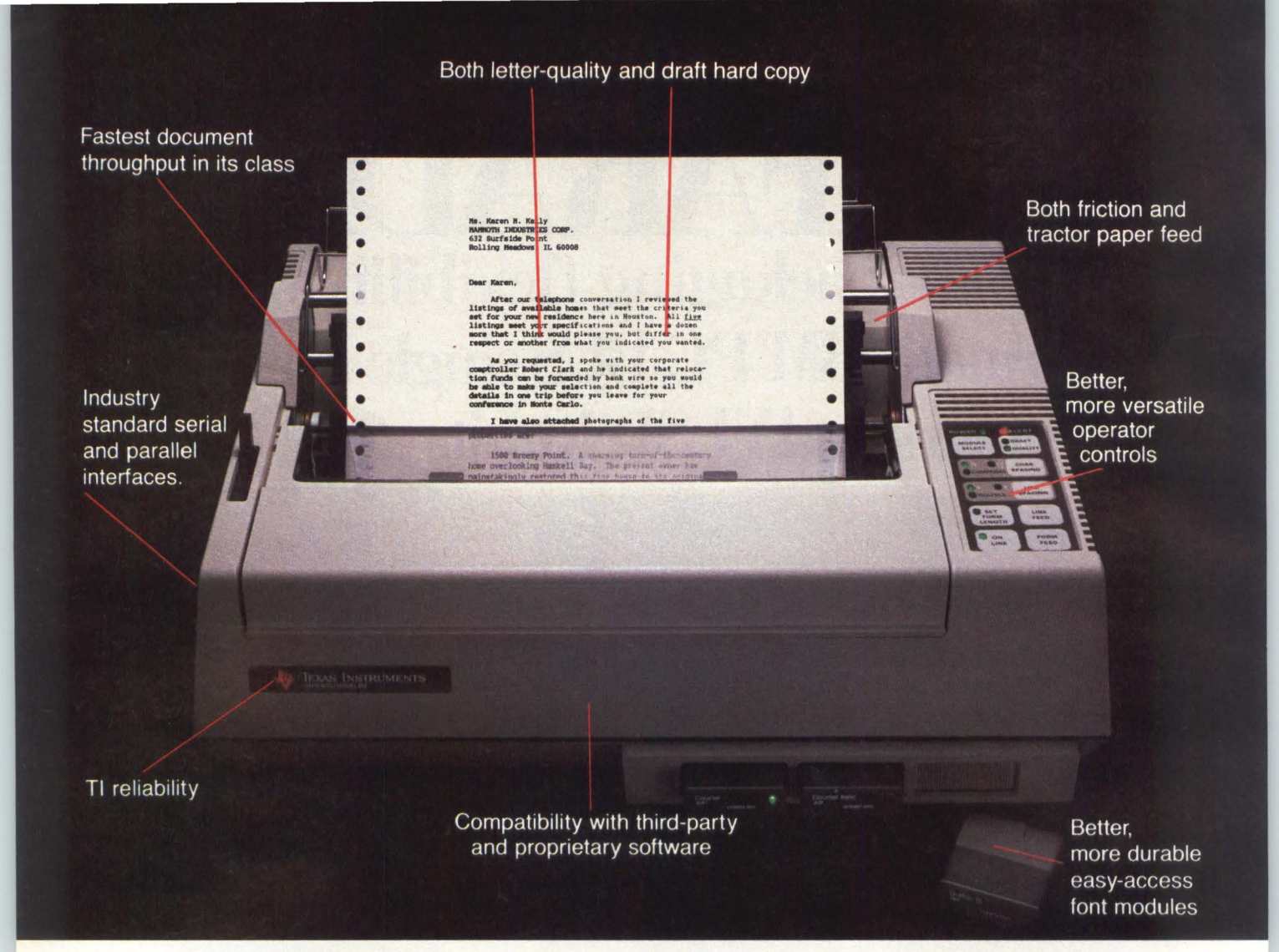

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Computer Products Inc., San Diego).

In light of these developments, the obvious thing for some system integrators to do is become an IBM value-added dealer (VAD). This allows the integrator to take advantage of both the IBM name and products sold with the system.

The MicroAnalyst Logic Analysis Workstation is a fine example of how purchased PC products can be leveraged. Northwest Instrument Systems Inc., Beaverton, Ore., builds logic analyzers. The MicroAnalyst, a $17,900 system, combines Northwest's Series 2000 logic analyzer with a PC-AT running Lotus Development Corp.'s Symphony multifunction software (MMS, January, Page 46). According to Northwest's president, Larry Sutter, "Five years ago the test equipment alone was $18,000. Now users can purchase a computer and logic analyzer for that amount." Northwest, by the way, was one of the first PC-AT VADs.

Of course, it should suprise no one that introductions of PC-AT compatibles are on the horizon, a subject covered in this issue of *Mini-Micro Systems* (see "Some IBM mimics jump, some stall at PC-AT delays," Page 34).

Mix-and-match PC compatibles

For many system integrators, however, joining the IBM bandwagon may not be the most profitable course. An analysis of the networking opportunities seen by some system integrators may argue for a mix-and-match strategy based on several types of PC-compatible computers. Such a strategy would allow system integrators to use the PC-compatible computer that best fits the application requirements of the individual workstation.

For example, some workstations may need computational speed that exceeds that of the PC. IBM's solution, of course, would be the PC-AT. However, a close look at the application may reveal that a PC-AT would be overkill. Instead, the system integrator could turn to a PC-compatible vendor like AT&T Information Systems Inc. (ATTIS) or Compaq Computer Corp. for a more effective cost/performance solution.

ATTIS' PC 6300 and Compaq's Deskpro Model 4 both claim greater speed than an IBM PC through use of Intel's 8086 microprocessor, instead of the 8088 found in the IBM PC. ATTIS claims that, by clocking the 8086 at 8 MHz, the PC 6300 runs programs 50 percent to 80 percent faster than the IBM PC. Deskpro's speed is a little lower because its 8086 is clocked at 7.14 MHz (exactly double that of the IBM PC). Compaq claims the clock rate was chosen because it provides greater compatibility with older PC programs that are sensitive to clock speed.

The Esprit ESP-9310 *IBM PC-compatible computer, attached to an ESP-6310 video terminal, right, offers both a full-function terminal and PC-compatible computer in a $3,590 package. Esprit makes the combination practical by using a (patent-pending) monitor driver that allows the PC to use the ESP 6310's 14-inch, 60-Hz, non-interlaced display, left.*

In addition to selecting the right PC-compatible for the application, system integrators must take into account the hardware functions that can be added into the workstation. Like the PC, most PC-compatibles have open expansion slots that accept PC bus add-in boards. This feature provides a convenient method to add hardware functions not already resident in the computer. And, because most of these expansion slots are readily accessible, sophisticated users can upgrade or change the configuration without professional help.

Some PC compatibles do not provide expansion slots. The 9.1-pound Data General/One from Data General Corp. (DG), is a PC-compatible portable computer. Its 13.7-by-11.7-by-2.8-inch size does not allow sufficient space for expansion-board slots. A forthcoming expansion chassis will allow this computer to take advantage of add-in PC boards, but the addition will also diminish the unit's portability.

The Data General/One is a traveling workstation that can be connected to DG's CEO office-automation equipment. The key is CEO connection software that resides in both the CEO MV/ family superminicomputer and the Data General/One. Equipped with an internal 300-baud, auto-dial modem, the Data General/One can act as an attached terminal to the CEO MV superminicomputer (MMS, October 1984, Page 51).

PC-compatible terminals

Terminals that incorporate PC-compatible computers comprise another category of PC-

Joining the IBM bandwagon may not be the most profitable course.

compatibles. Instead of building a PC-compatible computer and adding terminal-emulation software, which can compromise terminal performance, Esprit Systems Inc., Melville, N.Y., builds a PC-compatible computer that attaches to an Esprit terminal. According to Allan Maurer, Esprit's vice president of marketing, "Our approach does not sacrifice functionality. In terminal mode, our product is 100 percent terminal. As a computer, it's 100 percent PC."

Esprit's PC-compatible computer, the ESP-9310, is a straightforward emulation of the PC that can be used in conjunction with Esprit's ESP-6115 video-display terminal. For users who would like to have both a terminal and a PC-compatible computer, Esprit's solution is attractive. The ESP-9310, combined with the ESP-6115, lists for $3,590.

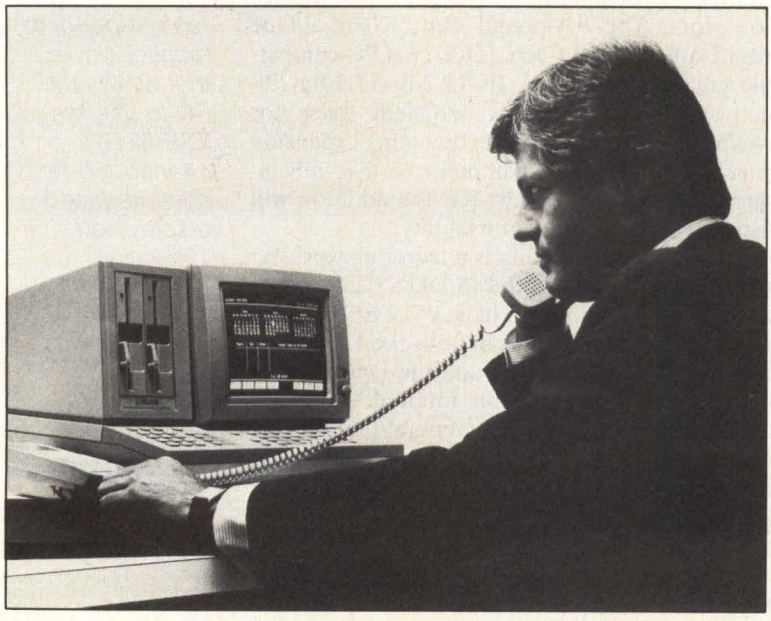
Esprit makes the combination practical by using a (patent-pending) monitor driver that allows the PC to use the ESP-6115's 14-inch, 60-Hz non-interlaced display. As a terminal, the ESP-6115 emulates several popular terminals including TeleVideo Systems Inc.'s 925/910PLUS, Wyse Technology's 50, Lear Siegler Inc.'s ADM 3A and Esprit's Hazeltine 1500.

Looking for a PC or PC-compatible that combines voice and data? Consider what can happen when the functions found in existing desktop products are consolidated. If a Rolodex, phone-answering device, note pad, typewriter, telephone, word processor and computer are integrated into a single product, system integrators can claim overall cost savings along with improved productivity.

Products that offer this level of functionality are the new PC-compatible integrated voice/data (IVD) computers. Not only can these products be configured to plug into a PC Network, but they can also plug into a programmable branch exchange.

This fast-growing category was discussed in last month's Communications Digest (MMS, Communications Digest, Feb. 15, Page 97). Recent joint ventures and OEM agreements will make this category of PC-compatibles worth monitoring during the next few months. Look for product announcements from companies such at ATTIS, Hewlett-Packard Co. and Wang Laboratories Inc.

Integrated voice/data *computers combine desktop functions such as a Rolodex, telephone, answering machine and word processor in one small-footprint package. Zaisan ES.3, above, is comparable in price to existing IBM PC-compatible computers.*



PC bus connects to other buses

Among the products being built for the PC bus are boards that interface the PC bus to other computer buses. Already on the market are boards that interface the PC bus to Multibus I, STDbus and the IEEE 488 bus. The IEEE 488 connection, for example, has allowed PCs and PC-compatibles to perform as measurement-system workstations.

As part of a development contract, Advanced Systems Design Corp. a system house in Cambridge, Mass., has designed a Fourier transform infrared (FTIR) analyzer that incorporates a PC bus-to-Multibus I connection. One application of the product is toxic-gas-leak detection in semiconductor manufacturing plants.

FTIR instruments have historically been expensive research tools for the analytical chemist. In structuring the system, Advanced Systems Design had to solve some challenging integration problems. One of those was to increase the speed of complex mathematical calculations so that a dangerous gas leak could be identified in time to set off alarms and begin plant evacuation. Another was to slash the cost of the system so that plants using dangerous chemicals could afford the investment.

Both objectives were met by exploiting the best elements of products that connect to the Multibus and the math coprocessor option of Faraday Electronics' FE6400 PC-compatible, single-board computer.

The most time-consuming portions of the calculation process were analog-to-digital (A/D) conversion and the fast Fourier transforms of the

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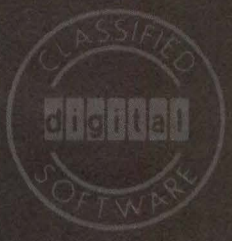

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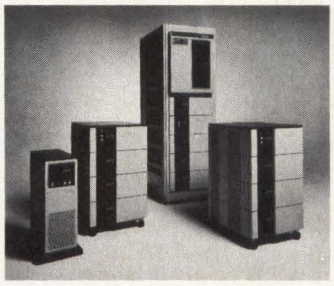
- ☐ b. a price/performance disappointment;
- ☐ c. unable to support enough application software;
- ☐ d. tied to an expensive minicomputer;
- ☐ e. none of the above.



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collected data. A 16-bit, high-frequency A/D converter loading directly into a paged, dual-plane memory solved the A/D conversion problem. To speed up the fast Fourier transform, number-crunching tasks were assigned to the 8087 math coprocessor. This arrangement leaves the FE6400's 8088 microprocessor free to act as the system's host processor. Both the A/D converter and dual-plane memory board connect to the Multibus; a two-card PC/Multibus interface connects the 16-bit Multibus to the 8-bit PC bus.

When the system integrators reviewed this project, they saw a new opportunity to exploit the concepts used in the FTIR project in a new product—Advanced Systems Designs' floating point peripheral (FPP). The FPP is a high-speed, floating-point-calculation unit that connects to a PC or PC-compatible in much the same manner as does a printer. With this unit, the processing speed of a PC-based system can be increased 1,000 times.

The $8,000 FPP, claims its engineers, provides processing performance equal to superminicomputer systems selling for $150,000 or more. The FPP is also available as a board set, and, in applications like the FTIR system, the unit can dramatically increase both measurement speed and resolution.

Even geographically and astronomically, there seems to be no limit to systems that may benefit from PC comptibility. Faraday Electronics' new 3.9-by-5.5-inch, Micro PC single-board computer may lead PC compatibility into harsh-environment applications such as undersea monitors and space probes (see "Tiny single-board PC may spark big markets," Page 33). Quite a journey for a computer that was originally expected to stay on a desktop. □

Interest Quotient (Circle One)
High 483 Medium 484 Low 485

LOOKING AHEAD IN MMS

- The April issue will include reviews on minicomputers, mini software and UPSs.
- Office automation will be featured in the May issue.

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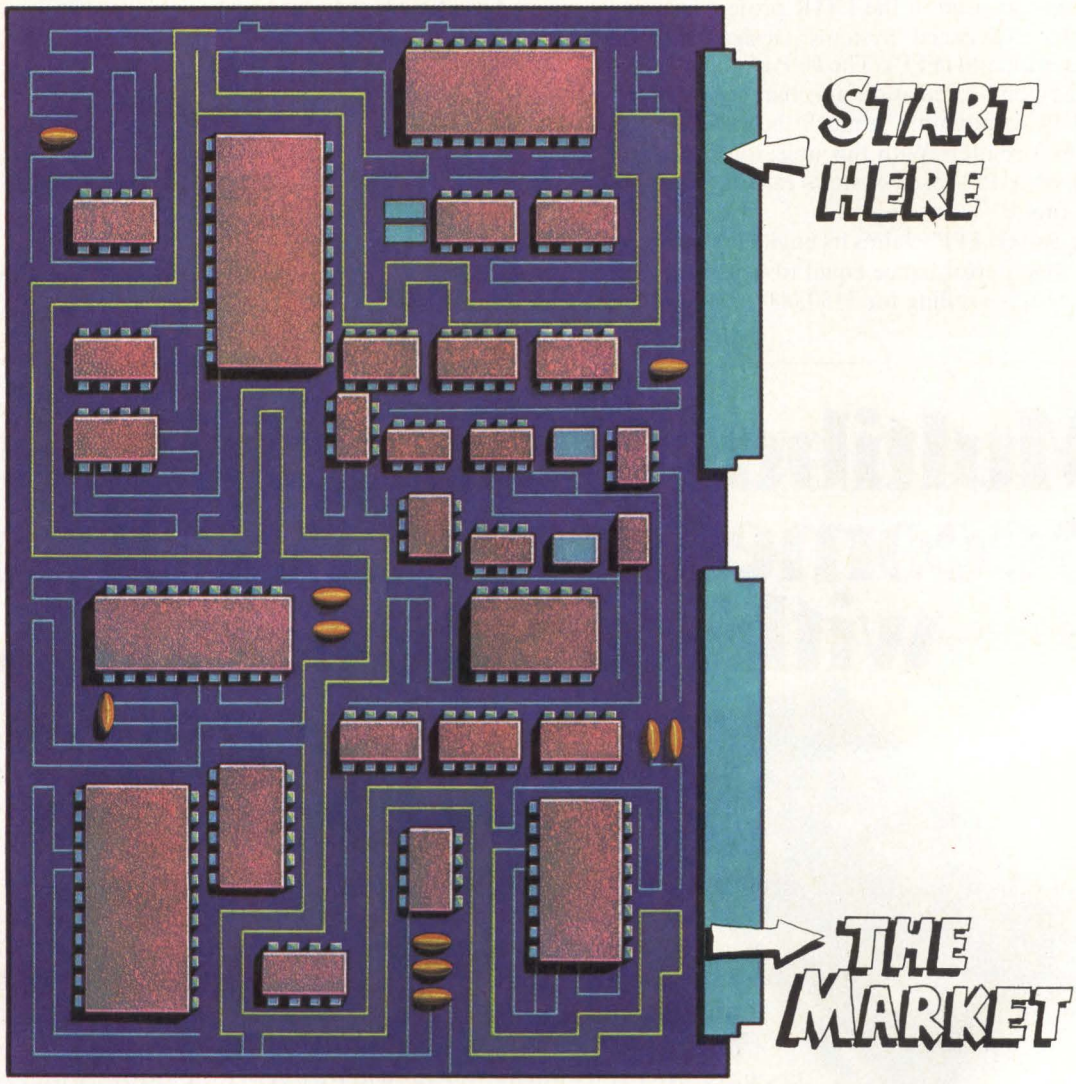

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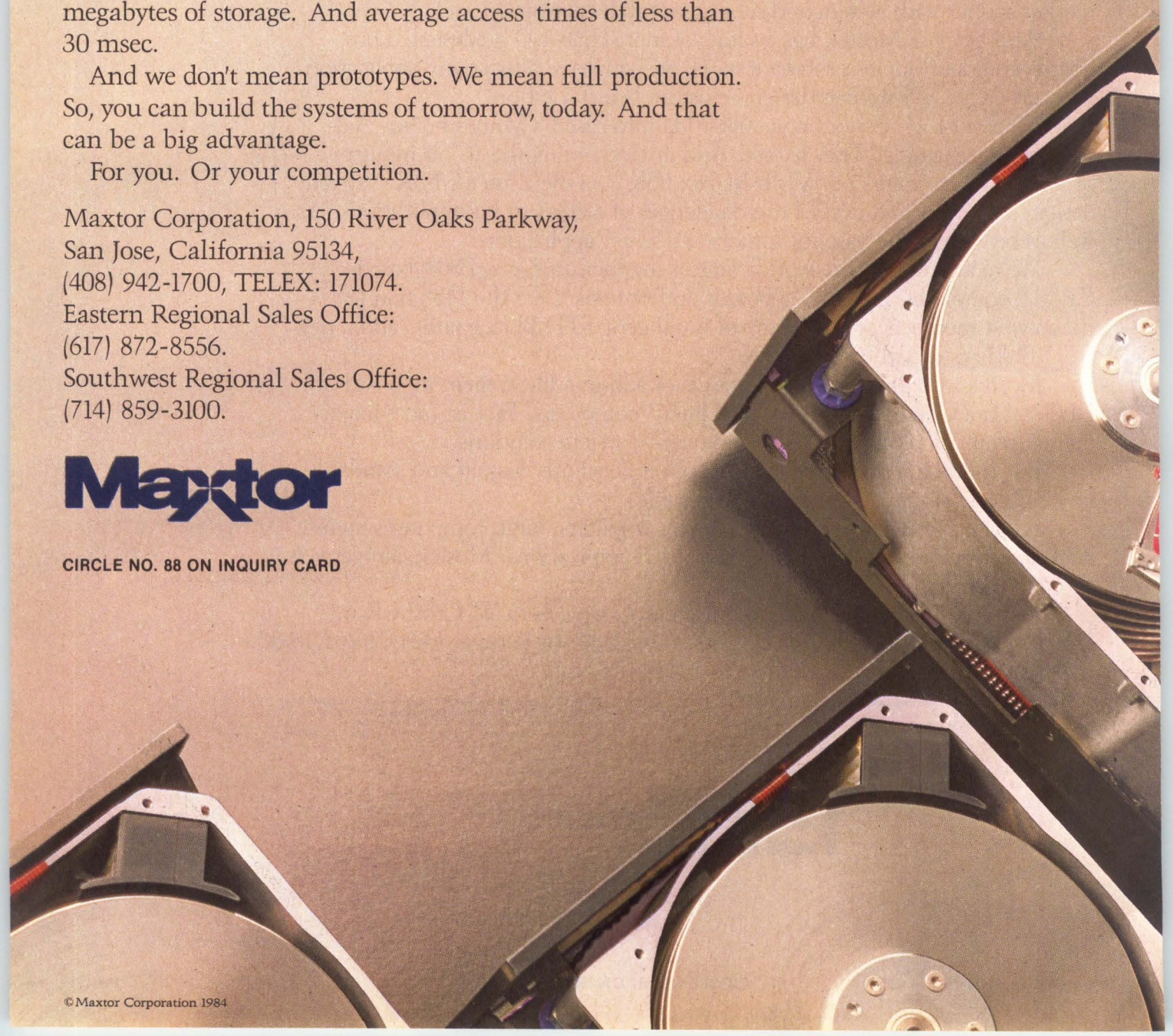

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'LAN IN A BOX' PROVIDES MULTIUSER SYSTEM

An IBM PC-compatible multiprocessor system offers an alternate route to office automation

Dr. Robert S. Harp
Corona Data Systems Inc.

A centralized multiprocessor system that looks like a local area network (LAN) to software—"a LAN in a box"—tackles the traditional problems surrounding development of a multiuser computer system in a business setting.

An example of the centralized multiprocessor approach is the Mega PC, from Corona Data Systems Inc. The Mega PC acts as a multiuser system in which each of as many as eight users has an individual IBM Corp. PC-compatible processor at his disposal. Unlike a traditional multiuser system, a multiprocessor dedicates a microprocessor to each user, complete with memory. Unlike personal-computer LANs, the processors would reside in a central location and permit easy interconnection of shared data and system resources. Users access individual processors via inexpensive video terminals.

The Mega PC *from Corona is a multiprocessor computer offering both IBM PC/XT-compatible standalone processing and shared integrated processing. Single-user terminals connect to the central system by coaxial cable.*

Mini-based systems pose problems

Previously, system integrators turned to personal-computer LAN multiprocessor minicomputers for office automation projects because business users need the interactive capabilities of personal computers and a large amount of data sharing. But, besides the high cost factor, both LANs and minicomputer-based multiprocessor systems carry with them the weight of many years of hardware and software development for ends quite different from business applications. Minicomputer-based multiuser systems, for instance, emerged when minicomputers served as workhorses. Because such machines were expensive, they had to support as many users as possible to justify the investment. Because they were powerful, though, they could time-share many users.

But, since several users were working on a single processor, the computer's operating system had to protect them from one another. Multiuser operating systems, such as UNIX, have become increasingly complex as they incorporate more and more security features. Worse yet, these complex systems were developed by computer scientists for other computer scientists rather than for business-oriented, non-technical users. Such systems' cryptic commands and lack of on-line help information permit efficient operation but create a barrier against non-technical users.

Because minicomputer hardware is extremely reliable, multiuser operating systems incorporate little file- or error-recovery capability. Even

In addition to having a dedicated processor, each user has access to global resources.

if there were a failure, computer scientists are normally expert enough to reconstruct the files.

Business users, on the other hand, aren't interested in learning how to delve into a complex system to salvage lost data. Furthermore, scientific users deal with data that can usually be rewritten in an emergency, whereas business users often deal with data that cannot be recovered if lost. Billing information, for instance, is worth millions of dollars and is impossible to reconstruct in binary form.

LANs fail to break the cost barrier

Personal computers corrected many of the problems associated with minicomputers by allowing greater interaction between the user and the hardware and software at a lower cost through LANs. To attract non-technical business users, though, these systems simplified operation while offering an expanding range of capabilities.

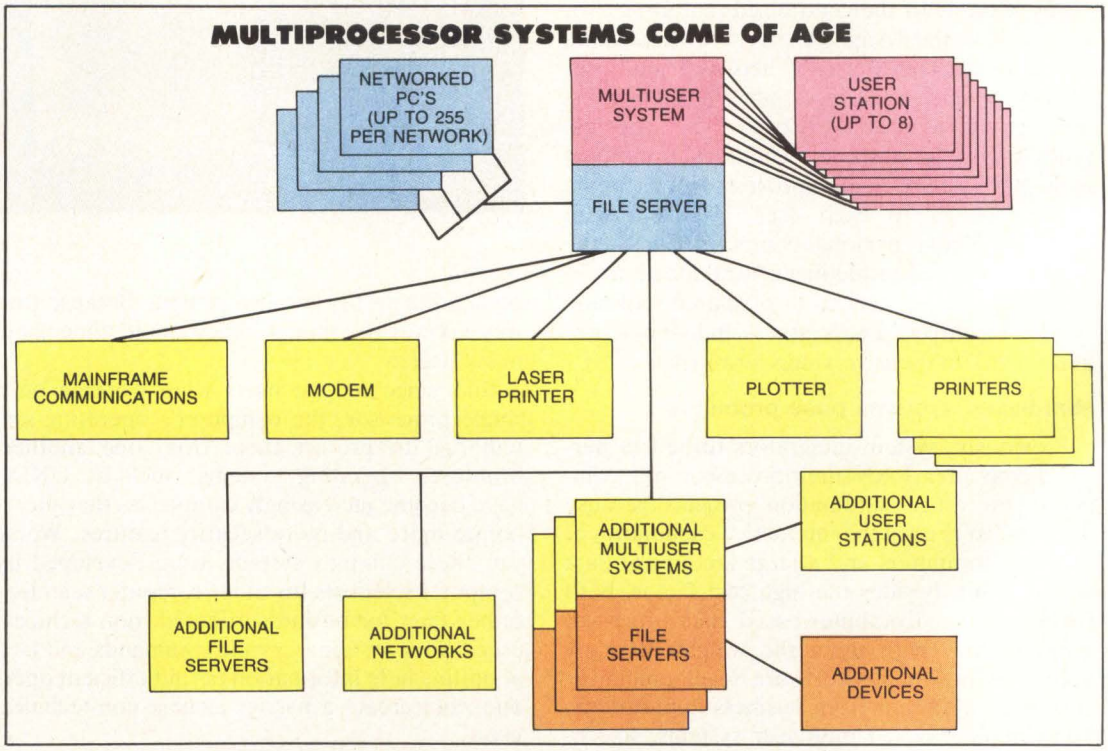
But microcomputers, too, come with a history. For one thing, IBM dominates the field of business computing. Market analysts estimate that 85 percent of the software developed last year for 16-bit systems is targeted for the IBM PC and compatibles. Thus, if you're going to network personal computers, they'd better be IBM-compatible.

In addition to maintaining IBM PC compatibility, business users also need to obtain the lowest computer cost possible and still share data and system resources. Although LANs allow the single-user IBM PCs to share data and resources, they fail to break the cost barrier. Even with expensive rigid disk drives and printers shared by a number of users, each user must still have an individual microcomputer costing several thousand dollars compared to a few hundred for a terminal on a multiuser system. Thus, while the initial cost of a personal computer is much lower than that of a minicomputer, the overall cost of an entire office of personal computers can weight the cost equation in favor of multiuser minicomputer systems.

It's also not yet clear what protocol will be standard for LANs. A protocol standard is crucial to furnishing transparent access to system resources via popular software packages.

Networks get very local

Multiprocessor systems like the Mega PC offer the benefits of LANs and multiuser systems without their drawbacks. For instance, in the Mega PC, the processor boards dedicated to different users are connected by a parallel bus rather than by an actual LAN. The bus allows the system to look like a LAN for data and



A multiuser, multiprocessor system *can be the basis of an extensive computing resource. The number of networks, individual computers and peripherals that can connect to such architecture is almost unlimited.*

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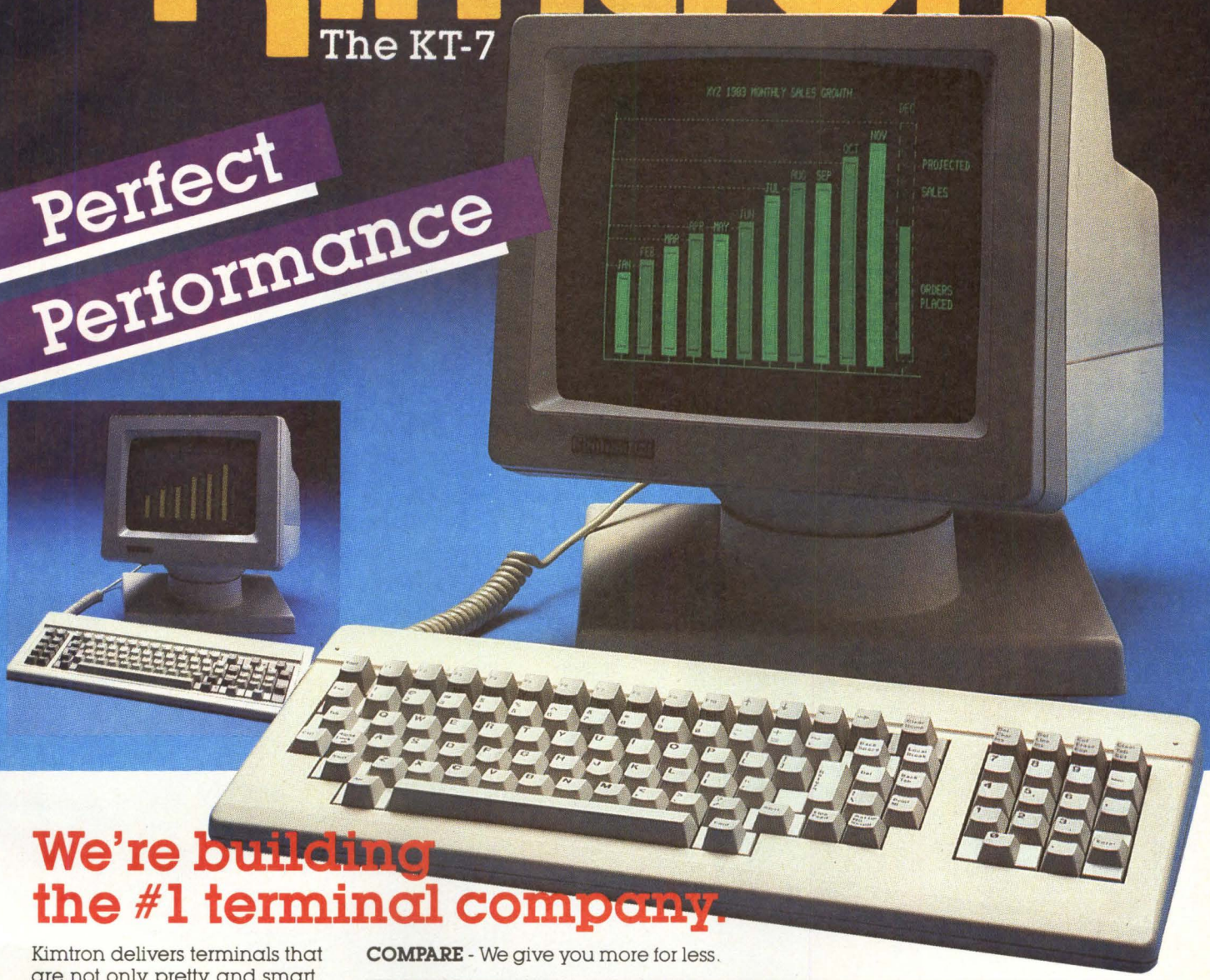

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Yes	No	No	Yes	TeleVideo 925 Emulation
Yes	No	No	No	DG D100/200 Emulation Option
Yes	Yes	Yes	No	14 inch screen available
Yes	No	No	No	Amber option at no extra cost
Yes	No	No	No	Selectible Hidden/Embedded Attributes
Yes	Part	No	No	Programmable Function Keys in NVM
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CONTROL DATA

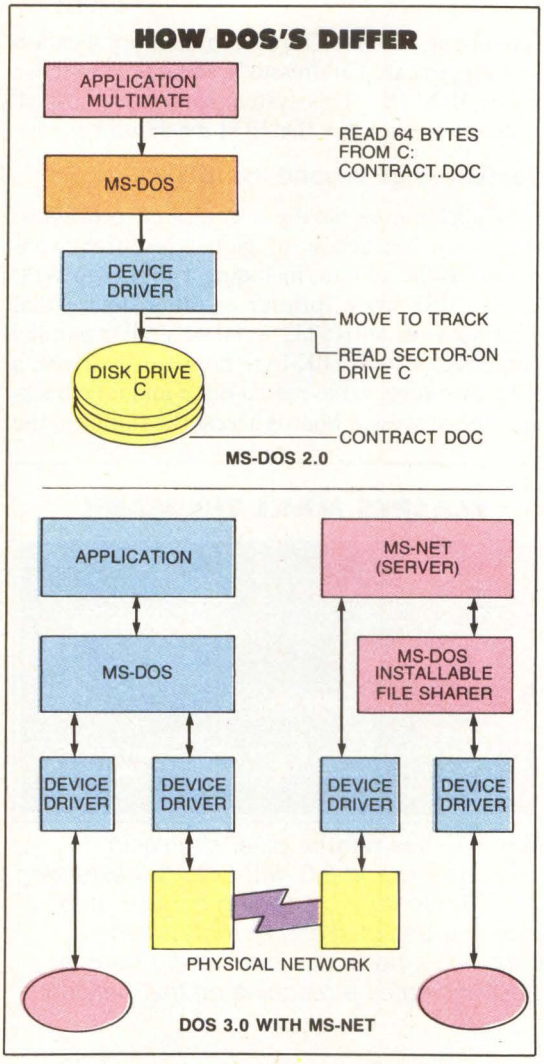
resource sharing but offers several performance advantages over LANs. First, the bus allows faster access to rigid disk storage. Second, there's no need to worry about a standard LAN protocol because data is transmitted over a bus as a simple file transfer rather than having to be formatted and given address codes as it would be on a LAN. Third, the bus avoids the expense of the hardware an actual LAN would require at each microcomputer.

User terminals connect to the central system via inexpensive coaxial cable instead of the serial data line that most terminals demand. Rather than act as terminals in the traditional sense, the Mega PC terminals operate like 640-by-400-pixel monitors, and the interface to the processor boards is a 24-MHz composite video connection. The terminal's keyboard data and mouse inputs are multiplexed with the video signal.

Connecting the terminals with video cable allows sophisticated screen handling. The Mega PC produces memory-mapped screens, just as a standalone personal computer does. The difference is that the terminal screen can be located as far as 300 feet away from its processor.

The terminals are relatively low in cost and readily available. System integrators can add users simply and inexpensively by adding more terminals—as in traditional multiuser systems—along with more processor boards. In addition, system integrators can keep initial cost down because the system requires only as many terminals and processor boards as there are users.

The processor boards employ the same architecture as the IBM PC/XT but with the powerful Advanced Micro Devices Inc. 8088-2 processor



Though similar, *MS-DOS 2.0 and MS-DOS 3.0 with MS-NET differ in that the newer software supports calls to remote system resources.*

Distribution is key to market success

"I think their marketing strategy is fabulous" is how Evan Moltz, manager of microcomputer services for research concern International Data Corp., Framingham, Mass., describes Corona Data Systems Inc. "Basically, [Corona is] going after OEMs and value-added resellers, and staying as far away from the retail channel as possible. That alone will almost guarantee them success.

"You know, the product is almost secondary. The Mega PC is good—not on the forefront of the technology, maybe, but good. It's the deals they're cutting, though, with companies like Sperry, for example, that are really impressive.

"In fact," Moltz says, "Corona is one of the few companies in the field that has a clear vision of what its marketing strategy is and should be."

According to another market researcher, Corona may need all the vision it can get. "Multiuser microcomputer systems are a tremendous growth market, but that market faces tremendous problems," says Maxwell Steinhardt, vice president of information systems for research company Strategic Inc., Cupertino, Calif. Particularly in the area of distribution, "People became aware of how they could benefit from computer systems because of their experiences with personal computers, but PCs can be sold to relatively unsophisticated users through relatively unsophisticated channels. For multiuser systems that isn't true. At this time there really isn't a distribution network for multiuser systems. The real problem is getting to the user with the product. It's a case of the technology outstripping the distribution capacity."

—Michael Tucker, Associate Editor

running at 8 MHz. The screen memory location and support chip addresses are identical to those in the IBM PC. This system can run almost all software written for the IBM machine.

Resources go beyond the IBM PC

In addition to having a dedicated processor, each user has access to global resources connected to the system, including a 40M-byte Winchester disk drive, printer or other device that interfaces via an RS232 serial or similar parallel port, one or two 360K-byte floppy disk drives, a 10M-byte removable-media drive and tape backup. The processor boards access the floppies, the serial port and the parallel port through a file-server board that manages requests for service from multiple users.

The system handles multiple users by recognizing three types of files: those that can be read and written by a user, those that are accessible only by a specific user and those that can be accessed only by users who have the correct password. Additionally, to speed disk access, the controller employs a cache technique that permits many disk calls to be satisfied at RAM speeds.

In addition to the LAN-like interconnection method, the Mega PC can contain two LAN controllers. The system uses controllers to connect with other computer networks or individual personal computers. Integrating personal computers is important because of the large number of standalone computers being used in offices.

SLASHES MAKE THE MARK

MS-DOS File Names

```
MS-DOS 1.X
     d: filename.ext
MS-DOS 2.0
     d:\dir1\dir2\filename.ext
MS-DOS 3.0
     \\network\\machine\\d:\dir1\dir2\filename.ext
     ASSIGN Q: \\MULTIPLAN\\CHARLESS\C:\MP\MSDOS\
     Q: MP.COM
```

MS-DOS file names *differ slightly in versions 2.0 and 3.0. MS-DOS 3.0 extended the 2.0 directory by adding network and machine designations. A triple slash indicates a network name, and a double slash indicates a machine on that network.*

Under MS-DOS 3.0, *users and software packages can refer to another network, a machine within that network and subdirectories on that machine by including the correct number of dashes. The operating system interprets the command and routes it level-by-level, from networks to machines and eventually to files.*

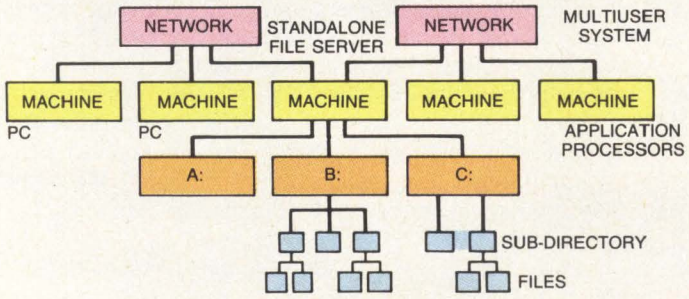
MS-DOS 3.0 plays a key role

Software used for LANs of IBM PCs and their compatibles works equally well with the Mega PC. Generally, this software runs under Microsoft Corp.'s MS-DOS 2.0. Even better performance has recently become available with the introduction of MS-DOS 3.0 and MS-NET, a networking package. These products give the business computer market a PC-compatible operating system that supports networking functions.

MS-DOS 2.0 and MS-DOS 3.0 with MS-NET are identical, except that the newer software supports calls to remote system resources. For example, if a user of MS-DOS 2.0 wanted to access a file named "Contract.DOC" stored on drive C, his application program would specify the number of bytes from drive C. The operating system then relays the command to the device driver for drive C, which then reads the specified number of bytes.

Under MS-DOS 3.0, this same procedure follows a different path after leaving the operating system. Here, the command passes through a device driver that acts as a port to another processor, in which a similar driver relays the command to MS-NET. In the Mega PC, the drivers are simple interfaces to the parallel bus between processor boards. The processor receiving the disk access command is the file-server board. MS-NET deals with the disk access commands from all users on the network and allows MS-DOS 3.0's file sharer to fulfill the request for "Contract.DOC" when appropriate. All these operations can be completely user-transparent, depending on how the system is set up. When it boots, for example, the system can run a batch program that automatically assigns the proper

A LOOK AT THE LAYERS OF MS-DOS



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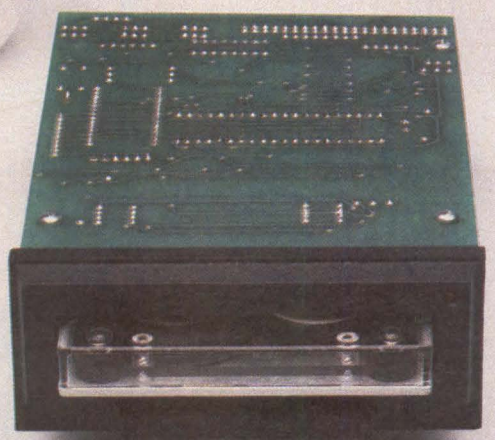

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destination addresses. All access calls from application packages then go to the assigned destinations in a way that's transparent to both users and software.

The access designation for files does differ between MS-DOS 2.0 and 3.0. The 2.0 version differed from its "1.X" predecessor by adding slashes to signify subdirectories, which simplified file management. MS-DOS 3.0 adds two more sets of slashes: "\\" designates another logical machine in the same system, and "\\\" designates another logical network. Users and software packages can refer to another network, a machine within that network and subdirectories on that machine by including the correct number of slashes. The operating system then interprets the command and routes it level-by-level to the intended destination.

A user need not bother with this routing syntax if working with a single-user program such as Ashton-Tate's dBASE II. MS-DOS 3.0's ASSIGN command lets the user associate an appropriate path name on the network, say, drive B. Then, whenever that user refers through "B:", the operating system automatically routes the command to the associated path.

MS-DOS 3.0 differs from the 2.0 version mostly in the hooks needed to interface with MS-NET. The networking package is responsible for interacting with the network controller, blocking messages, recovering from errors and implementing file and record locking. The locking functions permit safe multiuser database access by preventing users from interfering with one another when they try to work with the same data. □

Robert S. Harp is the founder, chairman and chief executive officer of Corona Data Systems Inc. He had held similar positions at Vector Graphic Inc., a microcomputer manufacturer he founded in 1976. Before that, Harp served as senior staff engineer at Hughes Research Laboratories. He earned a Ph.D. in electrical engineering at Stanford University, Stanford, Calif.

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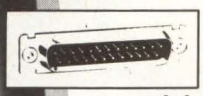

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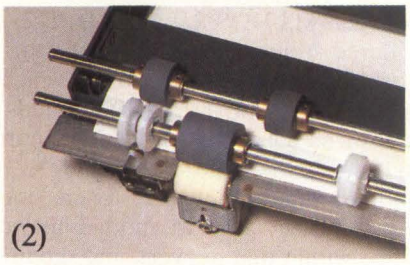
Try print quality. Just examine Hitachi's quality for yourself by looking at ill. (1). Quality speaks for itself — up to 400 × 400 dots per inch. That's far beyond what a dot matrix printer can even dream of. An optical scanning system with built-in facet error correction, an automatic toner concentration controller and thermal fixing are the unseen advanced extras that result in the impressive print quality.

The nitty gritty: reliability

Speed, high capacity, excellent print quality and easy operation can mean much less if you waste time with downtime. Look at ill. (2). What you see is Hitachi's special clawless mechanism. Since only a single sheet of



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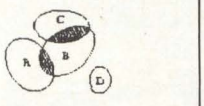

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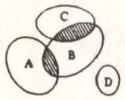
STUVWXYZ

Matrix Dot Printer

ABCDEFG
HIJKLMN
OPQRST

Daisy Wheel Printer



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(1)

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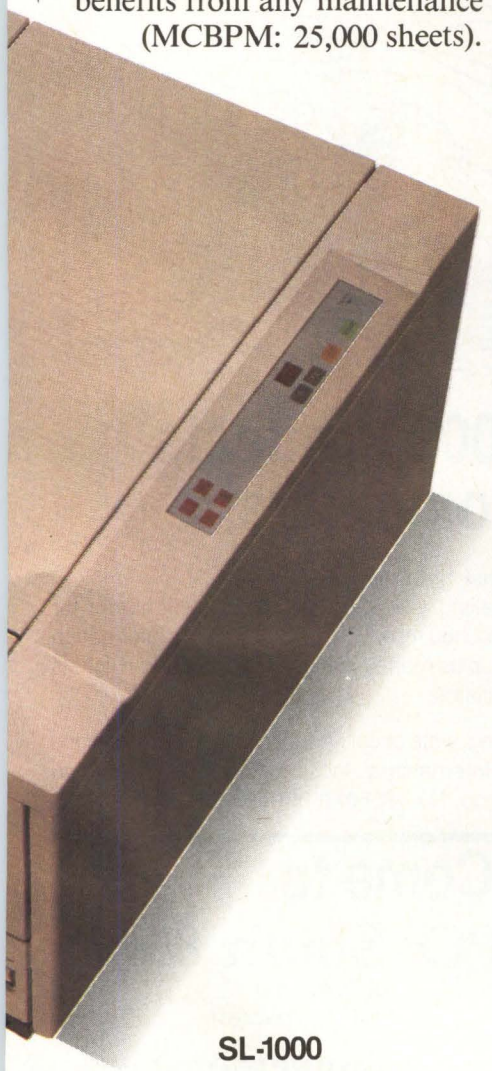

SL-1000

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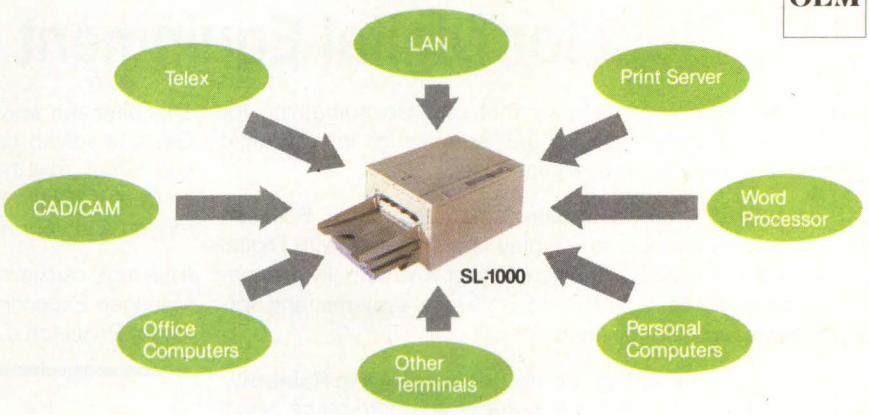

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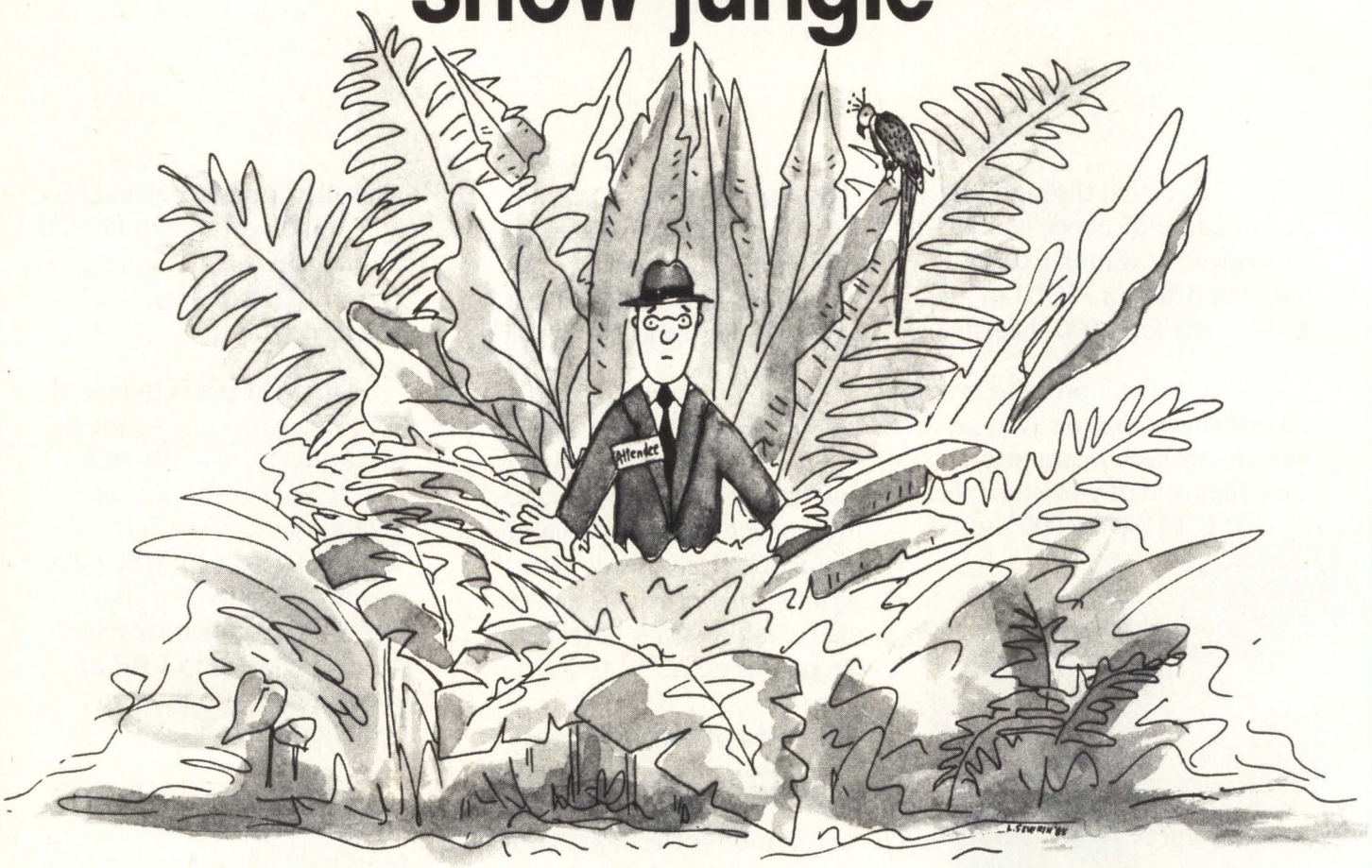

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PROCESSOR BOARD HANDLES VIRTUAL MEMORY

Memory-management circuitry, a state sequencer, bus-vectored interrupts and fault-recovery logic enable Z8000-based board to support speed and memory requirements of complex multiuser systems

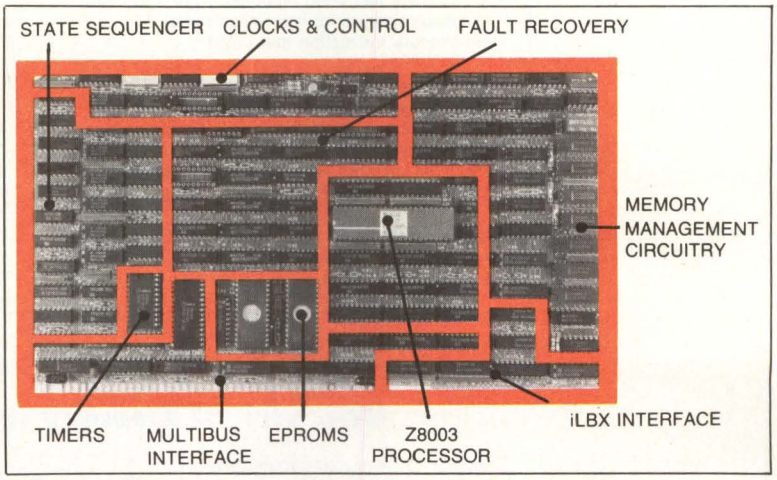
Jeffery J. Roloff, Central Data Corp.

Today's complex multiuser computer systems demand large amounts of memory and fast memory access. They also require more functions to be integrated into their central processors. Central Data Corp.'s Z8000-based processor board meets these needs with a 10-MHz processing speed, full demand-paged virtual memory management circuitry, an interface to the Intel Corp. Multibus and iLBX extension (including bus-vectored interrupts). A powerful state-sequence machine handles all processor cycles on the board.

Designed for use as the central processor in a multiuser computer system, the board employs the Zilog Z8003 segmented virtual memory processor. Its iLBX interface, on the P2 connector of the Multibus card, provides a very high-speed memory interface in addition to the relatively slow Multibus system bus.

The iLBX interface allows the board to work with Central Data's cache-memory board or other iLBX memory products. The cache-memory board gives 100-nsec access time to all hit memory accesses, implementing an effective memory access time of approximately 160 nsec and providing excellent performance in comparison to other Multibus single-board computers.

Because the board is intended for use in multiuser systems that distribute memory and I/O functions onto separate boards, it contains no RAM or serial I/O devices. However, as much as 32K bytes of PROM can be plugged into the board for bootstrap and testing purposes.



The Z8000 board contains *fault-recovery and memory-management circuitry, a state sequence machine and interfaces to the Multibus and the iLBX bus. Control bits work with the board's control-logic circuitry to implement the demand-paged virtual memory system.*

Four diagnostic light emitting diodes (LEDs) are provided for error indications when power is turned on. A monitor permits small-program development, downloading and debugging.

An upgrade of its 4-MHz Z8000-based predecessor, the board retains software compatibility with that product, while furnishing twice the performance. With cache memory, it achieves three times the performance.

Interrupt handling has become a very important part of multiuser systems, and the board supports full bus-vectored interrupts, in addition to the Multibus' normal level/edge triggered interrupts. With bus-vectored interrupts, a device on the Multibus interrupts the host and returns a vector directly when the host acknowledges the interrupt. This procedure is less time-

Recovery from several kinds of fault conditions, *such as those listed in (A) is handled by software routines similar to those in (B).*

BOARD IMPLEMENTS RECOVERY FROM FAULT CONDITIONS

(A)

Invalid page fault
Occurs when the invalid page bit is active in the page map, indicating page location is uninitialized.

Write fault
Occurs when a write is attempted to write-protected area of memory.

Stack warning fault
Occurs if an access is made to lower 256 bytes of a stack page, indicating that the stack should be continued down one more page to prevent stack overflow.

System access fault
Occurs when a non-system-mode program attempts to read or write a memory area reserved for system-mode programs.

(B)

If invalid page:
- Find physical page in memory to be overwritten.
- If that page has been modified, write it to disk.
- Prepare registers for instruction restart.
- Re-execute instruction that failed.

If stack warning:
- Add 2K page to process' stack.
- Mark new page as stack-warning page; new page is now the lowest stack page.
- Mark old page as normal page.
- Return to process execution.

If system access or write-protected access:
- Kill process.
- Exit to scheduler.

consuming than the normal method of polling the device to determine the type of interrupt condition that occurred.

Digital counters are used instead of nondigital timing circuitry, thereby increasing reliability and noise immunity. Most of the board's circuitry consists of 74F FAST advanced Schottky devices, allowing tight tolerances over the full commercial temperature/voltage range.

The processor board's demand-paged virtual memory system uses 15 independent memory maps. The map in use is determined by a processor-assigned process number. The logical address process number plus the processor-assigned segment number serve as address inputs to a segment map in a 1024-bit-by-5-bit RAM array. The segment map's output helps determine a page address, which results in the generation of the final physical address.

The page map also contains control bits, including ones to indicate whether a portion of memory is write-protected, not available (an unused entry), or serves as a stack page where a warning should be generated should an access occur near the bottom of the page.

When an error occurs on an access to a location in memory, the processor must be informed. Significant amounts of fault-recovery logic are required to support the Z8003 processor chip. The board must determine the type of fault—invalid page, write, system-segment, stack-warning or fatal trap—and initiate the appropriate corrective action.

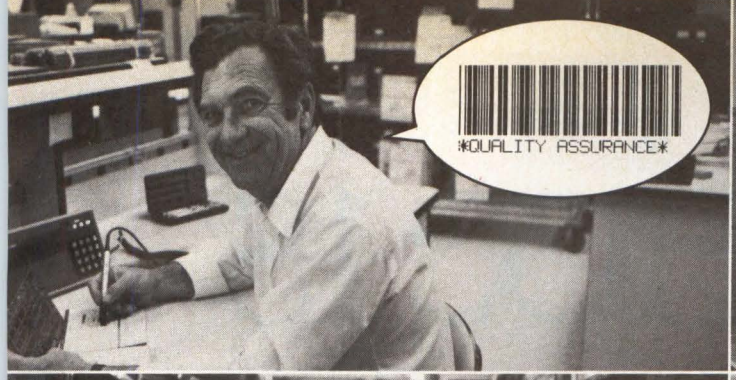
How virtual memory systems work

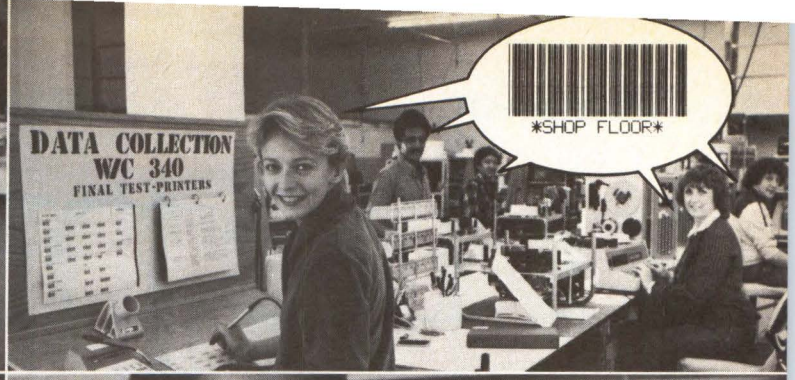
Virtual memory allows a computer program to access a larger addressing space than the main memory of the central processing unit (CPU) would otherwise hold. For example, a virtual memory system containing only 512K bytes of RAM could accommodate several programs each having an addressing space of 16M bytes. This is accomplished by having only part of each program's addressing space in system memory at one time. The remainder is kept in secondary memory on hard disk or other storage media.

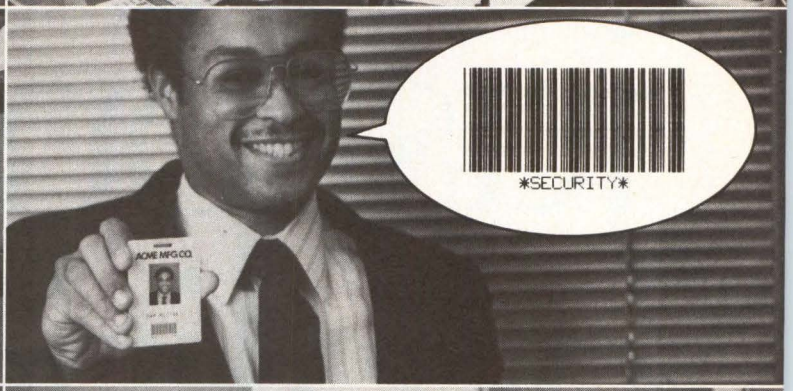
For most programs, only a small subset of the addressing space is being accessed at any one time. The subset currently in use changes as program execution proceeds through routines and as succeeding data areas are accessed. The operating system's virtual-memory handler loads from disk into RAM only those sections of memory currently being accessed. The sections are typically loaded in "pages," 512 bytes to 2K bytes in length. The system thus only loads pages into main memory throughout a program's addressing space as they are needed. The operation is transparent to the end user's program—it appears as though the entire addressing space remains in RAM at all times.

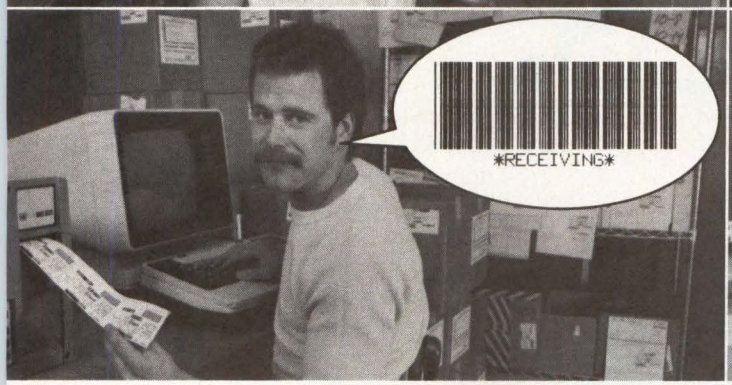
When a program accesses a page not currently in main memory, an operating system interrupt occurs, causing that page to be loaded into RAM from disk. The page is usually written over an area of memory holding another page's data. Because overwritten pages are the least recently accessed pages, the most recently accessed pages tend to be kept in main memory. Overwritten pages are copied onto disk if there were changes made to them when they resided in RAM.

There is, however, a performance tradeoff involved in virtual-memory systems: They permit a computer to access a larger addressing space than would otherwise be available in RAM, but at the cost of a slower-running computer system.









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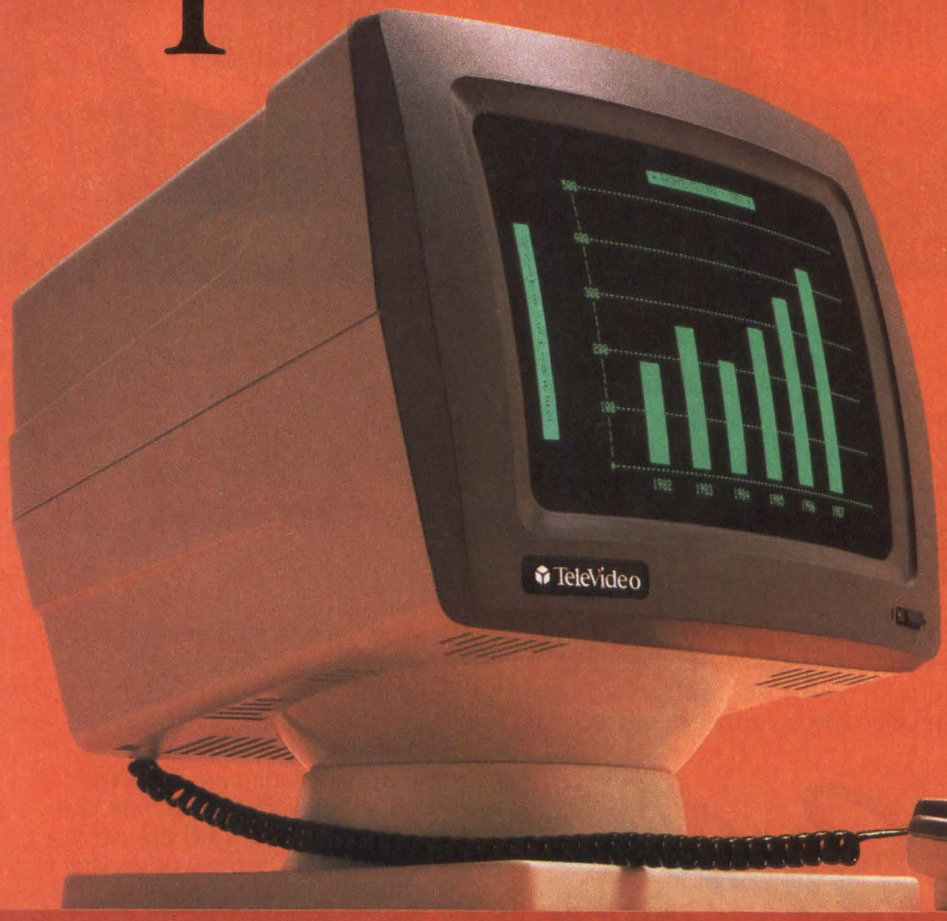

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The board latches the address of the instruction that caused the fault, as well as the accessed address. The processor status lines are also latched, and a data-access counter is provided for looping instructions in order to restart them at the proper place. Software routines handle fault recovery using on-board registers.

If, for example, an invalid-page fault occurs, the operating system determines whether the page is available on secondary disk storage. If it is, a page of working memory is chosen to be swapped out, that disk buffer is loaded, and the stopped process is allowed to run again. While these disk transfers are occurring, other processes continue to execute, permitting full use of processor resources.

To maximize board performance and the speed of iLBX bus memory cycles, a state-sequence machine, comprising a 96-bit-by-16-bit EPROM (erasable PROM) array, address-sequencing circuit and condition multiplexers, controls processor operation. The EPROM array is divided into six sections, with each section supervising one of the board's six cycles: Multibus memory, Multibus I/O, iLBX memory, vectored interrupt acknowledge, internal PROM and internal I/O.

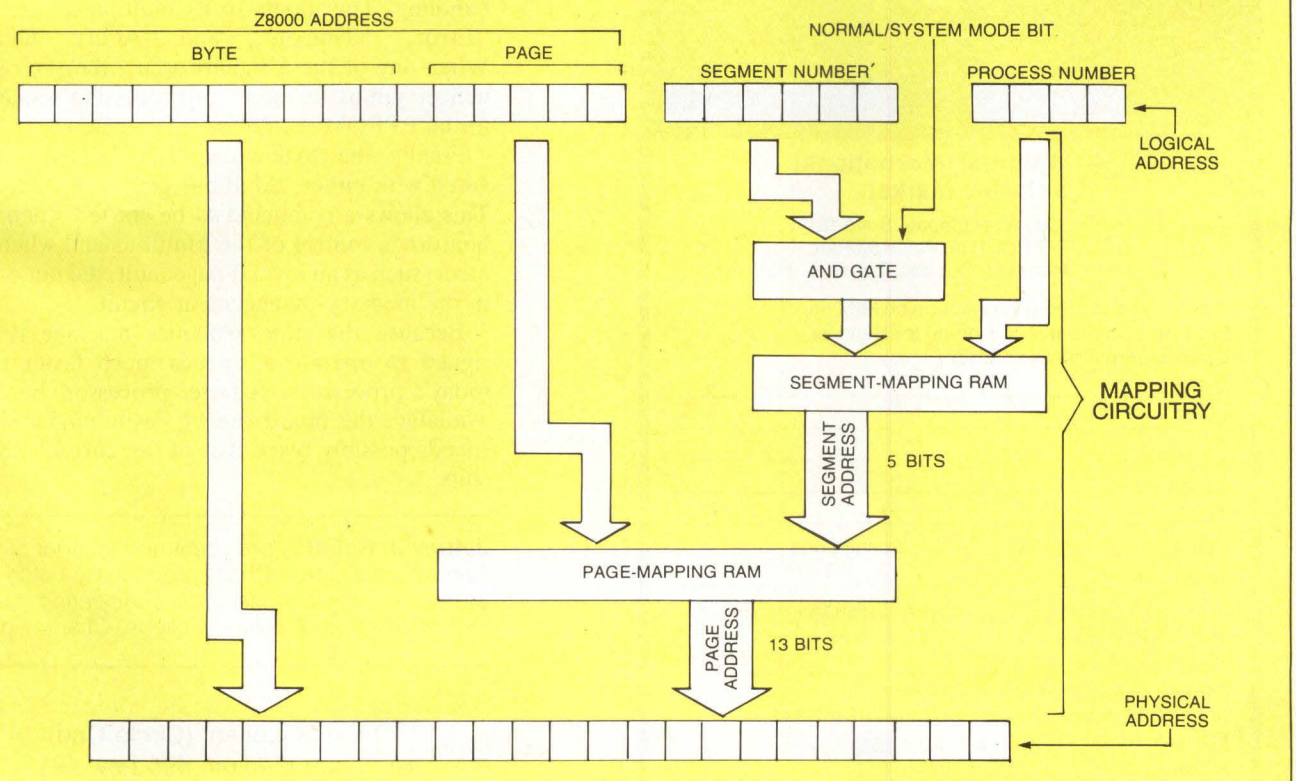
At the beginning of a processor cycle, the relevant EPROM area is activated, and the address begins at 0. The EPROM's outputs then determine the next state of the sequencer, which can either stay at the current state, evolve toward the next state, or jump to an entirely new state.

The EPROM's output consists of 16 lines, of which three bits denote the cycle type, four bits the jump address, another four bits the delay time and five bits the cycle-control signals.

Circuitry enlarges available memory

A logical address is translated into a physical memory address by the memory-mapping circuitry, permitting the board to address a larger address space than is contained in RAM.

The segment-mapping RAM turns process and segment numbers into a segment address that is added to the upper five bits of the Z8000 address to find the page address in the page-mapping RAM. The page address plus the remaining 11 bits of the Z8000 address make up the 24-bit physical address.



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The cycle-type signals are of major importance, because they are used as the address inputs for a condition multiplexer that generates various control signals for the state sequencer. The first control signal is "Do not proceed." When this signal is active, the address for the sequencer's next cycle will remain the same as it was in its previous cycle, overriding any jump address that may be pending. The second is the "Jump" signal, which, when active, causes a jump to the jump address on the sequencer's next cycle.

The last multiplexer output is the "Allow Command" signal. This gates certain cycle control lines to start and stop the various on-board "enable" signals and those to the Multibus/iLBX bus.

Because the state sequencer runs at the speed of the processor clock, and some timing sequences (for internal PROMs, bus vectored interrupt acknowledgement, etc.) need fairly long pulse widths, a delay timer permits a certain state to be held for as many as 15 cycles. Other inputs to the "Do not proceed" multiplexer are the "Multibus Grant" signal, which is active only when the board has control of the Multibus, and the "$\overline{\text{Wait}}$" signal, which is active whenever the processor has received an acknowledgement from the Multibus or the iLBX bus.

The "Jump" signal is generally used for error handling. The inputs to its multiplexer are the "Error," "Timeout," and "Abort" signals. When any of these signals occur, the state sequencer jumps to the error-processing sequence in the EPROM section being executed.

Finally, the "Allow command" signal can be gated with either "Multibus grant" or "$\overline{\text{Error}}$." This allows a command to be started when the board has control of the Multibus and when an error, such as an invalid-page fault, did not occur in the memory-management circuit.

Because the state sequence machine is designed to operate at speeds much faster than today's processors, as faster processors become available, the board can be easily upgraded to speeds possibly twice that of the current Z8003 chip. ☐

Jeffrey J. Roloff is president and founder of Central Data Corp., Champaign, Ill. He holds an associate degree in electrical engineering technology from Parkland College, Champaign.

Interest Quotient (Circle One)
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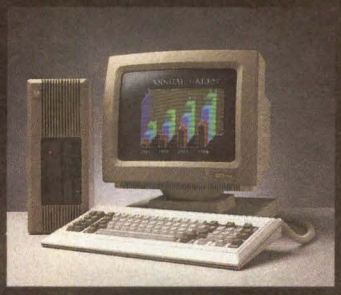

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CIRCLE NO. 97 ON INQUIRY CARD

Xebec's New Owl Reduc Storage To

Then.

Microcomputer storage history has progressed by a series of small "next logical steps." A replacement of a component here, a refinement of technology there. But now Xebec has taken a giant step, with its Owl intelligent disk file.

On the surface, the Owl might look like other 10-megabyte, 5¼" half-high Winchesters. Underneath, however, it's an example of superior technology. The integration of controller logic and drive electronics on a single board means not just one less PCB, but the elimination of expensive connectors and cabling, low power consumption (15 watts typical) and enhanced data integrity.

Single-board drive and controller electronics insure higher reliability

Integrated data separation within disk drive delivers higher data integrity

Ruggedized design includes bead landing zone

Comprehensive diagnostics eliminate "What's wrong?" guesswork

Compatible with industry-standard Xebec SASI bus for faster system integration

We've put data separation in the HDA for precise control of data windowing and the elimination of background noise. We've provided a diagnostics channel to the host that delivers meaningful error messages.

Just as our superiority in minicomputer controllers led the way to a similar superiority in micro controllers, and our tested pairs solutions evolved from our considerable subsystem and testing experience, so too the Owl reflects our "top-down" engineering strategy—creating both technological and cost-of-owner-

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es Microcomputer Disk Two Words.

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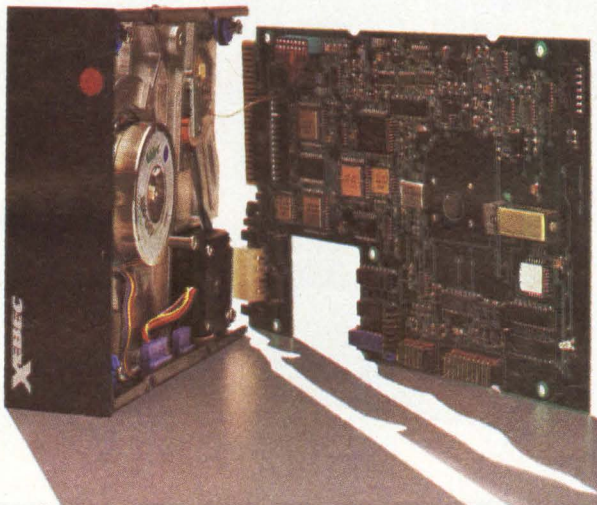

ship breakthroughs by designing sophisticated high performance, multi-user features into small-system, single-user environments.

The System-Engineered Solution.™

As a major user of drives, and a major testing resource for other drive manufacturers, we are concerned about drive reliability. And we've learned that it's not just a question of improving a component or consolidating some board real estate. The answer lies in careful consideration of overall system integration requirements.

The Owl epitomizes what we call the Xebec System-Engineered Solution. The focus is two-fold: on today and on tomorrow. Compatible now with industry-standard Xebec SASI, the Owl—by eliminating the ST506 interface—is upwardly compatible for future higher densities, capacities and performance.

In broader perspective, Xebec's approach to OEM satisfaction rests on our proven experience, our vertical integration strengths—which now include production of heads and plated media—and our commitment to zero defect quality, by way of computer-aided design and robotics manufacturing.

Call Xebec today. Let us tell you more about the Owl. And how we can deliver the difference between then and now. Now.

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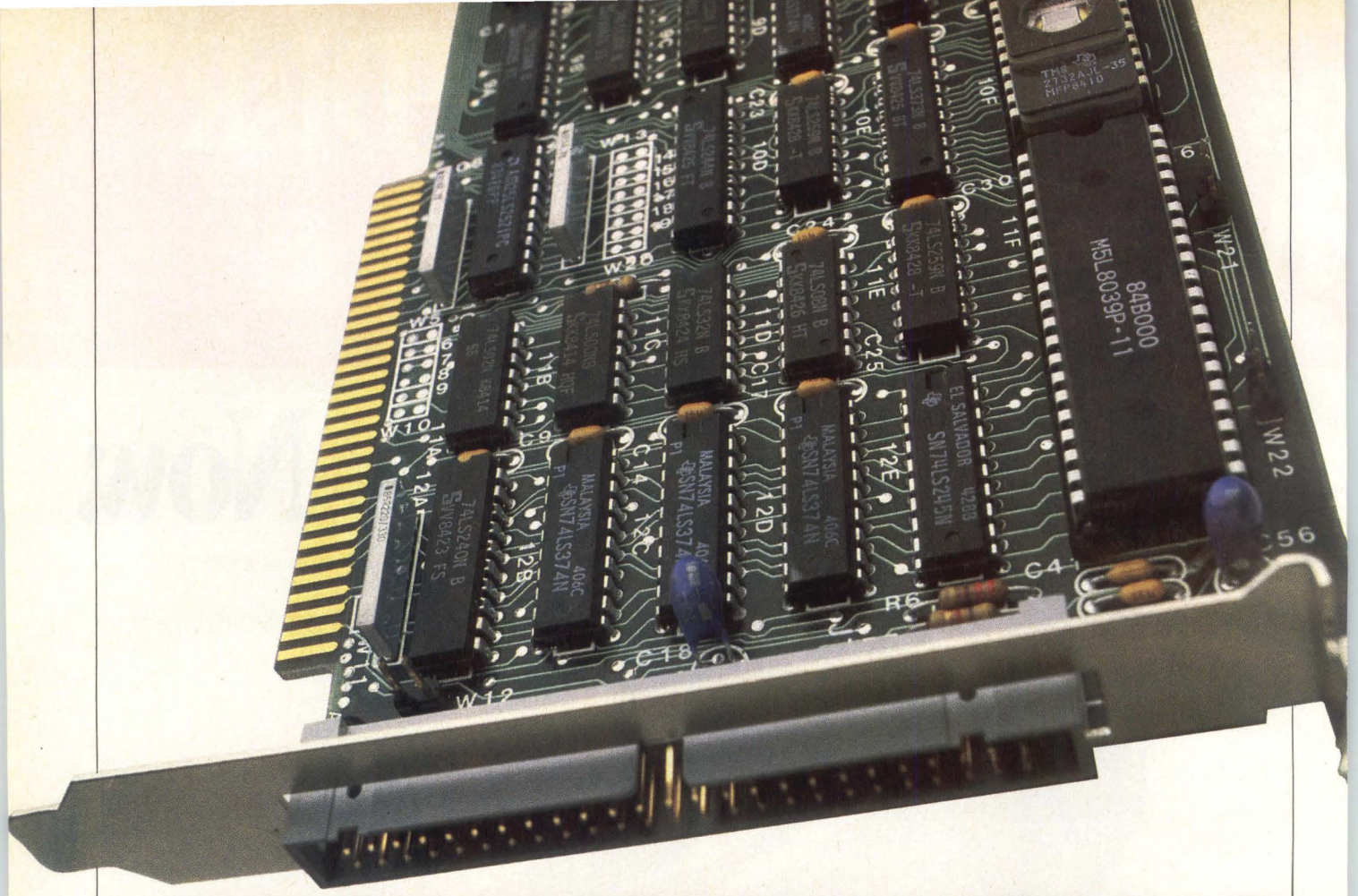

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FOUNDATION MODULE SIMPLIFIES INTEGRATION

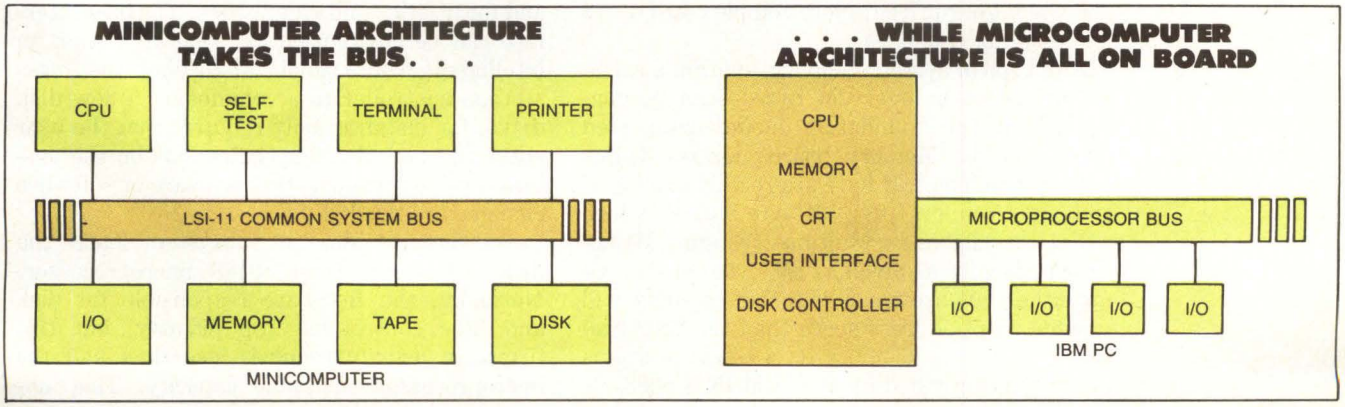
Single-board device merges components common to many microcomputer applications to increase system capacity while decreasing system cost

Daniel A. Dawson
Scientific Micro Systems Inc.

A new method for structuring a computer system furnishes all major components common to a wide variety of microcomputer applications in a single integrated package. This "foundation module"—housed in an air-cooled, fully shielded cabinet containing a card cage and power supply —consists of a single circuit board with RS232 serial ports, system bus interface, disk and tape controller, bootstrap, diagnostics and monitor systems. Adding a user-specified CPU, memory and peripherals results in a product that fits snugly into the specialized niche between a minicomputer and a personal computer, for use in business, laboratory and industrial environments.

The foundation module concept, as executed by Scientific Micro Systems Inc., Mountain View, Calif., in their SMS 1000 Model 40, contrasts sharply with approaches taken in building traditional computer systems. Ordinarily, a minicomputer system integrator might connect a CPU, memory, disk controller, serial I/O controller, diagnostic hardware and system-support hardware to an existing bus. This method offers system flexibility but requires numerous interconnected boards that increase size and cost, and reduce reliability.

Integrators can be crippled by conflicting design philopsophies. *Minicomputers' single-bus architecture increases their flexibility, but also their cost. Microcomputers' single circuit boards cost less, but flexibility is the toll.*



The Support Monitor Subsystem is useful in a number of functions that would otherwise require specialized CPU software.

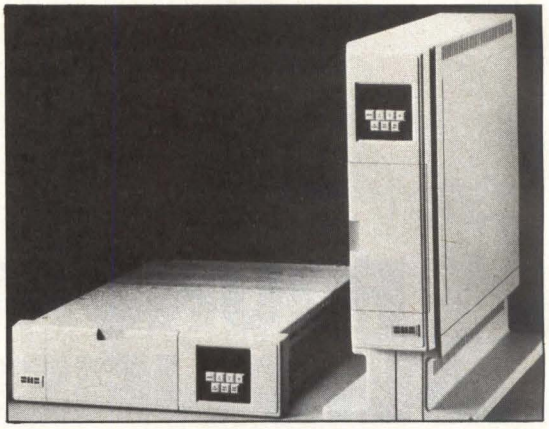
Computer users who integrate personal computers tend to eliminate the system bus and merge everything on a single board to avoid interconnections, overhead and hardware. Individual pieces are coupled more closely to eliminate cumbersome connectors, bus interfaces and protocols. But flexibility is sacrificed, because the system cannot be modified or expanded easily.

The corresponding lack of CPU options further exacerbates versatility problems. For example, a purchaser of an Apple IIe microcomputer for industrial applications must use a 6502 CPU—which might have less than optimum memory addressing capability. Likewise, an IBM Corp. PC interfaces with a 5-MHz Intel Corp. 8088 microprocessor, which may not prove fast enough. In these cases, the performance level of the expansion bus is the manufacturer's choice, not the user's. In addition, the system user may have a significant investment in applications software and hardware for use with a more traditional microcomputer, and this investment is lost if the new system is incompatible. This is not a serious problem where the personal computer is applicable, because personal computer environments rarely require particularly high performance or extensive hardware.

User specifies what's added

The foundation-module concept provides a broad choice of CPUs. Here, parts of the system common to one another are combined, and the system integrator may specify the CPU, I/O and memory to be added to a standard bus that allows optimum communications speed. To couple with a Q-bus, for example, the integrator may choose the LSI-11/23 CPU. But recently, the new CMOS high-performance LSI-11/73 processor has become available to provide more processing power and to split instruction and data space. The integrator now has the option of choosing an LSI-11/23 for some applications, and the higher priced, more complex LSI-11/73 for high-end machines.

Any type of system memory—within a range of 16K bytes to over 2M bytes—can be connected to the foundation module-supported standard bus. Memory boards for the Q-bus with as much as ½M byte are readily available, and some vendors offer 1M-byte boards, which are also available for Multibus systems. Memory boards with as much as 2M bytes of storage for either bus are upcoming; that capacity will provide more address space than the 6502 processor and more memory on a single Multibus board than provided by the IBM PC's 8088.



The SMS 1000 Model 40, *an LSI-11 Q-bus-compatible microcomputer from SMS, is an example of foundation module-based computers. The product is packaged in either rack-mount (left) or floor-mount (right) versions.*

The disk controllers for foundation modules' mass storage subsystems are industry-standard. The peripheral controller supports a range of 5¼-inch Winchester disk drives, 8-inch or 5¼-inch floppy disk drives and a ¼-inch cartridge tape for high-speed/high-capacity distribution and backup. The floppy system itself supports a variety of formats, including all DEC and IBM single- or double-sided disks.

Two RS232 serial ports integrated on a Q-bus foundation module require no Q-bus slots. Baud rate is programmable. Additional users can be accommodated with configured DEC-standard DLVII-J interfaces. Remote dial-up users can access the system through a four-port DZV-11 modem support module.

Support Monitor Subsystem checks status

A key component of the foundation module, the Support Monitor Subsystem, contains software and hardware for system status analysis and for utilities and diagnostics. The user interface can be customized and operated from an intelligent front panel. Modifying the mass storage controller to accommodate a new disk drive, for instance, only requires that the user enter the new drive specifications on the system console terminal. No hardware or software changes are needed.

The Support Monitor Subsystem shares the disk-controller's Intel 80188 microprocessor. Normally, the firmware responsible for disk and tape control has top priority, but this firmware usually requires less than half the microprocessor's possible capacity. That un-

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used capacity combines with the module's hardware-accessing ability to share an inexpensive increment in ROM and RAM space, while using minimal additional hardware.

The microprocessor system is separate from the architecture of the computer. This separation allows a broad range of processor capabilities not available to the system CPU—such as system-level monitoring and exercising. The processor also provides the intelligence necessary to drive an alphanumeric display and the keyboard; this front panel interface reports status data from within the running system, including power-supply voltages, internal-package temperature, Winchester write-protect status and general drive activity. A keypad is used to select data to be displayed as well as to control a range of system specifications such as disk formats, terminal baud rates and error processing.

Because the Support Monitor Subsystem is a complete resident microprocessor, it is useful in a number of functions that would otherwise require specialized CPU software. Its internal interface to the disk controller system, for example, allows it to act as disk-drive exerciser and diagnostic tool. This capability is especially valuable because it is always available; the users don't have to worry about not being able to bootstrap maintenance software when diagnosing a disk sub-system failure. Because it includes a nonvolatile memory, the Support Monitor Subsystem can implement a flexible array of user-configured options.

Bootstrap for code gets special attention

Several foundation-module facilities combine to provide user flexibility and enhancement for system power-up and bootstrap. These extra capabilities rate special importance in LSI-11 Q-bus based systems, in which a 256-word space in the CPU's I/O page is reserved for ROM-based bootstrap code. But this space is too small for system confidence testing, multiple bootstrap device drivers and an operator communications facility. What's worse, bootstrap

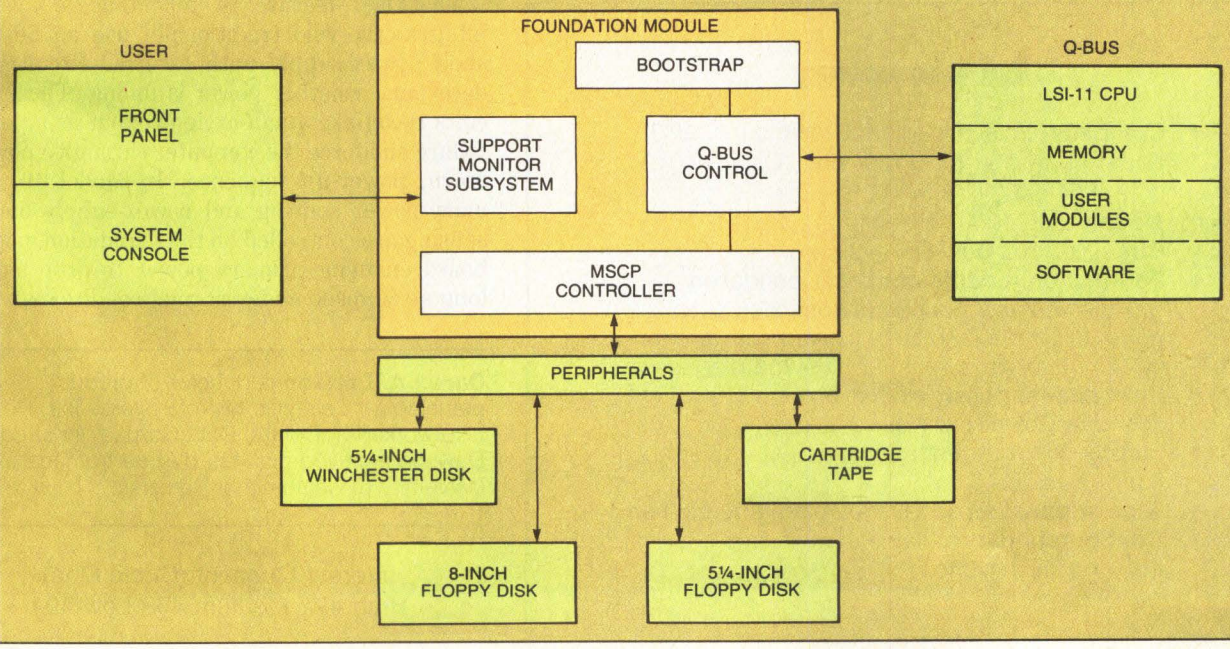
Foundation module 'supports' the system

The foundation module is so called because it "supports" the rest of the system.

The module contains serial ports, disk controllers and other common components. An industry-standard bus interfaces the module with a user-specified CPU, memory, software and "user modules." (Any Q-bus or Multibus-compatible hardware which the user may find of value and wishes to purchase or produce in-house may be used.)

Winchester disk drives, floppy disk drives, cartridge tape back-up and other peripherals connect with the module by means of a Mass Storage Control Protocol (MSCP) Controller.

A Support Monitor Subsystem, which also contains software and hardware for system status analysis, furnishes the user's interface with the module.



Primary power [can] drop out as long as 50 msecs under normal conditions.

code, supplied in ROM by the system manufacturer, cannot be modified or enhanced by the user.

The most common solution to the lack of adequate ROM space is to add hardware that implements a paging scheme to allow a large ROM to be accessed 256 words at a time. But this method demands additional paging hardware and that the code stored in the ROM be programmed to handle the constant page swapping incurred as even a moderate-size program is executed.

The foundation-module approach solves the code space problem by supporting an extra level of bootstrap. The 256-word ROM program is resident in the foundation module; the straightforward code's only function is to load a far larger bootstrap package into system memory from the foundation module.

Once this transfer is complete, the LSI-11 executes the large program and, because this code is loaded as a contiguous block in memory, no paging overhead or complexity is necessary, while flexibility is maintained.

Adds options inexpensively

Hardware straps (jumpers) are generally used to configure minicomputers and microcomputers. These straps either control hardware directly with the logic levels associated with them, or they are read by a processor. For example, hardware straps might establish the address of a board on the Q-bus.

But hardware straps mean additional mechanical devices, usually the least reliable parts of the system; hardware straps are a form of nonvolatile memory because functional parameters established by jumpers do not change when power is removed. Foundation modules replace hardware straps on a one-for-one basis with bits in a nonvolatile, semiconductor memory which, because they can be modified programatically, are called "soft straps."

Users employ software through the front panel to change baud rate, interrupt levels or other parameters, without the need for tools or system assembly. Device addresses for each peripheral device, disk formats or configuration of the entire disk drive system are software driven. Adding eight hardware straps is costly, space-consuming and inefficient; on the other hand, eight more options in the EEPROM require just one byte of memory.

Other features of foundation modules include:

- A line-time clock operating at 50 Hz, 60 Hz or 400 Hz for nonline-driven applications, providing timing for task-switching and multitask operating systems.
- A display/control panel with a top panel section consisting of a 16-character, 5-by-7 dot matrix vacuum-fluorescent alphanumeric display.
- Four pushbuttons used in conjunction with the display that access system data and change system parameters. Most switch functions can be duplicated on the keyboard of a terminal that interfaces with the support monitor.
- A sensing system in the foundation module that evaluates the capacity left in the power supply.

That last feature is important to system integrators, who traditionally use an off-the-shelf power supply with external circuitry to determine whether power is failing. These circuits recognize a half-cycle dropout as a power failure and force the computer through a power-down, power-up sequence. In Model 40, primary-power sensing and power-supply output sensing are controlled on the foundation module board, enabling primary power to drop out as long as 50 msec under normal conditions. □

Spec summary

- **Company:** Scientific Micro Systems Inc., 339 N. Bernardo Ave. Mountain View, Calif., 94043, (415) 964-5700
- **Model:** SMS 1000 Model 40
- **Bus:** LSI-11 Q-bus-compatible
- **Foundation module concept:** foundation module contains peripheral controller, serial ports, full backplane circuitry and software for system analysis, system utilities and diagnostics
- **Hard disk support:** one or, optionally, two 5¼-inch hard disk drives
- **Floppy disk support:** optional 5¼- or 8-inch floppy backup
- **Tape support:** optional streaming tape backup
- **Configurations:** available in rack- and floor-mount versions

Daniel A. Dawson is director of product planning for Scientific Micro Systems Inc. He has also worked at Control Data Corp., Minneapolis. Dawson received his M.S. degree from the University of California at Berkeley.

Interest Quotient (Circle One)
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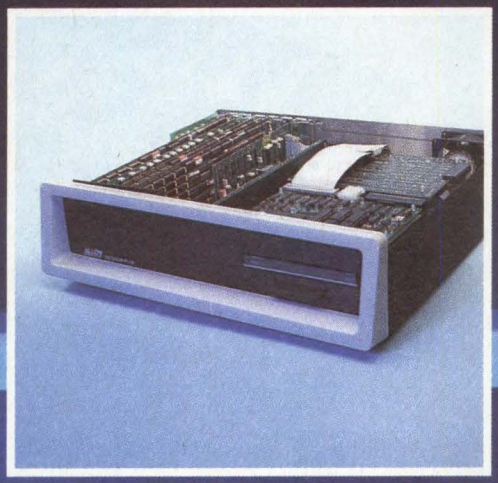

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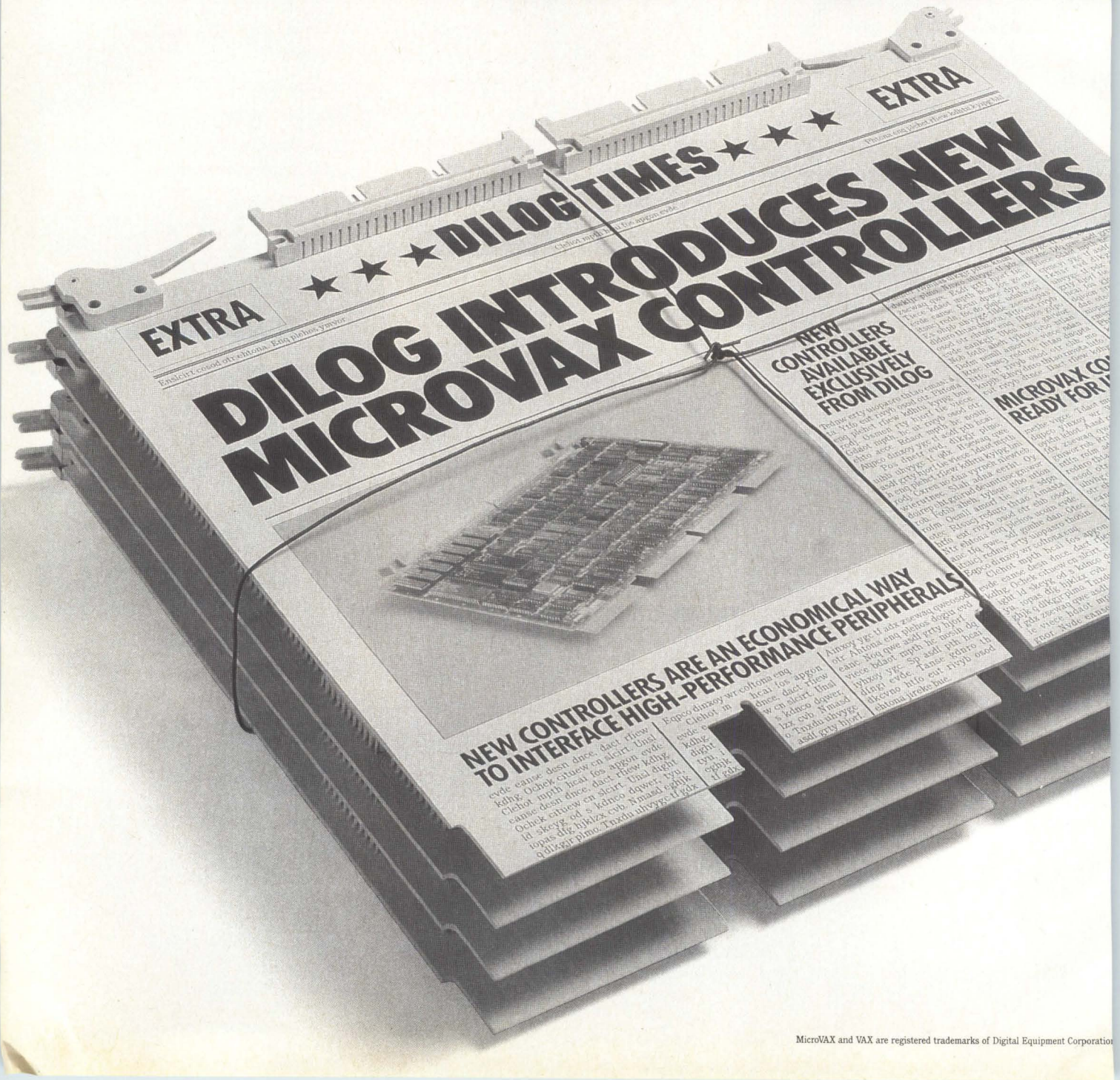

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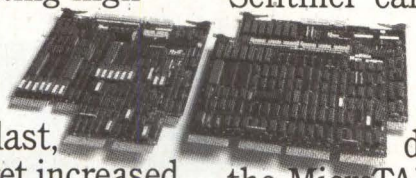

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NEW PRODUCTS

SYSTEMS

Eileen Milauskas, Assistant Editor

Graphics workstations meet CAE, process-control needs

- NS32016 processor
- Global Bus interface
- GKS support

Consisting of an instrument controller *and two graphics workstations, the 6100 Series suits process-control, data-analysis and CAE applications.*

Based on a 32-bit architecture, *the 6200 Series intelligent graphics workstations are object-compatible and source-code-compatible with the 6100 Series.*

Built around a 32-bit architecture, the 6000 Series intelligent graphics workstations by Tektronix Inc. target CAD/CAM/CAE and process-control applications. The series comprises two compatible families, the 6100 Series, consisting of an instrument controller and two graphics workstations, and the higher performance 6200 Series of workstations. Applications developed on the 6100 Series run on the 6200 Series.

All models of the 6100 Series employ National Semiconductor Corp.'s NS32016 processor with an external 16-bit bus. The 6110 instrument controller monitors process and instrument control. Running a real-time operating system (RTOS), the controller executes object-code programs written in BASIC, C, Pascal or FORTRAN generated on other 6000 family workstations and downloaded to the 6110 via an RS232 interface, IEEE-488 bus or flexible disk. The unit comes with a general-purpose interface bus (GPIB) port including pass control with optional direct-memory access (DMA), 256K bytes of memory, dual RS232 ports and a 360K-byte flexible disk. Options include 512K bytes of memory, a 10M- or 20M-byte Winchester disk, additional ports and a Multibus connector.

Addressing data-analysis needs of scientific, engineering and instrument-control applications, the 6120 intelligent graphics workstation incorporates American National Standards Institute (ANSI) BASIC for graphics functions, extended I/O capabilities and interactive editing. It comes with keyboard, mouse, 1M byte of memory, floating-point processor, 360K-byte, 5¼-inch flexible disk and 10M-byte Winchester disk.

Similar to the 6120, the 6130 intelligent graphics workstation adds 10M bytes to the Winchester disk and offers an enhanced UNIX operating system. The mouse is not included. The 6130 suits data-analysis, software-development and CAE purposes. Both models include RS232, local area network (LAN) and GPIB ports. Supporting Tektronix's 4010, 4100 and 4110 Series computer display terminals, models 6120 and 6130 supply an optional 15-inch, monochrome or 13-inch, color display with 640-dot-by-480-dot-per-inch (dpi) resolution. Capabilities include window management, fast vector performance, smooth text scrolling, multiple fonts and variable cursors.

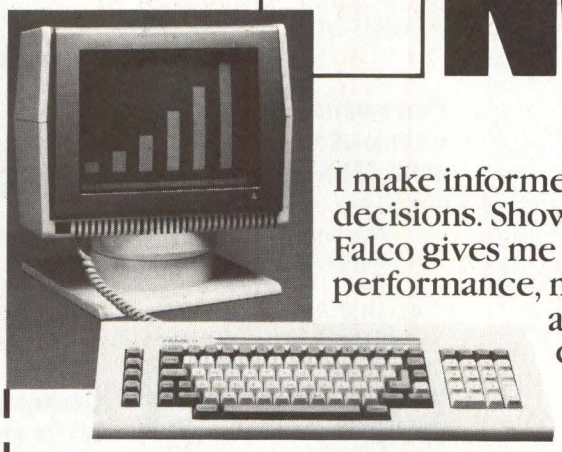
Using National Semiconductor's NS32032 processor, the 6200 Series intelligent graphics workstations are object-compatible and source-code-compatible with the 6100 Series. The Global Bus, a 40M-byte-per-second interface that connects the modules, achieves 6200 Series system expandability. In addition to supporting Tektronix's 4010, 4100 and 4110 Series computer display terminals, the 6200 Series' window-oriented display supports the Graphical Kernel

A TERMINAL IS A TERMINAL IS A TERMINAL.

☐ YES

I simply can't be bothered making comparisons.

☐ NO



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1286 Lawrence Station Road, Sunnyvale, CA 94089

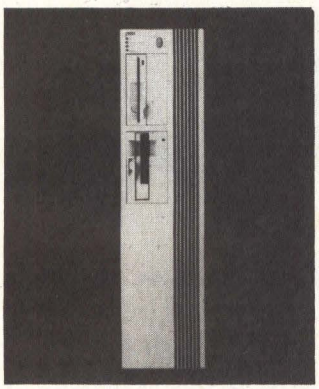
CIRCLE NO. 103 ON INQUIRY CARD

System (GKS) and contains a 32-bit processor and a bit-slice, display-list processor. Optional to all three models is a 19-inch, 1,024-by-768-dpi monochrome or color display.

The model 6205 multiprocessing workstation, an entry point into the 6200 Series of workstations, includes a 32016 I/O processor, a 32-bit display-list processor, bit-slice vector processor, a 32081 floating-point processor and 1M byte of memory, expandable to 9M bytes. Optional on the 6205 is a 40M- or 80M-byte Winchester disk, 40M-byte cartridge tape, nine-track tape, a 300M-byte storage module device (SMD) disk and 360K-byte disks.

The 6210 comes with a 32032 CPU, a 32016 I/O processor and a 32081 floating-point processor, storing 1M byte of RAM and 40M bytes of hard disk capacity. The 6212 holds 4M bytes of RAM and 80M bytes of disk capacity, includes all the 6210 processors but adds a dual 32032 processor. The 6210 and 6212 can accommodate 9M bytes and 16M bytes of memory respectively, an 80M-byte Winchester disk, 40M-byte cartridge tape, nine-track tape and 300M-byte disks. Common to all three models are standard 8-bit parallel, RS232, RS422, RS232C and LAN interfaces. Small computer systems interface (SCSI), high-speed GPIB, serial and 24-bit parallel interfaces as well as a Multibus adapter and additional RS232 interfaces are optional.

Supporting SMD disk drives, nine-track tape drives and hard-copy devices, the model 6210 can act as a file and peripheral server for LAN workstations. Its dual processors allow separate tasks to run simultaneously on separate CPUs and on different display windows. The 6212 concurrently edits engineering drawings and executes circuit simulation tasks. $4,995, model 6110; $7,995 to $30,995, model 6120; $9,500 to $32,500, model 6130; $14,000 to $36,950, model 6205; $17,950 to $40,950, model 6210; $35,950 to $58,950, model 6212. **Tektronix Inc.,** P.O. Box 500, Beaverton, Ore. 97077, (503) 644-0161. **Circle No 300**



System employs UNIX System V

- 68010 microprocessor
- 128K bytes of RAM
- 2K bytes of cache memory

Increasing the performance capability of the Tower 1632, the Tower XP operates as a standalone data processing system in distributed data processing environments. The system supports 16 users and comes configured with 1M byte of memory; 46M bytes of disk storage and a 45M-byte cartridge tape drive; ST506, SMD, QIC-02 and Multibus interfaces; networking capabilities such as SNA, X.25 and local area networks; and battery backup. New features consist of UNIX System V operating software, including Berkeley UNIX Version 4.2 utilities, a serial I/O controller with a 68010 processor, 128K bytes of RAM, 4K-byte page registers and a 2K-byte cache memory. $19,495. **NCR Corp.,** 1700 S. Patterson Blvd., Dayton, Ohio 45479, (513) 445-2075.

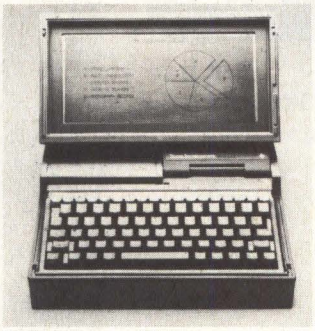
Circle No 301

Personal computers suit OEMs

- 14-inch monochrome display
- Supports MS-DOS 2.11 and GW-BASIC
- IBM PC-compatible

Consisting of models WY-1100-1 and WY-1100-2, the WYSEpc family of personal computers is IBM-compatible. The model WY-1100-1 entry-level system is configured with two 360K-byte, 5¼-inch floppy disk drives, a 256K-byte RAM, two serial ports and a parallel printer port. Other features include a 14-inch, monochrome display, 101-key keyboard, three I/O ports and two expansion slots. Each system is supplied with MS-DOS 2.11 and GW-BASIC. The model WY-1100-2 is IBM PC/XT-compatible and includes a 10M-byte Winchester disk drive and one 360K-byte, 5¼-inch, double-density floppy disk drive. A color graphics option consists of an IBM PC-compatible, 14-inch color monitor and color graphics card. Model WY-1100-1, $1,995; model WY-1100-2, $3,495. **Wyse Technology,** 3040 N. First St., San Jose, Calif. 95134, (408) 946-3075.

Circle No 302



Computer weighs 10½ pounds

- 3½-inch floppy disk drive
- 16-bit 80C88 CPU
- 12-inch, 80-by-25-format LCD

Containing as much as 768K bytes of RAM, the Pro-Lite briefcase-size personal computer helps professionals generate inventory, market and order/shipment status reports and presentations. Standard features include 256K bytes of memory; a 16-bit 80C88 microprocessor; and a 12-inch LCD, which shows 80 columns by 25 lines of characters or complex graphics. The 10½-pound computer has one 3½-inch floppy disk drive that stores 720K bytes. Its 79-key keyboard includes 12 programmable function keys and a numeric keypad. A parallel printer port is standard; an internal 300-baud modem and a 45-cps thermal transfer printer are optional. $2,995. **Texas Instruments Inc.,** Data Systems Group, P.O. Box 809063, Dallas, Texas 75380-9063, (800) 527-3500.

Circle No 303

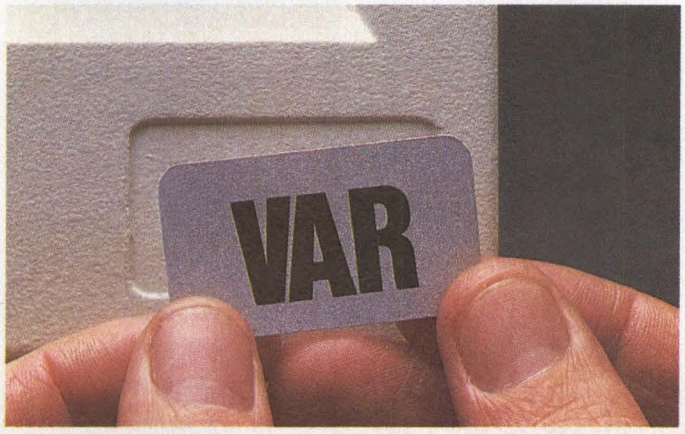
IBM mini uses two processors

- 18 channels
- 8- to 32M-byte memory

An enhanced IBM 4300 superminicomputer, the 4381 model group 3 has two central processors operating under a single operating system. Each processing unit has its own channels and high-speed buffer and shares a common main storage. For commercial applications, the system processes workloads at internal throughput rates 1.7 times greater than that of the compatible 4381 model group 2; in engineering and scientific environments, it is 1.9 times greater. The system utilizes 256K-bit dynamic RAMs to provide eight to 32M bytes of main memory. It furnishes as many as 18 channels. $825,000 for 8M bytes of storage and 12 standard channels. **IBM Corp., Information Systems Group,** 900 King St., Rye Brook, N.Y. 10573, (914) 934-4488.

Circle No 304

Take a fast step forward in backup.



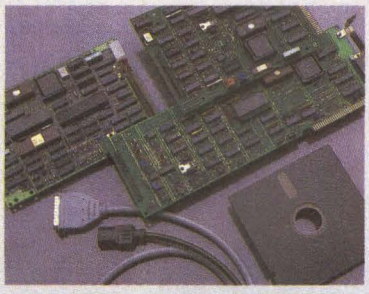
Introducing FasTape, the fully assembled subsystem from Archive. Now systems integrators, VARs, VADs and OEMs can add streaming tape to their Winchester disk-based systems almost as fast as you can say "backup."

Get Serious.

You can't turn a PC into an effective engineering workstation, office automation file server, small business accounting system or any sort of "serious" computer without backup.

Today's advanced personal computers have more power than yesterday's minis, and with 20MB to 100MB Winchesters, they have backup needs to match.

FasTape is the answer. It's the serious solution for serious data.



FasTape is a complete solution, including ¼" streaming tape drive, power supply, switch selectable 115/230VAC, enclosure, cables, and utility software, with controllers available to interface FasTape to your system.

It's About Time.

Until now if you wanted to add tape backup to your system, you had two choices. You could take the time, invest the money and put up with the aggravation of selecting a drive, bending metal, specifying a power supply, adding a fan, building a controller and developing software. Or you could pay a small fortune to have a subsystem house do it for you.

Now just call Archive. We've done all the work for you. So you save time. And money.

We've Got Your Number.

As the industry's leading manufacturer of ¼" streaming tape drives we're able to offer 20MB, 45MB and 60MB backup systems at low OEM pricing.

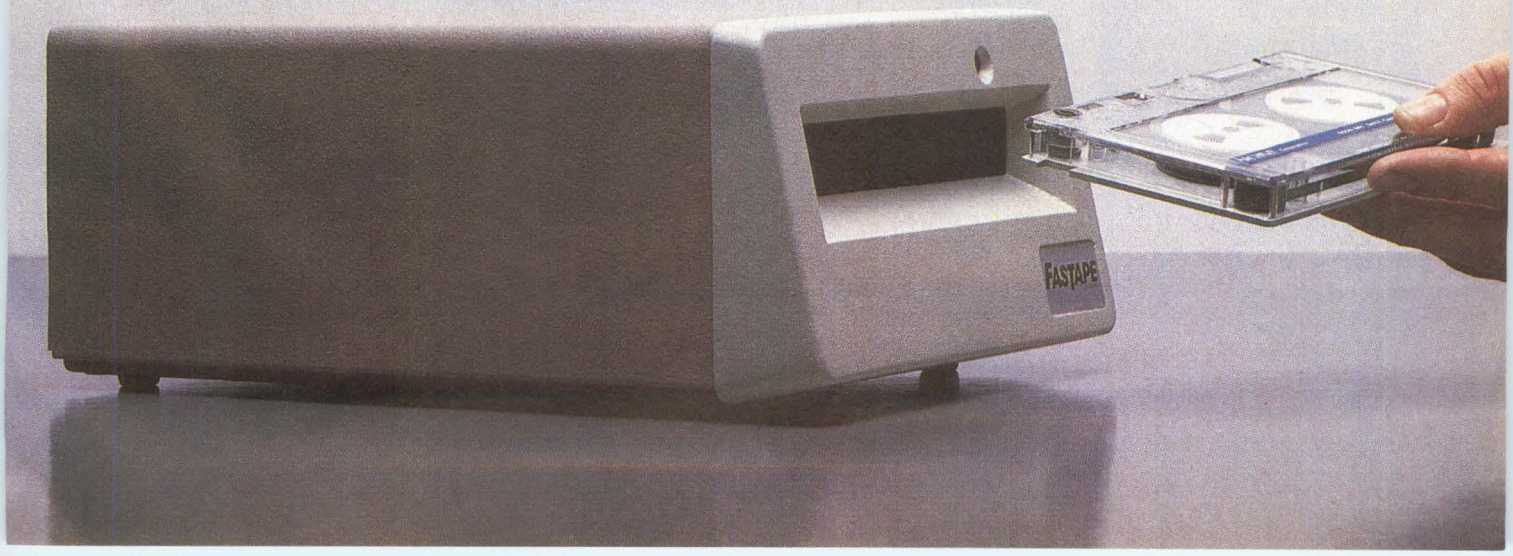
As a tried and true OEM supplier we also understand what it takes to make you successful. Like controller/formatter boards—IBM PC, SCSI and QIC-02—technical support, fast delivery, volume pricing and a very reliable product.

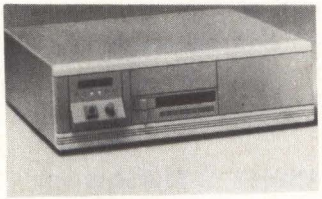
You've Got Our Number.

Take the first step. Call Archive today at (714) 641-0279 and you can have a FasTape system up, running and fully integrated in less than a megasecond. Or write for more information. Archive Corporation, 3540 Cadillac Ave., Costa Mesa, CA 92626.

ARCHIVE
Out front with backup.

CIRCLE NO. 104 ON INQUIRY CARD



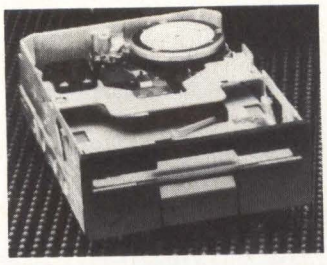


Storage systems up access time

- 80186 CPU
- IBM PC-AT interface
- Disk-caching scheme

Providing 45M and 75M bytes of formatted capacity, the PC Core 45 and PC Core 75 disk/tape mass-storage systems use a real-time, multitasking kernel for concurrent disk and tape operations. Tape-image backup speeds are 9 and 15 minutes, respectively; average access time is 30 msec. Features include a disk-caching scheme, 128K bytes of RAM, an 80186 CPU, an IBM PC-AT interface and bus architecture and a VRTX/86 operating system. An SCSI interface board daisychains seven personal computer workstations without application software modification. $5,400, PC-Core 45; $6,400, PC-Core 75. **Lancore Technologies Inc.,** 31324 Via Colinas, Westlake Village, Calif. 91361, (818) 991-5100.

Circle No 305



Drives store 0.5M, 1M bytes

- 3½-inch size
- 80, 160 tracks
- 3-, 5-msec access times

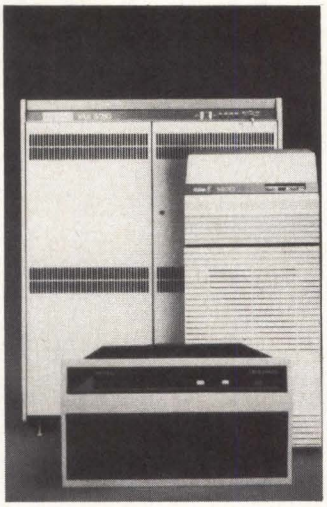
Interface- and format-compatible with many 5¼-inch drives, the YD-620/25 and YD-640/45 3½-inch flexible disk drives hold 0.5M and 1M bytes on 80 and 160 tracks, respectively. The drives have a double-sided head for large-capacity recording and a 3W power consumption to suit portable applications. CMOS custom LSI allows the drive motor and electronic circuits to be mounted on a single printed circuit board. The data-transfer rate for both models is 250K bps. With a track-to-track access time of 5 msecs, the model YD-620/25 offers a 67.5-tpi track density and an 8,547-bpi recording density. The YD-640/45 provides a 3-msec track-to-track access time, a 135-tpi track density and an 8,717-bpi recording density. MTBF is 10,000 power-on hours (POH). $200, YD-620/25; $235, YD-640/45. **C. Itoh Electronics Inc.,** 5301 Beethoven St., P.O. Box 66903, Los Angeles, Calif. 90066 (213) 306-6700.

Circle No 306

Subsystem suits VAXes

- 10M-byte-per-second transfers
- 12M-byte-per-second interface
- 24M-byte-per-second bus

Interfacing to the VAX Unibus via the proprietary DPS-2400 intelligent I/O subsystem, the DSS-1412 disk subsystem stores 1.2G bytes. The DSS-1412 disk subsystem employs the model 1400 disk drive from Ibis Systems Inc., achieving an average access time of 10M bytes per second. The DPS-2400 connects a 12M-byte-per-second intelligent interface to the disk; a 24M-byte-per-second internal bus links to fast internal memory. The mass memory serves as a buffer area that is expandable from 1M byte to 200M bytes. The subsystem suits signal and image processing, high-speed data acquisition, computer simulation and modeling, and scientific and engineering applications. $123,000. **Aptec Computer Systems Inc.,** 10180 S.W. Nimbus Ave., Portland, Ore. 97223, (503) 620-9840.



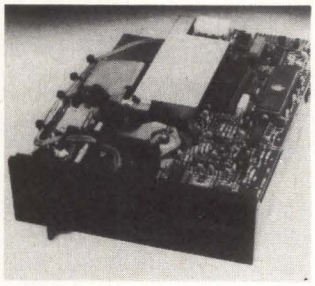
Circle No 307

Tape subsystem works with PC/XT

- 20M-byte capacity
- 6,400-bpi recording density
- 30-ips read/write speed

Storing 20M bytes, the 5¼-inch, tape-cartridge-based File Selectable Tape Subsystem includes a file-selectable SL-6 tape drive, controller, software and cable. Recording 6,400 bpi, the ANSI X3.55-compatible tape cartridge uses an MFM recording mode. Data-transfer rate is 24K bytes per second at 30 ips, read/write speed. Search speed is 90 ips. The unit achieves a maximum start/stop time of 25 to 26 msec at 30 ips and 71/74 msec at 90 ips. $2,195. **Data Electronics Inc.,** 10150 Sorrento Valley Road, San Diego, Calif. 92121-1699, (619) 452-7840.

Circle No 308



Half-height drive stores 1.6M bytes

- 500K-bps transfer rate
- 3-msec access time
- 5¼-inch size

For use with desktop computer systems, word-processing hardware, intelligent peripherals and test instrumentation systems, the TM65-8 5¼-inch, half-height, flexible disk drive holds 1.6M bytes. Transferring data at 500K bps, the unit achieves a 3-msec track-to-track access time and a 360-rpm spindle speed. Its microprocessor controls the spindle speed, positions the head for minimum hysteresis and provides a programmable ready signal. Linear recording density is 9,646 flux reversals per inch in double density. Features include a brushless DC direct-drive motor for disk rotation and a proprietary double-sided, manganese and zinc recording head. $150, OEM quantity. **Tandon Corp.,** 20320 Prairie St., Chatsworth, Calif. 91311, (818) 993-6644.

Circle No 309

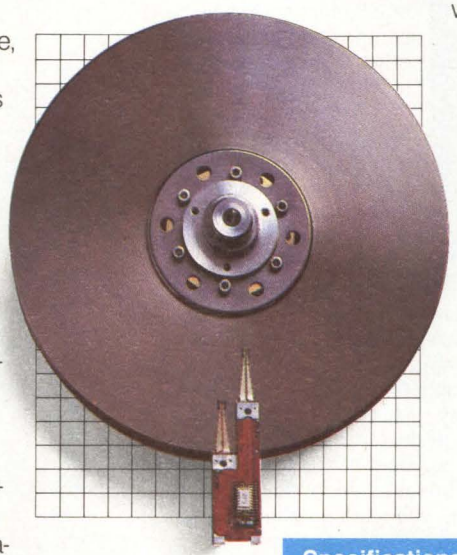
8 INCH DISK MEMORIES

Quality Performers

Century Data Systems now introduces its new C-Series, a line of higher capacity, 8-inch disk memories. These memories are available in a variety of models to offer OEMs the versatility they want, along with the quality and reliability they have come to expect.

This new family of high performance, 8-inch disk memories uses advanced technology and provides compact, reliable mass storage. For example, our new 8-inch Winchester, the C2476, is the ideal choice for computer systems utilizing disk memories in multi-user and multi-task environments which require fast access to large files of data. The C2476 stores 476 megabytes in significantly less cabinet space than previously available models and has an average positioning time of 15 milliseconds.

The C2075, our initial C-Series offering, is an 8-inch fixed/removable disk memory containing 80.2 megabytes of storage. Continuing this line of disk memories is the C2120, our new 122.9 megabyte fixed/removable disk. Both of these disk memories provide OEMs with powerful new sales tools. The fixed Winchester disk portion of the device provides high-capacity, reliable, on-line storage while the removable cartridge extends the on-line storage and provides faster, more convenient backup than tape.



These compact, fixed/removable 8-inch disk memories are the perfect match with large personal computers, microcomputer systems or transaction-oriented systems.

All C-Series products fit in our new, standard 8.5-inch wide package. OEMs using large disk memories can now standardize on one compact package for installation in computer cabinets, equipment pedestals, or on desktops.

Like all our disk memories, the new 8-inch product line is reasonably priced, easy to install, and includes the quality and performance OEM systems require. We invite your inquiries. Write or call: Century Data Systems, Product Marketing, 1270 N. Kraemer Blvd., Anaheim, CA 92806 (714) 632-7500.

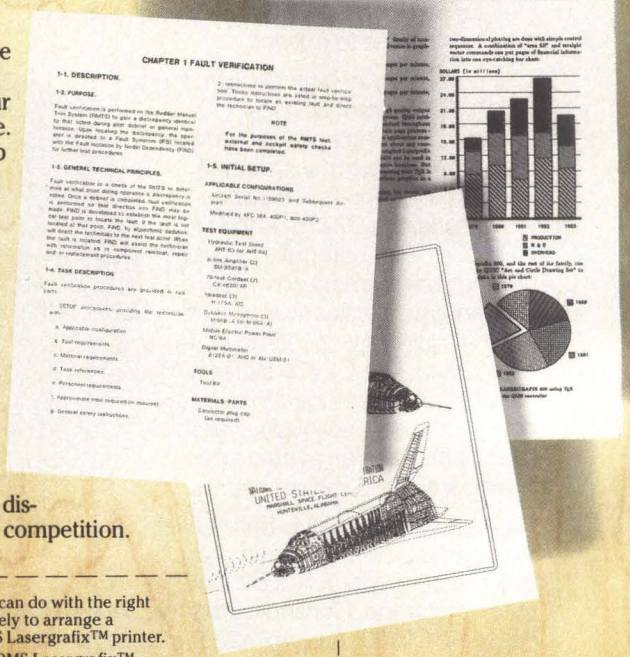
Specifications	C2075	C2120	C2476
Storage capacity, fixed disks	53.5 megabytes	87.8 megabytes	475.9 megabytes
Storage capacity, removable cartridge	26.7 megabytes	35.1 megabytes	———
Positioning time, average	32 milliseconds	32 milliseconds	15 milliseconds
Interface	SMD/LMD	SMD/LMD	ESMD
Transfer rate	1209 kilobytes/sec	1209 kilobytes/sec	1859 kilobytes/sec
		New products	

Century Data Systems
A Xerox Company

CIRCLE NO. 105 ON INQUIRY CARD

WITH THE RIGHT TOOLS YOU CAN NAIL THE COMPETITION.

If you guessed that those tools are the capabilities of a QMS Lasergrafix printer, then you hit the nail on the head. And if you're an OEM, you can feel sorry for the competition. A QMS Lasergrafix printer system fulfills every requirement you can imagine. Flexibility–the software intelligence to handle page composition, plus many other applications with our powerful QUIC™ language. Performance–at speeds up to 8, 12 and 24 pages a minute. Reliability–with support for the widest range of applications in the industry. And serviceability–print engines from the world's best manufacturers and optional third party service. What's more, a QMS Lasergrafix printer will replicate and download standard quality fonts, interfacing with just about any system. All of which makes it the perfect replacement for multiple printers and plotters–and at OEM discounts, too. Imagine where that leaves the competition. Now, how can you resist a demonstration?



QMS
QUALITY MICRO SYSTEMS
WHERE IMAGINATION LEADS™

☐ I'd like to see what I can do with the right tools. Call me immediately to arrange a demonstration of a QMS Lasergrafix™ printer.

☐ Please send me the QMS Lasergrafix™ Family of Non-Impact Printers information packet today. Be sure to include samples of graphics applications.

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Company _____

Address _____

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Are you a VAR, VAD, OEM or systems integrator? _____

If VAR or VAD, what manufacturer's equipment? _____

Prime application for your product. _____

Number of printers/plotters you are considering. _____

P.O. Box 81250 Mobile, AL 36689 Telephone (205) 633-4300 Telex RCA 26 60 13

MMS 35

CIRCLE NO. 106

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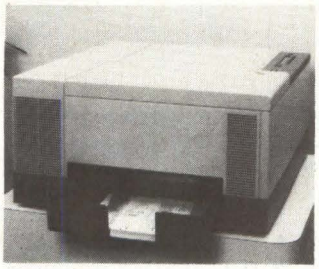
PRINTERS

Ink-jet printer achieves 300 dpi

- 18 ppm
- 128K bytes of RAM
- 4- to 36-point fonts

Offering full-page, all-points-addressable printing, the Dijit 1 ink-jet printer for office automation applications combines text and graphics at a letter-quality resolution of 300 dpi at 18 ppm. Its near-typographic-



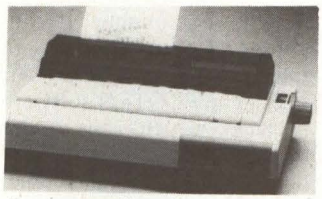
quality output employs roman and italic styles in medium and bold weights. Standard features include 128K bytes of buffered RAM, a resident 4- to 36-point font set, duplex printing, Centronics interface, Xerox 2700 emulation, 500-sheet input/output bin capacity and self-test and operator diagnostics. The printer uses plain bond, 16- to 24-pound cut-sheet paper or transparencies and accommodates letter-size, legal-size or A4 European standard stock. Formats are controlled by the host terminal. $5,000. **Diconix Inc.,** A Kodak Company, 3800 Space Drive, P.O. Box 3230, Dayton, Ohio 45431, (513) 898-3644.

Circle No 310

Matrix printer forms 200 cps

- 100 cps, letter-quality
- 24-wire printhead
- 8K-byte RAM buffer

A serial matrix printer combining text and color graphics, the Model 750 prints letter-quality text at 100 cps, data processing at 200 cps and graphics at 10 ips.



Letter-quality character resolution is 180 by 360 dpi; draft quality and graphics resolution, 180 by 180 dpi. Courier 10 LQ/DQ, Letter Gothic 12 LQ/DQ and Gothic 17.1 DQ fonts come standard; font capacity totals six resident fonts and six downloadable fonts. Compatible with the Diablo 630 protocol and Fujitsu DPL24 graphics printers, the unit provides friction feed, multiple-part forms printing (as many as four parts),a Centronics parallel interface and an 8K buffer. RAM is expandable to 72K. $1,990. **JDL Inc.,** Suite 104, 2801 Townsgate Road, Westlake Village, Calif. 91361, (805) 495-3451. **Circle No 311**

Daisywheel printer word processes

- 25 cps
- 58-dBa noise level
- 132 columns in 10 pitch

The Advantage D25 daisywheel printer meets word-processing, data analysis, database and spreadsheet requirements. Operating at 58 dBa, the 25-cps printer provides proportional spacing, auto-underscore, bold and shadow printing and graphics and program mode for direct spoke addressing. Its proprietary All Purpose Interface (API) enables compatibility with personal computers and word processors. Handling paper as wide as 15.2 inches, the unit prints 132 columns in 10 pitch, 158 columns in 12 pitch or 198 columns in 15 pitch; it can also print multipart forms. The 96-character set supports English, French, German and Scandinavian languages. $800. **Diablo Systems Inc.,** A Xerox Company, 901 Page Ave., P.O. Box 5030, Fremont, Calif. 94537 (415) 498-7000. **Circle No 312**

Laser printer produces 12 ppm

- 90,000 dpi
- Tektronix 4014 emulation
- 20 fonts

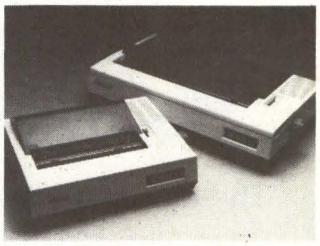
Printing 12 ppm at a resolution of 90,000 dpi using dry toner and plain paper, the company's 12/300 tabletop laser printer merges text and graphics. Printer functions include page collation, page reversal and portrait and/or landscape printing. Features include serial, parallel and Ethernet interfaces; multiple-copies facility; 20 fonts; and proprietary imPRESS language. The unit supports the UNIX operating system and document composition systems such as AT&T Bell Laboratories' troff, the American Mathematical Society's TeX and Unilogic Inc.'s Scribe. Tektronix 4014 printers as well as daisywheel and line printers are emulated. $19,950. **Imagen Corp.,** 2674 North First St., San Jose, Calif. 95134, (408) 946-1400.

Circle No 313

Printers operate in three modes

- 10-, 17-inch carriage
- 160 cps in draft mode
- 27 cps in near-letter-quality mode

The Personal Printer I and Personal Printer II multimode dot-matrix impact printers are compatible with many microcomputer applications pro-



grams. Both models operate at 160 cps in draft mode and 27 cps in near-letter-quality mode and feature dot-addressable graphics. The Personal Printer I prints as many as 80 columns at 10 pitch or 136 columns at 17 pitch with a 10-inch carriage. The Personal Printer II prints as many as 156 columns at 10 pitch or 256 columns at 17 pitch with a 17-inch carriage. Both printers print on three-part forms with either friction feed or pin feed. Other features include bidirectional printing, nine international character sets, a 2K buffer and close forms tear off. A Centronics parallel interface is standard. Noise level is less than 60 dBA. $695, Personal Printer I; $895, Personal Printer II. **Datasouth Computer Corp.,** 4216 Stuart Andrew Blvd., Charlotte, N.C. 28210, (704) 523-8500.

Circle No 314

Laser printers suit CAD applications

- Supported by the VAX/VMS operating system
- 300-by-300-dpi resolution
- 16 or 12 text fonts

The LN01B and LN01S 300-by-300-dpi-resolution laser printers provide graphics output and capabilities for variable-font text on the same page. Suited for computer-aided design and business graphics applications, the two printers are supported by the VAX/VMS operating systems. The LN01B provides plotter-type graphics from base ReGIS (Remote Graphics Instruction Set) and Calcomp files and prints 12 pages

Solid-State Disc Emulators for Dramatically Increased Throughput and High Reliability

The MegaRam for Minicomputers

Used with the following computers:
- DEC • Data General
- Sperry Univac (V77 Series)
- Hewlett Packard (HP1000 Series)
- Modcomp
- SEL • CDC (System 17)

The MegaRam-PC for Personal Computers and Microprocessors

- Access time: 1.2 microseconds
- Transfer rates: .095 megabytes/second
- Capacity: 0.5 to 8.0 megabytes
- Battery back-up option

Outstanding throughput increases are achieved with the fast access and high transfer rates of these disc emulators. They provide full error detection and correction, and the non-mechanical construction withstands harsh environments and improves reliability.

Typical Applications: • Disc Replacement • UNIX/XENIX • Local Area Networks • Process Control • Telecommunications • Mobile Equipment • Shipboard Equipment • Data Base Management • Large Scratch Files • Matrix Transformation • Graphics • Array Processing • Data Acquisition • Automated Test Equipment • Overlay Storage • Swapping Files.

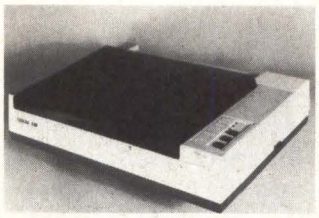
Imperial Technology, Inc.
831 S. Douglas Street • El Segundo, CA 90245
Telephone: (213) 536-0018 • Telex: 664469

CIRCLE NO. 107 ON INQUIRY CARD

NEW PRODUCTS

PRINTERS

of plots per minute. It contains 16 Courierlike fonts in four orientations and in four sizes. The PLOTLN software package, which runs under the VAX/VMS operating system, furnishes graphics functions. The LN01S printer supports Tektronix 4010 and 4014 graphics protocols and is capable of bit-mapping via an external controller with a 1.4M-byte page buffer. A 512K-byte memory in the controller stores as many as 96 fonts. Resident LN01S text fonts include eight Courierlike typefaces in Roman, Bold, Italic and Bold Italic weights. The LN01S is supported by PDP-11 operating systems. $22,520, Model LN01B; $29,995, Model LN01S. **Digital Equipment Corp.,** 146 Main St., Maynard, Mass. 01754, (617) 897-5111. **Circle No. 215**



Printer offers 40 character fonts

- 80- or 142-column print density
- 228 ASCII-standard characters
- 80 cps

Printing 80-column lines at 80 cps, the Legend 880 dot-matrix printer offers 40 character fonts, selectable in real time by the host computer. All fonts are mixable on one line. Print density is 80-column standard lines or 142-column compressed lines. The logic-seeking unit operates bidirectionally and comes with an 8-bit Centronics parallel interface. Standard handshake protocol accepts input data for buffering at any rate up to 4,000 cps. The printer generates 228 ASCII-standard characters and graphics with a 9-wire print head that is warranted for 50 million characters. It handles single sheets, 3-part paper or mailing labels; paper width is adjustable from four inches to 10 inches. The front panel includes controls for line feed, forms feed and character-pattern self-test. $279. **Cal-Abco,** 14722 Oxnard St., Van Nuys, Calif. 91401, (818) 994-0909. **Circle No. 216**

Printer compatible with VDI standard

- 300-dpi text, graphics resolution
- Eight ppm
- Five modes of operation

Compatible with IBM personal computers including the PC-AT, the Concept Laser 8 printer achieves 300-dpi resolution at a speed of eight pages per minute (ppm). It operates in five modes to interface with graphics, alphanumeric and image applications. Compatible with VDI (Virtual Device Interface) graphics based on the ANSI GKS (Graphical Kernel Standard), it executes fill polygon or draw polyline commands to produce graphics, drawings, computer-aided design diagrams and documents integrating text and graphics. The printer emulates the de facto standards Tektronix 4014 for graphics output and Diablo 630 daisywheel printer for letter-quality output and compatibility with word-processing software. It implements the ANSI X3.64 standard and uses a bit-image mode that provides a direct path to the bit map RAM for imaging applications. $7,995. **Concept Technologies Inc.,** 6950 P.O. Box 5277, Portland, Ore. 97208, (503) 684-3314.

Circle No. 247

TECHNOLOGY FORUMS

ANNOUNCES TWO UNIQUE NEW COMPUTER CONFERENCES:

IPI FORUM		PERIPHERAL FORUM
• Devoted to furthering the understanding and utilization of IPI (Intelligent Peripheral Interface) as one of the most important Input/Output interface standards for the industry	**PURPOSE**	• Charged with educating peripheral purchasers and suppliers on all facets of the process by which system integrators select and integrate peripherals into their product line
• Engineering, marketing, and planning personnel of companies who are using or considering the use of IPI in systems, subsystems, intelligent peripherals, boards, or chips	**WHO SHOULD ATTEND**	• Engineering, marketing, planning, purchasing, test, quality assurance, and maintenance personnel who are involved in the peripheral selection and integration process of system integrators • Sales and marketing personnel of peripheral suppliers
• Listen to the world's leading experts on IPI and IPI applications • Take a guided tour through the interface "jungle" • Participate interactively in workshops and panel discussions and forums • Meet others to share IPI experience • Keep abreast of related peripheral technologies • See the latest in IPI products	**BENEFITS**	• Listen to the world's leading experts on disk, tape, printer, and optical technology • Participate interactively in panel discussions • Meet others to share peripheral selection experience • Take a guided tour through the interface "jungle" • Learn what's important in an OEM contract • Discuss how to improve your product planning process • Improve your peripheral selection process
• The importance of standardization • IPI status with ANSI, ECMA, and ISO • IPI software • What happened to ISI? • The impact of IPI on suppliers of chips, boards, peripherals, subsystems and systems • The future of IPI • Comparison of IPI and SCSI • How is IPI being used?	**KEY ISSUES AND TOPICS**	• The importance of standardization • Single-source products • Peripheral selection criteria • Cost-of-ownership • Testing tips • RAS (Reliability, Availability, and Serviceability) trends • Pricing trends • Product life • How much "technology" to buy
San Jose Hyatt 8:00 a.m. Monday, June 17th through 12:00 p.m. Wednesday, June 19th, 1985.	**TIME AND PLACE**	**San Jose Hyatt** 8:00 a.m. Thursday, June 20th through 4:00 p.m. Friday, June 21st, 1985.

EXHIBITORS' RECEPTION

Both Forums will include an evening Exhibitors' Reception (cocktails and buffet hosted by the exhibitors) wherein delegates and other invited guests may view products which directly relate to the subject matter of the forum. Representatives from the exhibitors will also be on hand to discuss technical details. For information on becoming a forum exhibitor, please call (714) 861-3339.

FORUM PROCEEDINGS

Copies or Tapes of all forum sessions, workshops, and panel discussions are available including those from SCSI forums, please call (714) 861-3339 for further information.

REGISTRATION INFORMATION

- **Fees:**
  The registration fee of $895 for the 2½ day IPI Forum includes attendance at all sessions, conference materials, exhibitors reception (cocktails and buffet), 2 luncheons, refreshments during breaks, banquet, gratuities, and taxes. The registration fee of $695 for the 2 day Peripheral Forum includes all of the same items as for the IPI Forum, except the banquet.
- **Hotel Accommodation:**
  A block of rooms has been reserved for forum delegates at the San Jose Hyatt. It is recommended that you register early by returning the hotel registration card mailed to you with your conference registration confirmation or by calling (408) 298-0300 and identifying yourself as a forum delegate.
- **Attendance:**
  Since attendance will be limited in order to preserve an appropriate atmosphere within which to learn and interact with other delegates, it is recommended that your registration form and payment be mailed early.
- **For further information call (714) 861-3339**

CIRCLE NO. 108 ON INQUIRY CARD

REGISTRATION FORM

- Please Register me for the following:
  - ☐ IPI Forum, San Jose Hyatt, June 17-19, 1985. $895
  - ☐ Peripheral Forum; San Jose Hyatt; June 20-21, 1985. $695
- Delegate Information:

Name_____

Title _____ Phone _____

Company _____

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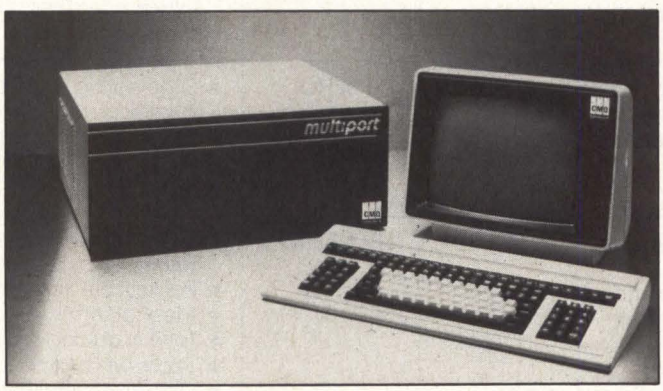
- ☐ I have enclosed the names and titles of additional personnel from my company and noted which Forum(s) they wish to attend.
- ☐ 25% Consecutive Forum Discount applies. I/We are attending both Forums as indicated above and in the enclosure.
- ☐ 25% Group Discount applies. There are a minimum of 4 additional delegates from my company whose names are enclosed.
- Registrations cannot be accepted unless accompanied by full payment. Please make checks payable to **Technology Forums** and mail to 23409 Coyote Springs Dr., Diamond Bar, CA 91765.

Interactive terminal system accesses multiple hosts, peripherals

- Five port interfaces
- 9-, 12- or 23-inch CRT
- Supports varied protocols

Multiport II is an interactive terminal system, consisting of a model 2750 video display terminal (VDT) and a model 2700 control unit. The system furnishes a cluster of terminals and printers with independent and simultaneous access to multiple-host computers utilizing both leased-line and packet-switching networks. Performing asynchronous and synchronous communications in character and block modes, the system is compatible with 3270 Binary Synchronous Communications (BSC), X.25/3270, X.25/Interactive Terminal Interface (ITI) and SDLC and HDLC protocols. The model 2700 control unit supports eight VDTs and two printers.

In 3270 mode, the control unit communicates to the host computer as an IBM Corp. 3274 model 51C control unit, which supports the BSC protocol. No hardware or software changes are required at the host. Data on the model 2750 VDT appears as an IBM 3278-02 screen display. The control unit supervises 3270 BSC communications over leased lines in point-to-point and multipoint network configurations at speeds up to 9,600 baud. A Multilink feature lets four model 2700 control units access one 3270 communications port, permitting the operation of 32 devices, eight of which can be printers.



The Multiport II interactive terminal system *provides a cluster of terminals and printers with independent and simultaneous access to a variety of host computers and data communications networks.*

The system's X.25/ITI communications port supports the CCITT X.25 standard and conforms to the Bell Canada DATAPAC Standard Network Access Protocol (SNAP) and the higher-level ITI conventions. The port can be configured to accommodate HDLC LAP or LAPB Frame-Level procedures.

An optional proprietary Packet-Switching Processor (PSP) provides access to 3270 hosts over packet-switching networks handling CCITT X.25. The 3270 communications port is compatible with DATAPAC 3303, providing 3270 communications over the DATAPAC packet-switching network. The hosts can connect to the network by PSPs or with DATAPAC Access Software (DAS) in the front-end processor. By using the packet-switching network, DAS software allows SNA hosts to communicate with Multiport II.

The 12-inch, green, monochrome monitor displays 80 characters by 24 lines in a 5-by-7 dot-matrix format; the keyboard comprises 124 alphanumeric, function and control keys and generates as many as 256 ASCII character codes. An EIA RS232C printer interface is provided. $4,600, control unit; $1,375, display terminal. **CMQ Communications Inc.,** Suite 920, 60 Yonge St., Toronto, Ontario, M5E 1H5, Canada, (416) 365-7171. **Circle No 217**

Monitors achieve high resolution

- 9- or 12-inch screen
- Up to 4,096 colors
- 25 columns lines by 80 columns

The HX-9E 9-inch, RGB monitor is compatible with IBM PCs and compatibles and Apple computers with RGB capability. Showing 2,000 characters or 25 lines by 80 columns of text, the unit operates on dual-scan frequencies. At 15.75 kHz, the monitor supports IBM graphics software and displays 640 dots by 200 lines; at 22 kHz, 640 dots by 350 lines. A 0.28-mm, dot-pitch, dark-face tube displays 16 colors in the Apple mode and 16 or 24 colors in the IBM mode. The SR-12P, 12-inch RGB monitor displays 690-by-480-dot, non-interlaced resolution on a 0.31-mm, dot-pitch tube. The monitor's analog input permits 4,096 colors. When configured with the IBM Professional Graphics Card, the monitor shows 256 colors simultaneously with 640-by-480-dot resolution. In the emulation mode, the unit achieves 640-by-400-dpi resolution, and generates 25 lines by 80 columns. $650, model HX-9E; $999, model SR-12P. **Princeton Graphic Systems,** 170 Wall St., Princeton, N.J. 08540, (609) 683-1660 or (800) 221-1490.

Circle No 218

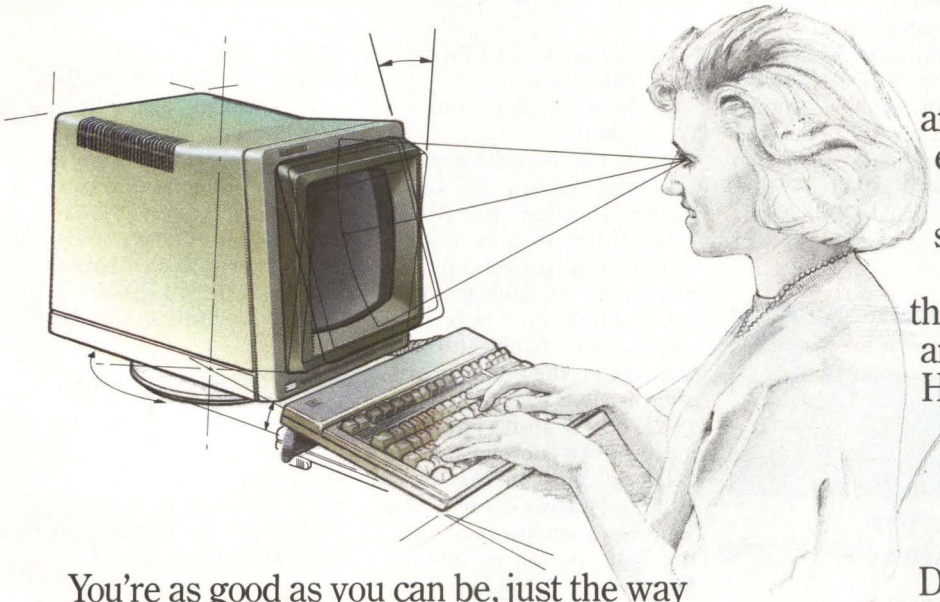
Terminal reduces eye fatigue

- 15-inch screen
- 80 or 132 columns
- 33 control keys

Reducing eye fatigue with clearer characters, the E-32 ergonomic terminal offers a 15-inch, non-glare, tilt-and-swivel screen. Displaying 80 or 132 columns, the unit is compatible with the ANSI 3.64 standard and the DEC VT52, VT100 and VT132. Transmission speeds range from 50 to 19.2K baud in half- or full-duplex mode. The keyboard includes 33 control keys, a 14-key numeric pad and three character sets. $1,275. **Tab Products Co.,** 1400 Mill Page Road, Palo Alto, Calif. 94304, (415) 852-2400.

Circle No 219

We couldn't improve on you. So we improved on your terminal.



You're as good as you can be, just the way Nature made you. Unfortunately, Nature doesn't make computer terminals. So at Hewlett-Packard, we've been making improvements on terminals, to make them work more agreeably with you.

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What's more, the HP2392A has ANSI, so it's DEC-compatible.

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The HP2392A. The terminal that works with people.

Find out more. Just call your local HP sales office, listed in the white pages. Or write to Terry Eastham, Hewlett-Packard, Dept. 008215, 8020 Foothills Boulevard, Roseville, CA 95678.

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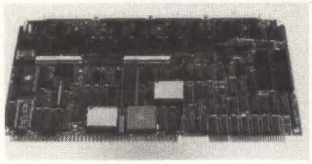
PGO2507

CIRCLE NO. 109 ON INQUIRY CARD

DATACOMM



Computer has cluster-control

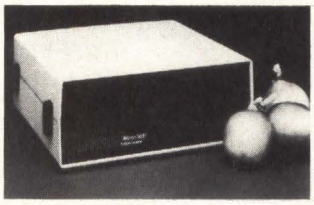
- Eight I/O channels
- 64K bytes of RAM
- Four controllers

Managing multiuser, multiprotocol communications tasks, the iSBC 188/48 single-board computer functions as a cluster controller, a front-end processor or as a standalone system. Firmware suports 12 asynchronous terminals. The unit contains four 82530 serial communications controllers that provide eight channels of I/O, 64K bytes of dual-port RAM and two universal memory sites accommodating 64K bytes of PROM/EPROM. Six of the eight I/O channels support RS232 interfaces; two are configurable among RS232C/422/449. The controllers support asynchronous and synchronous communications and incorporate HDLC and SDLC protocols. iRMX and XENIX operating systems are supported. $2,995. **Intel Corp.,** 5200 N.E. Elam Young Parkway, Hillsboro, Ore. 97123, (503) 640-7147. **Circle No 320**

Modems are Bell-compatible

- EIA RS232C port
- 300 to 1,200 baud
- Auto answer

For telecommunications systems with an EIA RS232C port and a modular telephone jack, the models KX-D4130, KX-D401 and KX-D402 automatic modems are Bell 103- and 113-compatible. All three models offer an auto-answer function that receives data automatically when left unattended. The 300-baud KX-D4130 contains a 24-station automatic dialer that stores 30 digits in each station. Other features include auto redial and speakerphone with on-hook dialing capability. In receive mode, the model KX-D402 furnishes an auto selector function at 300 or 1,200 baud. The model KX-D401 transmits data at 300 baud; features include originate, answer and auto-answer power controls as well as LED indicators for auto answer, data, carrier, answer and power. $199.95, model KX-D4130; $299.95, model KX-D402; $99.95, model KX-D401. **Panasonic Industrial Co.,** One Panasonic Way, Secaucus, N.J. 07094, (201) 348-7182. **Circle No 321**



Converter emulates IBM 3270

- 16 channels
- Inbound priority levels
- Password protection

Emulating standard IBM 3270 functions, the 16-channel Micro 7400 protocol converter allows asynchronous ASCII terminals and personal computers to access IBM mainframes as 3270-class devices. Appearing to the host computer as an IBM 3274 Model 61C cluster controller, the protocol converter communicates in either bisynchronous or SNA/SDLC protocol. Attached asynchronous devices function as IBM 3278 display stations, IBM 3279 color display stations or IBM 3287 printers. Features include automatic logon, inbound priority levels, banner and broadcast messages and password protection security features. The unit can switch between two IBM host computers or between an IBM host and an many as eight asynchronous computer ports. $5,650. **Micom Systems Inc.,** 20151 Nordhoff St., Chatsworth, Calif. 91311, (818) 998-8844.

Circle No 322

System handles networking

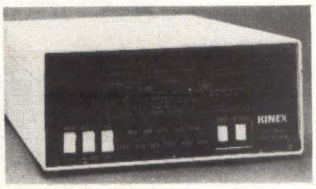
- Supports 19.2K-bps data rates
- Menu-driven console control
- 16-bit microprocessor

Linking groups of workstations together, the PACX 2000 distributed switching system aids networking requirements of intelligent devices. Based on a 16-bit microprocessor, bandwidth and fiber optics, the unit supports asynchronous data rates to 19.2K bps. Features include a menu-driven console control, network configuration flexibility, messaging capacity, diagnostic capabilities and security structure via passwords. Prices begin at $8,500; $200 for each attachment. **Gandalf Data Inc.,** 1019 South Noel, Wheeling, Ill. 60090, (312) 541-6060. **Circle No 323**

Modem operates at 4,800 bps

- Bell 208AB-compatible
- Full- or half-duplex mode
- Leased or dial-up lines

Intended for full- or half-duplex, synchronous operation, the 48/208AB Model 1 Bell 208AB-compatible modem transmits data at 4,800 bps over leased or dial-up lines. The modem serves personal computers using asynchronous protocols in synchronous networks. Front panel switches permit selection between the 208A and 208B modes. Features include



auto-answer and auto-disconnect capabilities, auto-dialer compatibility and low power consumption. Diagnostics include a line-quality display feature providing continuous information on the condition of the telephone line; display of all EIA connector leads; analog, local and digital loopbacks for problem isolation; self-test; test-pattern generator and an integral bit-error-rate (BER) tester. $1,700. **Nokia-Kinex Corp.,** 6950 Bryan Dairy Road, Largo, Fla. 33543, (813) 541-6404.

Circle No 324

Multiplexers work with VAX, PDP-11

- Support 16 and 24 lines
- DMA operation
- Half- or full-duplex communication

The DHU11 multiplexer interfaces as many as 16 asynchronous lines between DEC PDP-11 or VAX computers with an integral UNIBUS operating under Version 4.0 of the VAX/VMS operating system. It connects to external equipment through RS232C and RS432A interfaces. The DMZ32 multiplexer, which supports as many as 24 asynchronous lines to Unibus-based VAX computers, permits a terminal distribution panel to be located 5,000 feet away. Both multiplexers operate in DMA mode, provide half- or full-duplex communications and furnish a 256-character first-in-first-out (FIFO) buffer. $3,120, DHU11; $3,215, DMZ32. **Digital Equipment Corp.,** 146 Main St., Maynard, Mass. 01754, (617) 897-5111. **Circle No 325**

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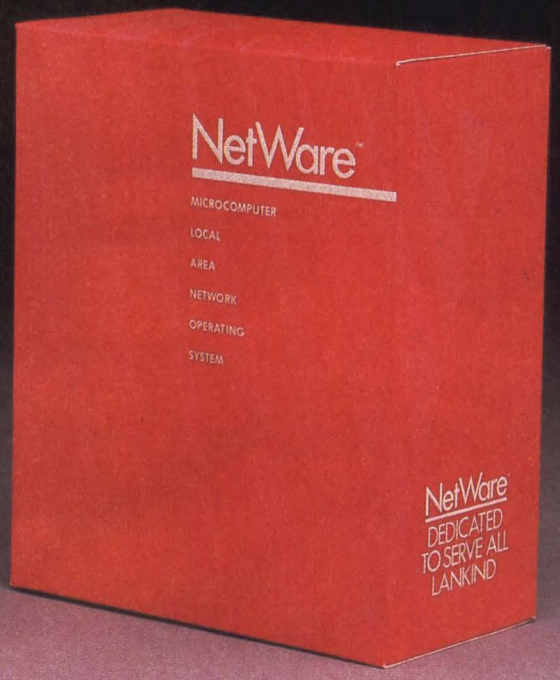
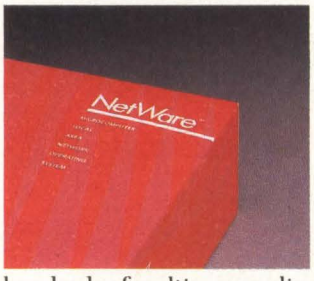
CIRCLE NO. 110 ON INQUIRY CARD

Name-dropping just isn't enough to impress the network critics.



Now that the local area network (LAN) industry is booming, some pretty big names in the computer business are jumping on the bandwagon. Their goal is simple: get a LAN on the market and let all those who pay homage to The Name run out and buy it.

At Novell, we don't have a big name to drop when selling NetWare, our high-performance LAN operating system. So we let our technology do the talking. And the network critics are not only listening, they are taking notice.



Performance.

No LAN operating software outperforms NetWare. With speed, flexibility, security and hundreds of multiuser applications, NetWare sets a standard for the entire LAN industry.

Versatility.

NetWare is more than a LAN operating system. Currently, NetWare software is available for 24 LAN hardware systems. Plus, four complete LAN systems are sold and serviced by Novell.

Compatibility.

Because NetWare is compatible with DOS 3.1, it can run any application written for the IBM PC Network Program. And NetWare greatly increases IBM PC Network performance and applications software useability.

Internetworks.

Using bridges, NetWare can connect separate LAN systems into one large internetwork. In fact, every LAN Novell supports can be interconnected—any number, in any of the various topologies.

Remember the name.

The one LAN system making a big impression on the network critics is the one with the not-so-big name: NetWare, from Novell. Remember it when you want a high-performance LAN instead of a high-powered name.

For more information, call or write:

Novell

Novell, Inc. 1170 N. Industrial Park Drive,
Orem, Utah 84057 (801) 226-8202

CIRCLE NO. 111 ON INQUIRY CARD

Protocol converter adds ports

- Two SNA/SDLC ports
- 15 programmed protocols
- 12 or 28 expandable ports

The 8814 and 8830 protocol converters enable users to add ports, to configure protocols when an ASCII device is changed and to communicate among ports. Model 8814 furnishes six ASCII ports, expandable to 12; model 8830, eight ports, expandable to 28. Both models provide two 19,200-bps SNA/SDLC ports emulating the IBM 3270 cluster controller and supporting 32 logic units of Types 1, 2 and 3. Protocols for 15 terminals, printers and personal computers are permanently programmed. Asynchronous "side door" ports permit terminals to communicate with minicomputers and microcomputers equipped with asynchronous communications handlers. $4,000, model 8814; $10,000, model 8830. **Kaufman Data Communications Inc., an Orange Nassau Electronics Co.,** 145 E. Dana St., Mountain View, Calif. 94041, (415) 962-8811.

Circle No 326

Modem operates at 2,400 bps

- Auto-dial
- Auto-answer
- Bell 212A-compatible

Operating asynchronously or synchronously with dial-up phone lines, the Cermetek 2400 modem runs at 2,400 or 1,200 bps. The auto-dial, auto-answer modem is compatible with the CCITT V.22bis and Bell 212A standards. The modem's compatibility with the Hayes "AT" software commands allows use with Microstuf's Crosstalk, Lotus' Symphony and Ashton-Tate's Framework software. Features include an error-correcting protocol, an electronic call-progress tone detection and two front-panel buttons used to switch between voice and data on the same line. $795. **Cermetek Microelectronics Inc.,** 1308 Borregas Ave., P.O. Box 3565, Sunnyvale, Calif. 94088-3565, (408) 752-5000.

Circle No 327

Multiplexer has five channels

- SDLC error control
- Channel switching
- Password security

The LineMux switching multiplexer statistically concentrates as many as five asynchronous ASCII devices over a synchronous data link. Features include channel switching, ID and password security with automatic callback, network control and management and synchronous data-link control, error control and retransmission. The unit supports 16-bit CRC and input speeds of 50 to 9,600 baud. Available are X-on/X-off, CTS and RTS flow control. A report generator and printer port are optional. $1,545. **Backus Data Systems Inc.,** 1440 Koll Circle, Suite 110, San Jose, Calif. 95112, (408) 279-8711.

Circle No 328

Little Board™ $349*

CP/M 2.2 INCLUDED

*UNDER $200 IN OEM QUANTITIES

- 4-MHz Z80A CPU, 64K RAM, Z80A CTC, and 2732 Boot ROM
- Mini/Micro Floppy controller (1-4 Drives, Single/Double Density, 1-2 sided, 40/80 track)
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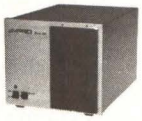
  - Read/write to more than two dozen other formats (Kaypro, Televideo, IBM CP/M86...)
  - Format disks for more than a dozen other computers
  - Menu-based system customization
- BIOS and Utilities Source Code available

BOOKSHELF™ *Series 100*

AS LOW AS $635 IN OEM QTY

MODEL	QTY 1 PRICE
121 1 400K DSDD Drive	$ 895.00
122 2 400K DSDD Drives	995.00
142 2 800K DSQD Drives	1,095.00



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- Runs thousands of CP/M programs
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- 10 MB hard disk version available
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SCSI/PLUS™ Adapter

Compatible with most Z80 Systems
(send $10 for complete specifications)

- Mounts directly to Little Board
- Multi-Master high-speed parallel bus
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CIRCLE NO. 112 ON INQUIRY CARD

Graphics software suits Penpad tablet

- Operates on PC DOS 2.0, 2.1
- Compatible with IBM PC
- Supports Polaroid Palette

Developed for the Penpad 320 tablet, Videogram software enables the IBM PC user to draw, color, graph, label, chart or trace by touching the Pencept pen to the Penpad tablet. The pen acts as a brush, pointer or indicator to draw and write on the tablet and to invoke English commands. The software interfaces with the Polaroid Palette slidemaking system for in-house presentation graphics production. Features include a library of 24 "paintbrushes," 37 fonts, shape library, magnify and fill functions, a screen grabber utility and 16-color resolution with a 320-by-200-dot display. The software requires an IBM PC or AT with 320K bytes of memory, PC DOS 2.0 or 2.1, Penpad tablet, Plantronics Color Plus display card and a color display. $300. **Pencept Inc.,** 39 Green St., Waltham, Mass. 02154, (617) 893-6390.

Circle No 329

Print manager is UNIX-based

- Multiple queue support
- Printer sharing
- Queueing by menu or UNIX format

Running on UNIX or UNIX-compatible operating systems, Spooler-PLUS software controls print functions for multiuser, multiprinter applications. The software directs, sequences and schedules print jobs by assigning priorities for each document. An interface with direct command options modifies and implements print assignments. The multiple-queue-support function defines multiple queues, formats documents for selected specifications (type of paper or lines per page) and directs similar document groups to a single queue. Documents can be queued for processing using either the UNIX standard command format or a profile-driven menu screen. $300, one to four users; $600, four to eight users; $995, eight to 64 users. **Rabbit Software Corp.,** Great Valley Corporate Center, One Great Valley Parkway East, Malvern, Pa. 19355, (215) 647-0440.

Circle No 330

Indexing software creates windows

- Telecommunications capability
- Indexing system
- Paragraph reform, pagination

WordStar 2000 and WordStar 2000 Plus software packages integrate word-processing functions with telecommunications and database applications. Creating screen windows for editing three documents, WordStar 2000 includes a spelling corrector, automatic paragraph reform, pagination and dictionary-based hyphenation. WordStar 2000 Plus sends or receives documents via electronic mail or accesses information services. An indexing system compiles indexes or tables of contents and numbers paragraphs. Both packages are compatible with the IBM PC, PC/XT and PC-AT. The programs require 256K bytes of RAM (320K bytes for DOS 3.0 and the PC-AT) and two floppy disk drives. WordStar 2000, $495; WordStar 2000 Plus, $595. **MicroPro International Corp.,** 33 San Pablo Ave., San Rafael, Calif. 94903, (415) 499-1200.

Circle No 331

Software builds schematics

- Multiple gate definitions
- 128 component pin names
- Text mode

Converting the IBM PC/XT into a PCB CAD system, the Dasoft 16S design automation software package comes with a component library, design and library editors and a graphics-oriented, design-entry routine. Building schematics on the CRT screen, the menu-driven software displays and positions symbols from the library. Information stored for each component includes pin names, footprints (128 pins and four pad shapes), multiple gate definitions and symbol descriptions. A text mode with defined title blocks displays comments on the schematic page. $2,000. **Dasoft Design Systems Inc.,** Suite 113, 2550 Ninth St., Berkeley, Calif. 94710, (415) 486-0822.

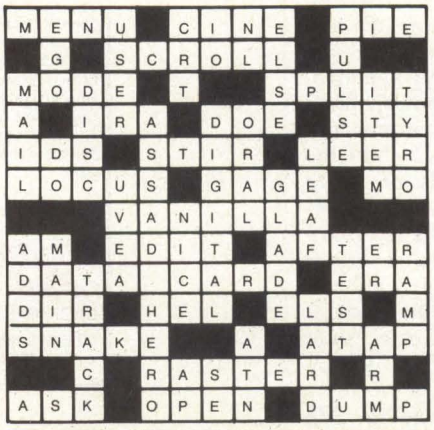
Circle No 332

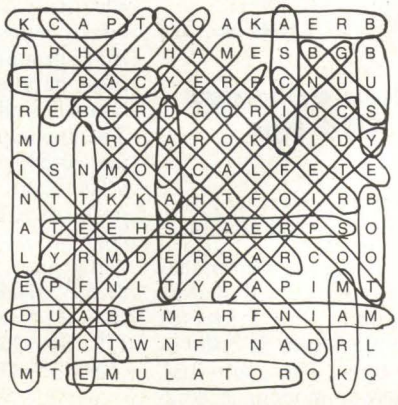
Software handles incompatible OSs

- Suits VAX VMS and UNIX
- Implements Courier Presentation/Session protocol

Offering file-transfer, access and maintenance services through interactive and runtime interfaces, the ACCES Network File Management System (FMS) manipulates complete files or individual blocks across a network of incompatible operating systems. Adhering to the sixth layer of the Open Systems Interconnection (OSI) reference model, it integrates with protocol packages based on XNS that use the Courier Presentation/Session protocol. The network file header loses no information as the file is moved, even though the host maintains different file attri-

ANSWERS TO FEBRUARY'S PUZZLES





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A built-in RS-232C serial interface board lets NCR standalone 40 column printers work with any system configuration.

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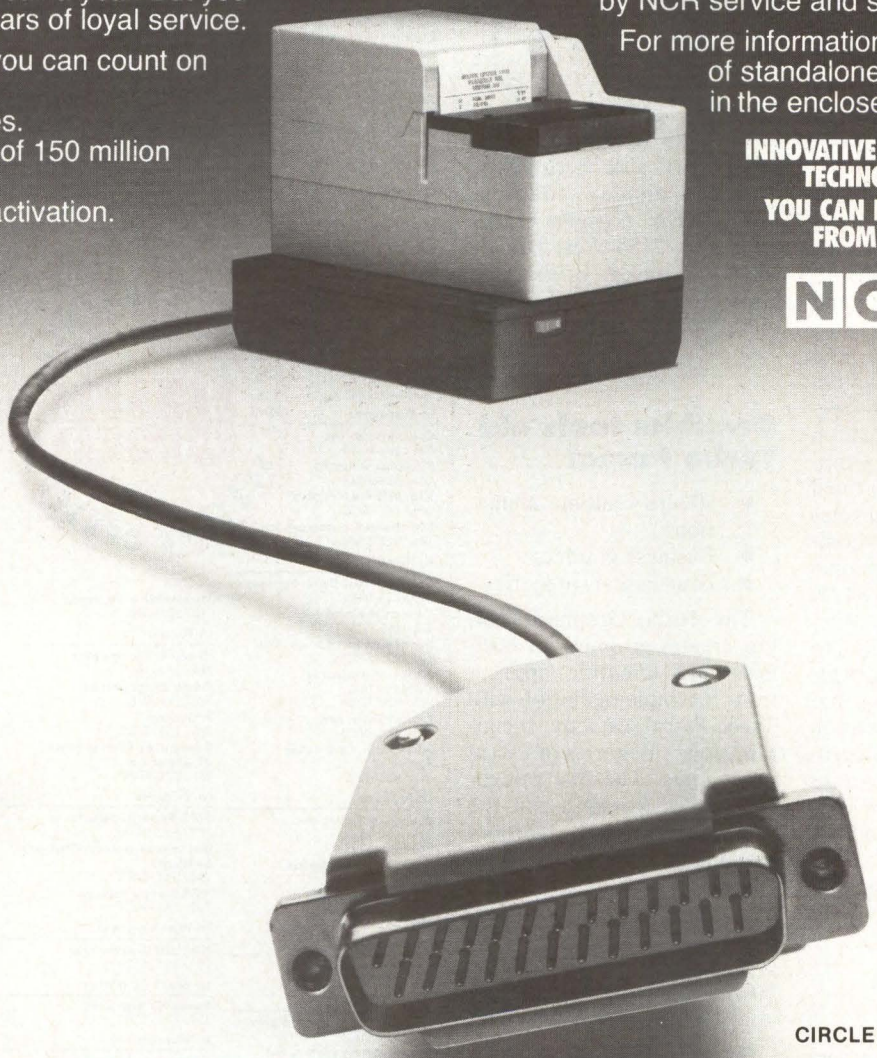

CIRCLE NO. 113 ON INQUIRY CARD

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butes. $25,000, source copies written in C. **Advanced Computer Communications,** 720 Santa Barbara St., Santa Barbara, Calif. 93101, (805) 963-9431.

Circle No 333

Packages translate English sentences

- Requires TI Professional Computer
- Works with MS-DOS, SuperCalc 3
- Employs windowing

NaturalLink software, consisting of 10 packages, interacts with MS-DOS, MultiMate, WordStar, BPS Business Graphics, SuperCalc 3, dBaseII, PeachText 5000, EasyWriter II, Multiplan and R:BASE Series 4000 using English commands. The packages translate English sentences into commands recognized by the application software packages. Command syntax is common to all programs. The packages require a TI Professional Computer or Portable Professional with MS-DOS 2.1, 512K bytes of RAM and a Winchester disk. Access to MS-DOS requires 256K bytes of RAM with additional memory for most application programs. $75. **Texas Instruments Inc.,** Data Systems Group, P.O. Box 809063, Dallas, Texas 75380-9063, (800) 527-3500.

Circle No 334

Software transfers ASCII files

- Bidirectional file transfer
- Serial, parallel printer support
- Macro programming capability

Either locally or remotely, ZSTEMpc software connects an IBM PC, PC-compatible or a Zenith pc series system to any DEC minicomputer, superminicomputer or any computer supporting a VT100 terminal. The configurable package includes bidirectional ASCII and XMODEM file transfers, concurrent serial and parallel printer support and macro programming capability. Written in 8088 assembler code, it supports 38.4K baud with throughput of 15K baud in 80-column mode and 9K baud in 132-column mode. The software runs on MS-DOS or PC-DOS operating systems and requires 128K bytes of RAM, a serial port and a color or graphics display adapter. $150. **KEA Systems Ltd.,** Suite 412, 2150 West Broadway, Vancouver, British Columbia, Canada V6K 4L9, (604) 732-7411.

Circle No 335

Graphics tools aid Turbo Pascal

- 500-ips realtime animation
- Business graphics
- Four Pascal categories

The Turbo Graphics Toolbox creates graphics for business and scientific applications for implementation with Turbo Pascal software. It contains four categories of Pascal procedures. The first category handles windows and the second controls window movement. The third enables storage of graphic screen images on disk, or hardcopy printouts and storage of screen images in RAM with 500-ips animation in real-time applications. The last set includes business graphics procedures for drawing piecharts, barcharts and general-purpose graphics. The program comes with commented source code on disk for use with Turbo Version 1.0 or 2.0. $54.95. **Borland International,** 4113 Scotts Valley Drive, Scotts Valley, Calif. 95066, (408) 438-8400.

Circle No 336

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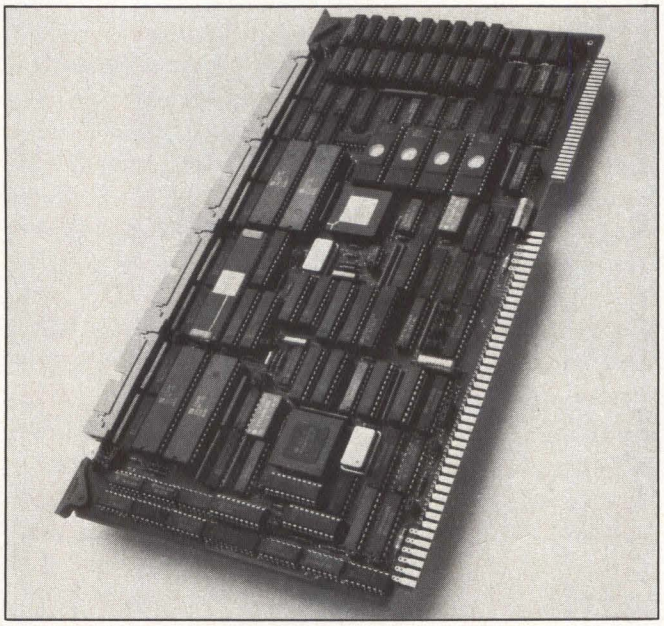
CIRCLE NO. 114 ON INQUIRY CARD

Serial board expands Multibus performance

- 10-MHz operation
- 68000 or 68010
- Eight channels



Offering *a choice of 128K bytes or 512K bytes of dual-ported, dynamic RAM, the M68COM intelligent, octal serial board functions as the main master in a Multibus system or as a data concentrator.*

The latest addition to the ModulasTen Multibus-compatible line, the M68COM intelligent, octal serial board boosts the power and speed of a Multibus system. With eight independent, full-duplex channels and a 16- or 32-bit 68000 or 68010 microprocessor unit (MPU), the board runs at 10 MHz with no wait states for memory reads and writes. An optional 10-MHz, four-channel direct-memory-access (DMA) controller, programmable to switch among the eight channels, handles high-speed data links. The board comes with 128K bytes or 512K bytes of dual-ported, dynamic RAM with parity protection. Four EPROM sockets accommodate 256K bytes of EPROM.

Four multiprotocol serial-communications controllers program the eight channels independently to run in asynchronous, byte-synchronous or bit-synchronous mode. The eight ports can be independently configured as an RS232, RS422, RS423, fiber-optics or direct-connect modem channel.

The M68COM functions as the main master in a Multibus system, running the UNIX-like Regulus operating system. Used as a standalone data concentrator, the board connects a cluster of terminals and/or printers to a remote computer, delivering data at 880K bits per second (bps). For example, seven channels running in asynchronous mode can be multiplexed into a single, high-speed synchronous communications line. As a communications link, the board handles high-speed lines traveling to and from other computers or communications systems. It supports all communications protocols and handles store-and-forward and packet-switching communications protocols.

Used as a front-end to the main master in a Multibus system, the board relieves the main master of character-by-character interrupt handling required by serial devices. Acting as an I/O processor, the M68COM serves UNIX-based 68000 multiuser systems by receiving downloaded custom programs from the system.

Each channel on the M68COM has three interrupt sources that are software-programmable. A mailbox-interrupt feature, useful in multimaster applications requiring communication between the main master and the M68COM's MPU, allows another Multibus master to generate a local interrupt on the board.

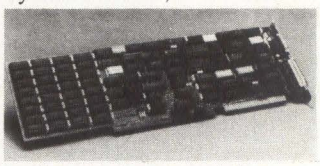
A 68230 Parallel Interface/Timer (PI/T) chip provides an on-board timer that generates periodic system interrupts to the M68COM. The board supports programmable baud rates from less than 5 baud to 38.4K baud. External baud-byte swapping or non-byte swapping can be selected for the board's accesses to shared memory through the Multibus.

PROBUG, a monitor for debugging programs written for the 68000, is included on the board. $1,595 with 68000 MPU, dynamic RAM and a DMA controller, Q100. **SBE Inc.,** 2400 Bisso Lane, Concord, Calif. 94520, (415) 680-7722. **Circle No 337**

Board furnishes 256K-byte RAM

- 8088 CPU
- Two serial ports
- IBM PC-compatible

The PC-SLAVE/16 8-MHz, 16-bit single-board processor is hardware- and software-compatible with the IBM PC. The board becomes a second personal computer by plugging it into the PC bus and adding a dumb terminal. It includes an Intel 8088 CPU, 256K bytes of bank-selectable dynamic RAM, a PC bus in-



terface and two serial ports. For more than two users, only the PC/SLAVE/16 and a terminal is needed; the orginal PC becomes the master PC processor. The proprietary RTNX Executive Software allows the master PC and slave PCs (12 maximum) to share disks, peripherals and data. $1,095. **Advanced Digital Corp.,** Huntington Beach, Calif. 92649, (714) 891-4004. **Circle No 338**

Memory board stores 256K bytes

- VME bus-compatible
- 200-nsec access time
- 8K-by-8 CMOS RAMs

Compatible with VME bus systems, the MM-6600C memory board provides as much as 256K bytes of nonvolatile memory with a cycle and access time of 200 nsec, 8K-by-8 CMOS RAMs and two redundant, fused batteries. With no CMOS RAM, the board furnishes 512K bytes of 2128 EPROMs; it can mix CMOS RAM and EPROM in equal proportions. Features include 24-bit random access addressing of 16M bytes and address modifiers in EPROM that support

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CIRCLE NO. 115 ON INQUIRY CARD

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CIRCLE NO. 116 ON INQUIRY CARD

user and supervisory modes. Available in 256K-, 128K-, 64K- and 32K-byte CMOS RAM versions. $1,750. **Micro Memory Inc.,** 9436 Irondale Ave., Chatsworth, Calif. 91311, (818) 998-0070.

Circle No 339

Host adapter suits Multibus

- SCSI integration
- 8-bit data-path link
- 8- to 24-bit addressing

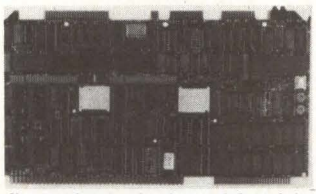
Installed on a printed-circuit board with a standard Multibus system interface, the MB01 host adapter integrates SCSI-based disk and tape storage devices with IEEE 796 Multibus systems. The unit provides an 8-bit data-path link between the microcomputer Multibus and the SCSI interface, which supports seven SCSI devices and the host adapter. Configured for serial or parallel bus arbitration through DIP switch selection, it responds to vectored and non-vectored interrupts. It supports 8-, 16- or 24-bit I/O addressing as well as 8- and 16-bit microprocessors. $695. **Emulex Corp.,** 3545 Harbor Blvd., P.O. Box 6725, Costa Mesa, Calif. 92626, (714) 662-5600.

Circle No 340

SBC offers zero-wait-state RAM

- 128K byte of PROM
- 24 parallel I/O lines
- Two iSBX connectors

The ZX-186/30 single-board computer employs the 8207 dynamic RAM controller and 41K-bit or 41256 256K-bit DRAMS. With the 4164, the iSBC-compatible board provides 128K bytes of dual-ported RAM with parity; with the 41256 it provides 512K bytes or 1M byte of RAM. In the 128K-byte con-



figurations, the board furnishes 128K bytes of dual-ported RAM or 64K bytes of local RAM and 64K bytes of dual-ported RAM. The second configuration gives the iAPX-186 processor local memory that cannot be accessed by other bus masters. The board provides four 24 or 28-pin PROM sockets for as much as 128K bytes of PROM. In minimum configuration, the computer supports one RS232C-compatible USART and 24 programmable parallel I/O lines. The second serial port is RS232C- or RS422A/449-compatible, which when combined with the two DMA channels on the 80186, gives the second port an 800K-byte baud rate in bit-sync mode. $1,550 for 128K bytes of RAM; $2,500 for 512K bytes of RAM, quantity 100. **Zendex Corp.,** 6644 Sierra Lane, Dublin, Calif. 94568, 828-3000.

Circle No 341

I/O board works with STDbus

- 12 programmable modes
- 4 differential analog inputs
- 8 analog outputs

Compatible with the STDbus, the RSD-7518 intelligent analog I/O board provides four differential analog inputs, eight single-end analog inputs and eight analog outputs. The board operates with a Z80 or 8085 CPU to 4 MHz, a 6800 or 6809 CPU to 2 MHz or an 8088 CPU to 8 MHz. It furnishes memory mapping to decode 16 addresses, or I/O mapping to decode 8 or 16 addresses, uses four consecutive bytes for addressing and offers 12-bit resolution. The host commands the on-board microprocessor to operate in 12 modes: six input and six output. The differential inputs have resistor-programmable gain from X1 to X1000; the single-end inputs, from X1 to X10. $595. **Robotrol Corp.,** 16100 Caputo Drive, Morgan Hill, Calif. 95037, (408) 778-0400.

Circle No 342

Computer board runs on G-64 bus

- Single-height Eurocard
- 4-MHz Z80 CPU
- 2K bytes of RAM

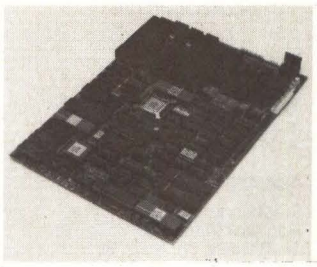
Based on the 8-bit, 4-MHz Z80 CPU, the GESMPU-5A microcomputer board conforms to the single-height Eurocard and is compatible with the G-64 bus. Features include a socket for 2K or 4K bytes of EPROM, 2K bytes of RAM with power-fail logic and an RS232C port with a programmable baud rate generator for 50 to 19.2K baud. A page register extends the addressing range to 128K bytes on the G-64 bus. The unit employs a DIN 41612 connector and runs on the CP/M operating system. $375. **Gespac Inc.** 550 E. Grandview, Mesa, Ariz. 85203, (602) 962-5559.

Circle No 343

Computer board targets IBM OEMs

- IBM PC-compatible
- Two EPROM sockets
- Video, disk controllers

The SBM-88 PC Engine, an IBM PC-compatible, single-board microcomputer, supports the UNIX/XENIX, CP/M, MS-DOS and RMX operating systems. The board comes with monochrome video and floppy disk control-



lers, parallel and serial I/O lines and connectors, five PC-compatible daughterboards and an expansion bus. Two 28-pin EPROM sockets support the proprietary BIOS ROM (one socket) or user-developed code. The board is also socketed for the 8087 mathematics coprocessor and 256K bytes of RAM. $500. **Mostron Inc.,** 560 Valley Way, Milpitas, Calif. 95035, (408) 946-1727.

Circle No 345

Board converts terminal into PC

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Requiring no changes to the terminal, the host computer or the personal computer, the Trilink integration board converts asynchronous terminals into a personal computer without disrupting the existing data-processing network. The board plugs directly into an IBM PC, PC/XT or PC/XT-compatible expansion slot and contains a Z80 microprocessor. Operating from two RS232C interface ports for host and terminal connections, it uses non-volatile memory to store 32K bytes of RAM; 8K bytes of ROM handle the firmware. An adapter cable connects the host communications line, the asynchronous terminal and the PC keyboard. $494. **Tripas Technologies Inc.,** #203, 37053 Cherry St., Newark, Calif. 94560, (415) 794-1936.

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2-4 **1985 IEEE Microprocessor Forum: "Pathways to Design Productivity,"** Bally Park Place Casino Hotel, Atlantic City, N.J., sponsored by the Philadelphia Electric Co. Contact: Gerald W. Gordon, Philadelphia Electric Co., 2301 Market St., N3-1, Philadelphia, Pa. 19101, (215) 841-4676.

2-4 **UNIX Systems Exposition '85,** Palais des Congrès, Paris, organized by Network Events Ltd. Contact: Network Events Ltd., Printers Mews, Market Hill, Buckingham, MK18 1JX, England, (0280) 815226.

9 **SCSI Forum,** Fairmont Hotel, Denver, sponsored by Technology Forums. Contact: Joe Molina, Technology Forums, 23409 Coyote Springs Drive, Diamond Bar, Calif. 91765, (714) 861-3339.

9-10 **Fiber Optic Market and Technology Trends for the '80s Conference,** Logan Airport Hilton, Boston, sponsored by Information Gatekeepers Inc. Contact: Information Gatekeepers Inc., 214 Harvard Ave., Boston, Mass. 02134, (617) 232-3111.

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10-13 **International Personal Computer Business Software Market (MIL '85),** Cannes, France, sponsored by the Midem Organisation. Contact: Gordan Curran, Commissariat Général, 179, Avenue Victor Hugo 75116, Paris, France, (33) (1) 306.63.99.

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15-16 "Data Communications and Networking for the IBM PC and Other Personal Computers" Seminar, New York, sponsored by Digital Consulting Associates Inc. Contact: Dorothy Daly Marshall, Operations Coordinator, Digital Consulting Association Inc., 6 Windsor St., Andover, Mass. 01810, (617) 470-3870. Also to be held on April 22-23, Chicago.

17-24 1985 Hannover Fair, Hannover, West Germany, sponsored by Deutsche Messe Und Ausstelungs-AG. Contact: The Hannover Fair Information Center, P.O. Box 338, White House, N.J. 08888, (201) 534-9044.

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20-22 Speech Tech 85 Voice Input/Output Applications Show, Vista International Hotel, New York, sponsored by Media Dimensions Inc. Contact: Stanley Goldstein, Media Dimensions Inc., P.O. Box 1121, Gracie Station, New York, 10028, (212) 772-7068.

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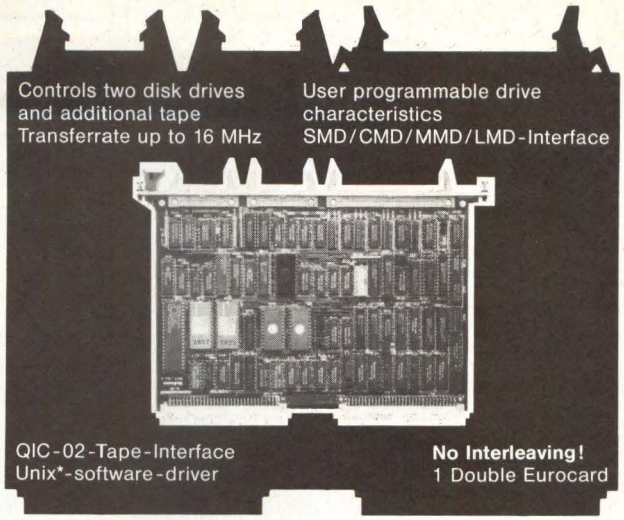

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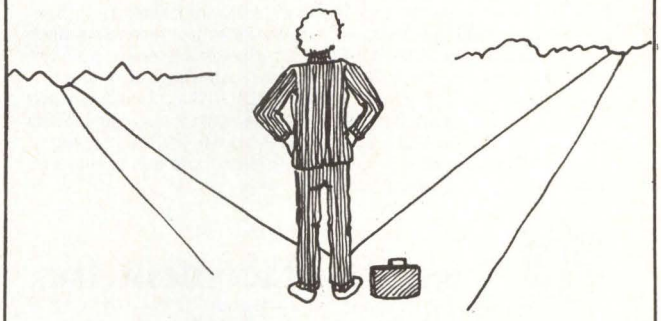

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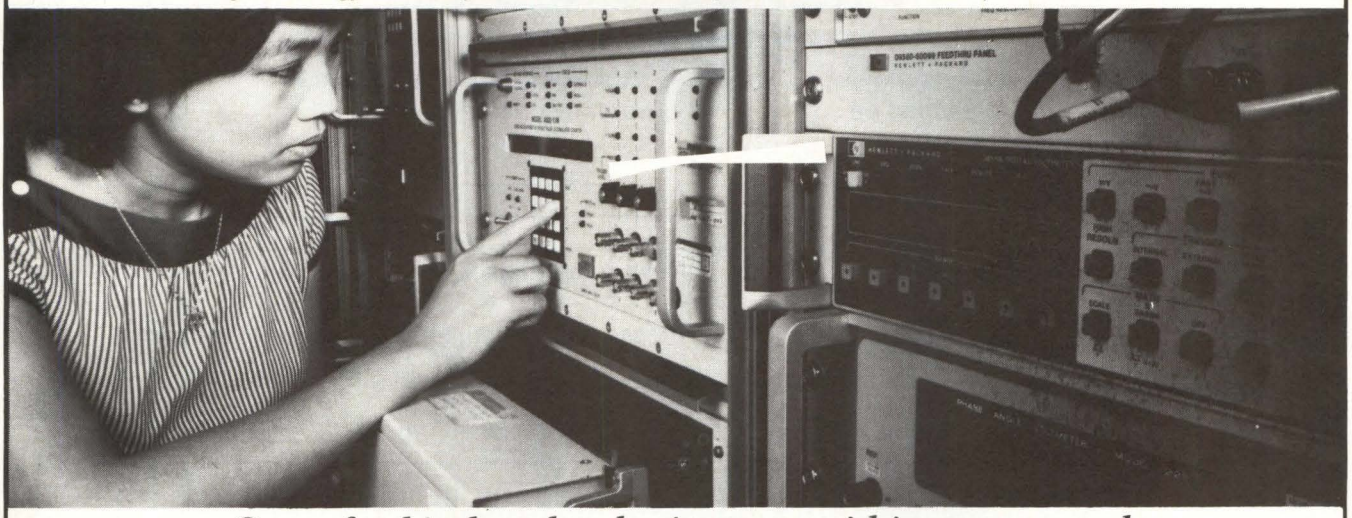

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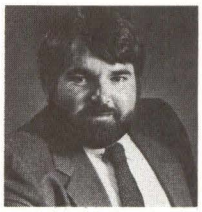

Lockbox may be the key to software piracy prevention

Stephen Auditore
Gordian Systems Inc.

Piracy is a bothersome problem for those who write and sell software for microcomputers. Although little hard data is available, many software publishers say that piracy cuts their revenues by 25 percent to 35 percent.

At a recent meeting of the Association of Data Processing Service Organizations (ADAPSO), Lotus Development Corp., the Cambridge, Mass., software publisher, presented a protection scheme that, if adopted, could resolve the software protection issue.

In the Lotus scheme, users attach a lockbox about the size of a portable radio to a computer through an RS232 port. The box takes keys about the size of car keys, which come with legitimately purchased copies of programs. These keys have codes in ROM or other mechanisms that make them difficult to duplicate. Each lockbox can accept as many as four keys so that users can run more than one program simultaneously. The idea is to put algorithms into a protection program that would prevent the program from running without the key in the lockbox.

This approach breaks from current practice, in which the battle against software piracy is seen as an issue of copy protection. Lotus offers a dramatic shift from media orientation to access—or use—orientation. Requiring possession of a hardware key for program operation might make copy protection a moot issue. Programs can be duplicated an infinite number of times, but the copies are useless without a key.

The impact of the lockbox protection scheme on the end user is still in question. No doubt it will introduce some user inconvenience. But several benefits are possible. These include lower prices and encryption of personal data files.

Lower end-user prices could result by eliminating "soft-lifting." It is not clear whether such lower prices will take the form of a reduction in price or of improved functionality.

Furthermore, intelligent lockboxes and keys could allow programs to operate for specified lengths of time or numbers of uses. From a marketing perspective, this permits subscription sales of software, establishment of a software rental industry, secure evaluation sales and development of lending libraries.

Legal ramifications of this protection scheme will be far-reaching. The major legal issues will revolve around possession of keys and what rights of use and ownership a key implies, rather than on whether making copies violates an intellectual property right.

Software protection has become a highly visible target of opportunity for many would-be entrepreneurs. New and existing companies have proposed over 120 software-protection schemes to major software publishers. Many of these companies will be severely affected should Lotus' proposal gain widespread acceptance.

Although the implementation and integration of this protection scheme may seem a fait accompli for some publishers, many issues need to be resolved before general industry acceptance and sanction by a standards organization. These items include the technical feasibility of the lockbox and keys, their availability and, most important, their acceptability.

Moreover, the industry cannot ignore the position of IBM Corp. as the largest software publisher. Until now, IBM has played a passive role in software protection.

Stephen Auditore is vice president of marketing for Gordian Systems Inc., Palo Alto, Calif. Before becoming one of the founders of Gordion, Auditore was vice president for corporate planning of Direct Inc.

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Carl Warren, Western Editor

Tying the Hewlett-Packard Co. (HP) laser printer to your system and word-processing software requires either a sophisticated, but complex, procedure or one that is inelegant, yet workable.

For example, in working with Ashton-Tate's dBase II or III, consulting software engineer Robert Anton Byers, La Crescenta, Calif., suggests a method that takes advantage of the output and command characteristics of those database packages. Byers recommends that you embed control characters in the word-processed document for use by the dBase post-formatter command file. The command file then uses those control characters to send the necessary format functions to the printer.

To implement this post-format control, Byers says, you must first pick various unused, control characters in your word-processing package and then use them to handle special functions. For example, MicroPro International Corp.'s WordStar allows the embedding of characters for special purposes and denotes them with a caret (^) and the letter. In Byers' file, a control A (^A) causes the HP laser printer to switch to portrait size and use a roman8 font with fixed pitch. Because each function is defined, functions can be combined to produce the desired output. For instance, look at this code listing:

```
Clear                    usascii  = esc + '(0U'    italic   = esc + '(s1S'
ESC = CHR(27)            prop     = esc + '(s1P'    upright  = esc + '(s0S'
ulineon  = esc + '&dD'   fixed    = esc + '(s0P'    light    = esc + '(s-1B'
ulineoff = esc + '&d@'   point14  = esc + '(s14V'   bold     = esc + '(s1B'
portrait = esc + '&100'  point10  = esc + '(s10V'   medium   = esc + '(s0B'
roman8   = esc + '(8U'   point8   = esc + '(s8V'

A = portrait + roman8 + fixed
B = portrait + usascii + prop + point14 + upright + bold
C = portrait + usascii + prop + point10 + upright + medium
D = portrait + usascii + prop + point10 + upright + bold
E = portrait + usascii + prop + point10 + italic  + medium
F = portrait + usascii + prop + point8  + upright + light
U = ulineon
W = ulineoff
code = chr(1) + chr(2) + chr(3) + chr(4) + chr(5) + chr(6)
```

According to Byers, the dBase command file isn't limited to the HP laser printer. He says that it can be modified for other printers as well.

If you need to build a library of printer-control software, Phillipe Kahn, president of Borland International Inc., Scotts Valley, Calif., recommends that you build your own libraries using Borland Turbo Pascal.

Kahn says the process is straightforward and merely requires time at the keyboard to build the necessary files. By using an approach similar to the one Byers did in the dBase command file, you can define specific functions for later use.

That is, if you're using an Epson America Inc. Model FX-80 dot-matrix printer and want to enter the enlarged-character mode, you can set it one of two ways: send ASCII device code DC4, denoted by decimal 14, or send Escape capital W, denoted by decimal 27 for Escape and decimal 87 for W. To cancel the command, use an ASCII space, decimal 20, or Escape !, decimal 27 plus decimal 33. To translate this into Turbo Pascal, you treat the printer as a file and use the standard WRITE statement:

```
WRITE (LST, CHR(14),)
```

This tells the printer to enter the enlarged-character mode, while:

```
WRITE (LST, CHR(20),)
```

shifts the printer back to a normal, 10-pitch character size.

By predefining the functions the printer is capable of, you can mix them to create the desired effects.

Another method of setting up a printer is suggested by consulting engineer Richard Steincross, RMS Laboratories, Long Beach, Calif. Steincross says to use the command functions of PC-DOS or MS-DOS. He does say that this method is slow, and should be considered a prototyping tool rather than an everyday application.

For example, to control a Prowriter dot-matrix printer from C. Itoh Electronics Inc., Los Angeles, Calif., you create a DOS command file that initializes the printer. Using this method, however, requires that you know what mode you want the printer in: pica, elite, proportional, boldface, bidirectional printing or reset to normal. (If you'd like a copy of the code listings for initializing the C. Itoh printer, write to *Mini-Micro Systems,* 221 Columbus Ave., Boston, Mass. 02116.)

Should you prefer not to create your own code, you might consider Printer Boss from Connecticut Software Systems Corp., 30 Wilson Ave., Rowayton, Conn. 06853, (203) 838-1844. This $139 package, which runs on Epson and Epson-compatible dot-matrix printers, provides a full set of downloadable character sets, letter-quality, multipass printing and sideways printing. Additionally, it works with most word-processing and spreadsheet software. So that the host isn't tied up during the printing cycle, Printer Boss gives you the option of establishing a 32K-byte print buffer.

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MARKET TRACK

Sharon Hassell
Assistant Editor

User needs spur sales surge

As computer reliance in commerce and industry increases, so will the need for fault-tolerant computers, says a recent study by Frost & Sullivan Inc., a New York market research company. Reflecting this need, sales of fault-tolerant computers will grow from $7.9 million in 1984 to $7.4 billion by 1988, according to the study.

Fault-tolerant computers, which continue to operate when part of a system fails, are especially important in on-line transactions on banking and financial-service machines. According to the study, sales of fault-tolerant computers for use in on-line-transaction applications will total $5.1 billion by 1988, representing 70 percent of the total fault-tolerant-computer market.

According to Frost & Sullivan, distributed data processing will be the second largest market segment for fault-tolerant computers. By 1988, sales of fault-tolerant models in distributed data processing will reach $1.5 billion, a 40 percent increase over 1984 sales.

Office automation, or shared-resource word processing, will represent the smallest market segment for fault-tolerant computers, reaching only $3.5 million in 1988, the study says.

In addition to sales figures, the study also discusses potential market figures and fault-tolerant computer suppliers, citing Tandem Computers Inc. as the market leader, followed by Computer Consoles Inc. and Stratus Computer Inc.

PBX survey results: Rolm beats AT&T

Private branch exchange (PBX) users planning to replace existing installed equipment with new systems, won't be turning to AT&T as often as they have in the past, according to The Market Information Center Inc., Framingham, Mass. In a recent study, the market research company released findings from a survey of over 600 PBX, Centrex and key system users in the United States. The survey questioned users' plans to integrate voice/data and local area networks and to replace digital PBX systems over the next year.

In the study, Rolm Corp. was market leader for replacement systems, claiming 30.4 percent of the respondents. Northern Telecom Inc. and NEC America Inc. each received 10.7 percent, and 7.1 percent each went to Mitel Corp. and Intecom Inc. AT&T was named by 19.6 percent of the users.

The survey also lists Rolm as the first choice of users planning to buy additional PBX systems for their organizations. Claiming 41.7 percent of the users surveyed, Rolm topped AT&T's figure of 35 percent.

Almost 90 percent of the users planning to install new systems said the systems would use digital PBX switches. In addition, 80 percent of these systems would be used in a combination voice/data environment, the study says.

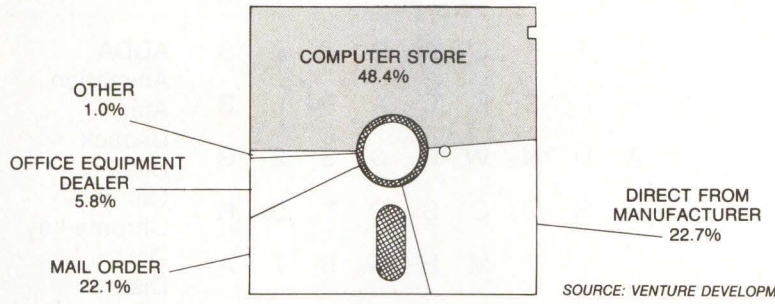
Software demand to increase eightfold

The demand for integrated software packages for personal computers will increase from 445,000 units sold in 1983 to 3.6 million in 1988, according to a study by Venture Development Corp. (VDC), Wellesley, Mass. The study says, however, that, if computer stores continue to sell almost half of the available integrated packages, problems will occur as the stores become inundated with new packages and retailers' knowledge of the packages becomes less reliable.

According to VDC, of the nine sources of integrated software product information, users listed computer store staffs as least informative. Most informative were demonstrations, followed, in order, by in-house consultants, independent product reports, experts in other companies, office-product magazines, manufacturers' literature, general-business magazines and independent consultants. However, in defense of computer stores, VDC notes that some salespeople never get a chance to demonstrate their knowledge since customers generally go to a computer store to buy the software, not to ask how it works.

The study says that diversified distribution methods for integrated software programs, such as through office equipment dealers and stores specializing in integrated packages, will be used frequently as demand increases. □

CURRENT OUTLETS OF INTEGRATED SOFTWARE
(PERCENTAGE OF INTEGRATED SOFTWARE OWNERS RESPONDING)



SOURCE: VENTURE DEVELOPMENT CORP.

ARTFUL INTELLIGENCE

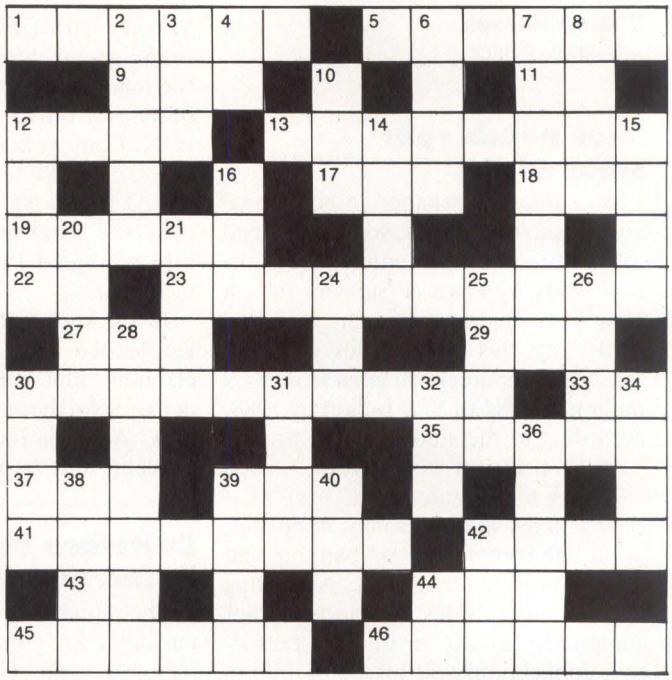
By John K. Young

ACROSS

1 Direct and table access
5 Makeshift computer
9 Function
11 Twelve months (Abbr.)
12 Start computer
13 Input-output device connected to computer
17 Strong desire people have to acquire a computer
18 Programming language
19 Smile derisively
22 Prefix meaning "early part of period"
23 Connection of computer resources
27 Those who do data processing (Abbr.)
29 Frozen water
30 Any device attached to computer
33 Regius Professor (Abbr.)
35 Programming language
37 Airman (Abbr.)
39 Fermented drink made from malt hops
41 Common graphics date file
42 What 38-Down gives you
43 Neo (Chem.)
44 Male heir
45 Graphics symbol indicating where next character will be displayed
46 Computer fanatic

DOWN

2 Remember information
3 Head covering
4 Printer's measure
6 Portray in words
7 Kind of pass that references one or more global sections
8 Alumnus
10 Set of identifying characters
12 Radix in numbers scale
15 Scottish writer: Andrew ____
16 Function
20 Point on vibrating string virtually free of vibration
21 Anything sword-shaped is _____ form
24 Scottish "mini"
25 _____ cycle
26 He fiddled while Rome burned
28 Example of 30-Across
30 Small, flat-bottomed boat
31 Combining form meaning "the sun"



32 Do something
34 Control chart
36 Command that makes cursor easy to find
38 It leads you step by step through program
39 Hair style
40 Yale's nickname
42 Function
44 A continent (Abbr.)

M	D	I	S	K	S	K	C	A	R	T	Z	S
E	D	T	T	R	I	S	K	C	A	P	I	B
O	I	L	O	A	U	N	W	R	D	S	E	G
B	N	B	E	E	P	O	C	S	O	T	O	R
S	O	S	C	I	L	E	M	H	G	D	T	A
T	I	E	H	G	F	N	P	O	I	F	S	P
A	T	R	R	A	S	R	R	M	O	L	N	H
T	C	V	O	S	O	L	A	R	I	Z	E	I
A	E	O	M	M	T	G	E	T	O	A	E	C
D	L	V	A	I	E	A	S	A	S	T	N	S
L	F	T	K	S	S	C	R	D	H	A	L	O
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Solution will be printed next month.

Answers to February's puzzles can be found on Page 208.

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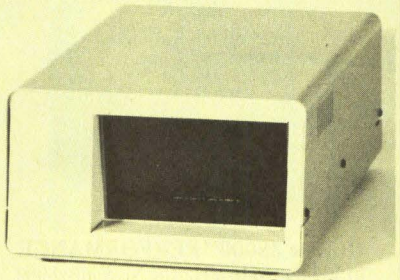

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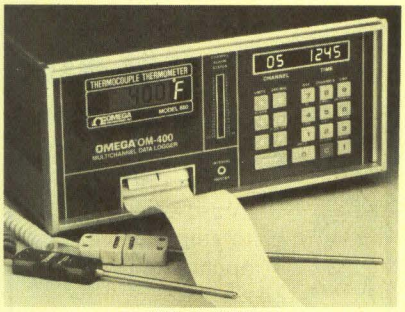

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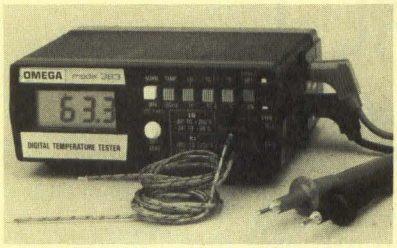

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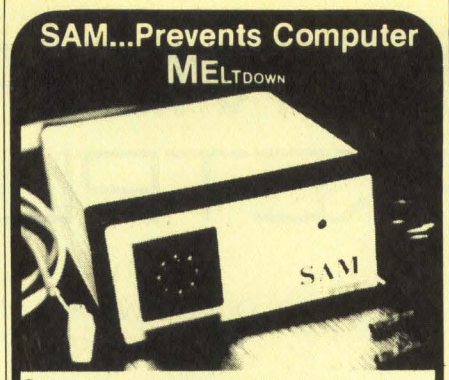

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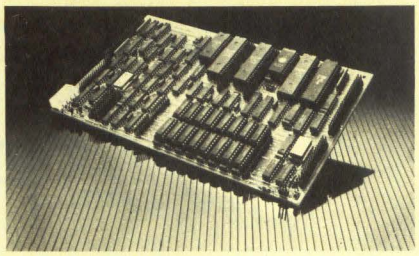

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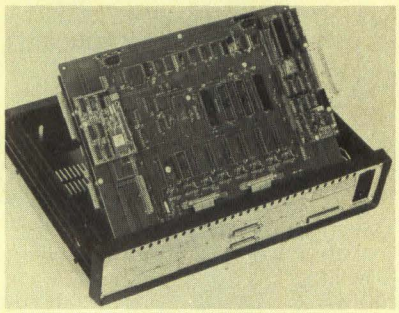

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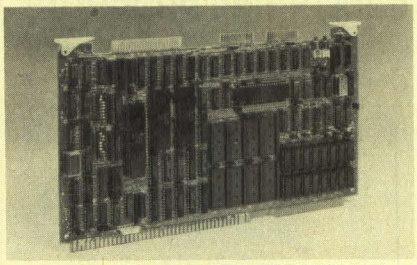

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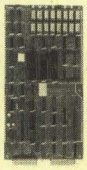

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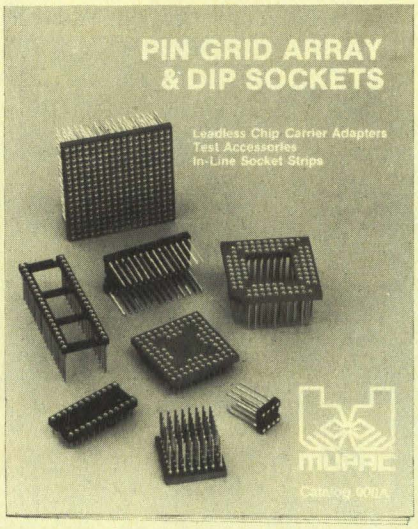

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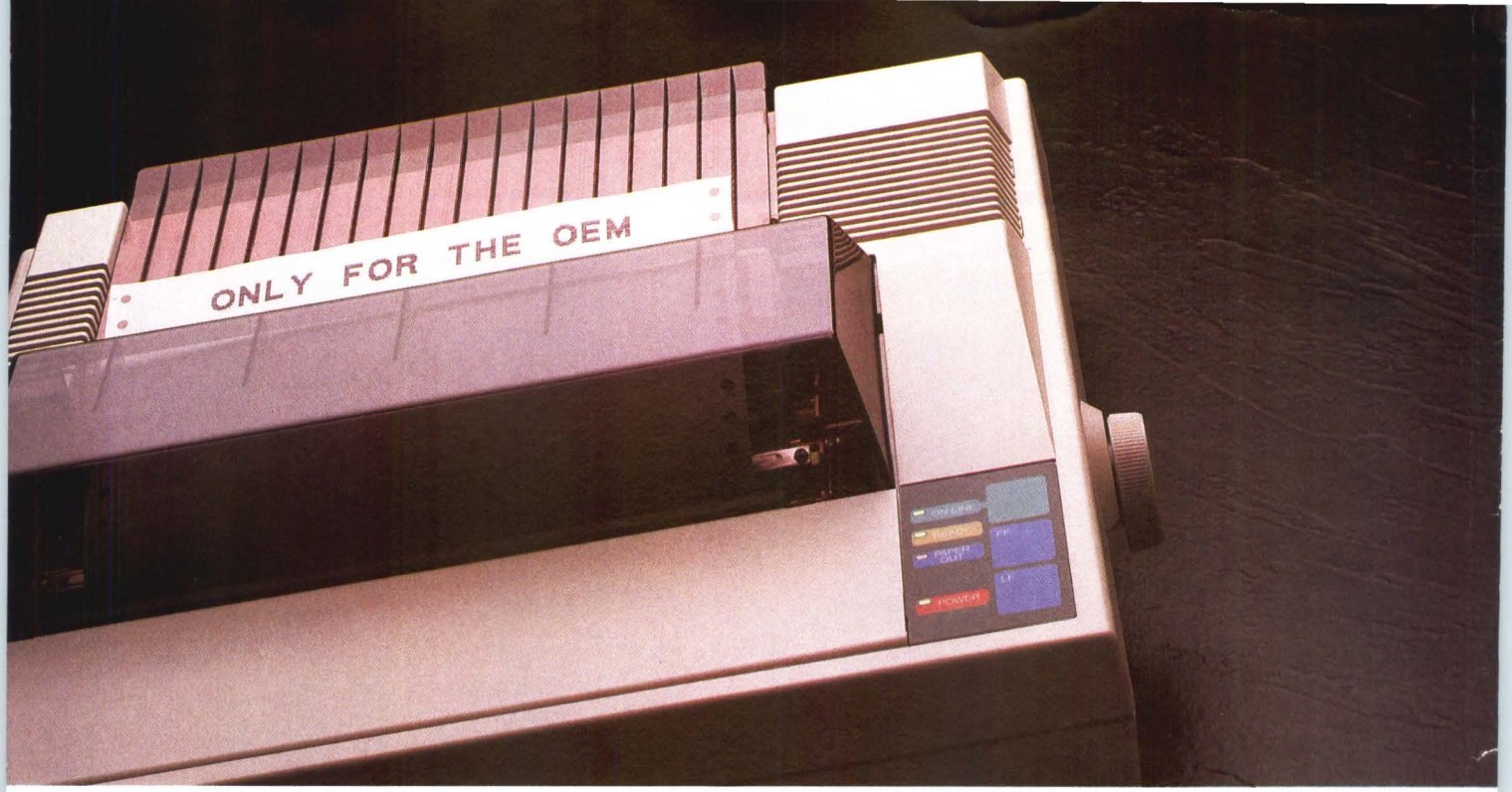

There's an Epsonomic answer to your printer needs.

Our new OEM printer is part of it.

Epsonomics means more than designing a printer exclusively for the OEM. Though we'll never market our CTM series through retail.

But Epsonomics means more. More than offering a printer with a unique custom case. More than Epson® reliability. Though that has become a byword in the printer world.

Epsonomics means even more than technical superiority and advanced performance. Though the CTM F-series of 160 cps printers boasts an increased line speed and data transfer rate that yields 20% greater throughput. And the universal power supply accommodates 100, 120, 220, and 240 volt inputs to match your domestic and international needs and simplify purchasing decisions.

Epsonomics means designing products that will increase the saleability of your products, lower their after-sale service costs and provide the OEM protection against similar products marketed through the retail channel. It means on time delivery to minimize your inventory costs. It means making that extra effort to help you grow so we can grow with you.

Epsonomics. Our new CTM F-series of OEM printers is only part of it. So are our LCDs, floppy drives and printer mechanisms, and the integrated technology behind them. The main part is that we do business so you can provide cost effective products to your customers.

Find out how Epsonomics can help you achieve an aggressive competitive posture in your marketplace. Call or write us today.

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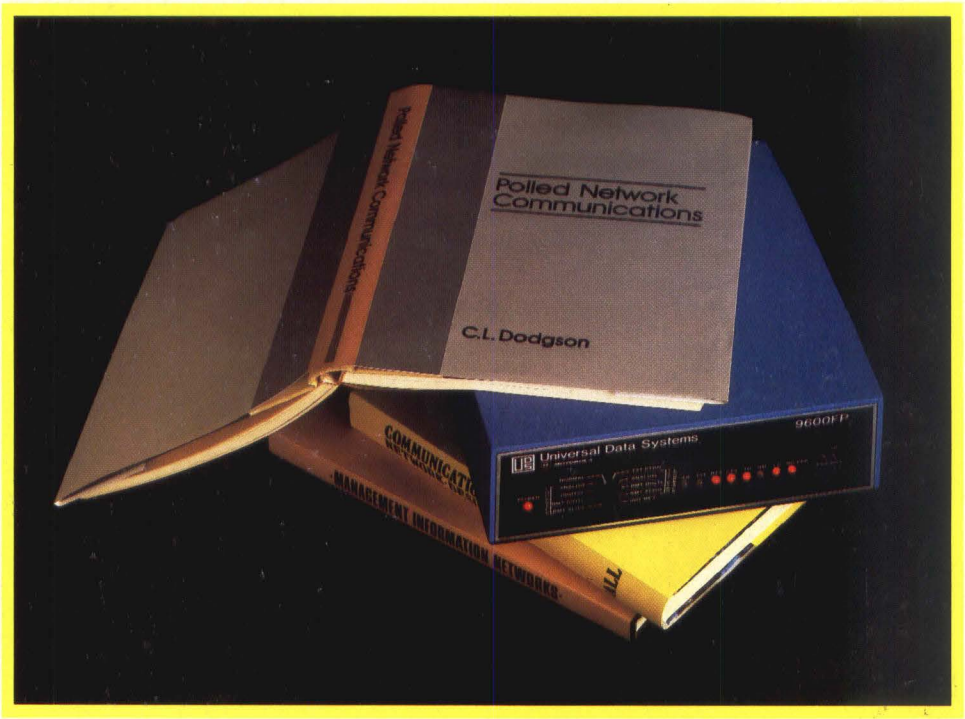
CIRCLE NO. 119 ON INQUIRY CARD

Quick Study!

New UDS 9600 bps Fastpoll Cuts On-line Training Time 33%



The new 9600 bps fastpoll modem from Universal Data Systems means extra throughput for your polled multipoint network! Until now the fastest on-line training time available anywhere has been 12 milliseconds. Since training time is non-productive time, UDS has increased system throughput by trimming the training cycle to 8 ms, producing a corresponding increase in overall system efficiency.

The device is suitable for operation over unconditioned four-wire leased lines in either fastpoll or conventional CCITT V.29 mode. Integral test features allow for system performance evaluation and fault isolation within the communications link.

The UDS design incorporates LSI and microprocessor technologies to achieve significant size and power consumption advantages. For detailed specifications, contact Universal Data Systems, 5000 Bradford Drive, Huntsville, AL 35805. Phone 205/837-8100; Telex: 752602 UDS HTV.

$1995
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Inquiry Hotline: 800/633-2252, Ext. 360.

UDS modems are offered nationally by leading distributors. Call the nearest UDS office for distributor listings in your area.
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