

Mini-Micro Systems

THE MAGAZINE FOR COMPUTER SYSTEMS INTEGRATION

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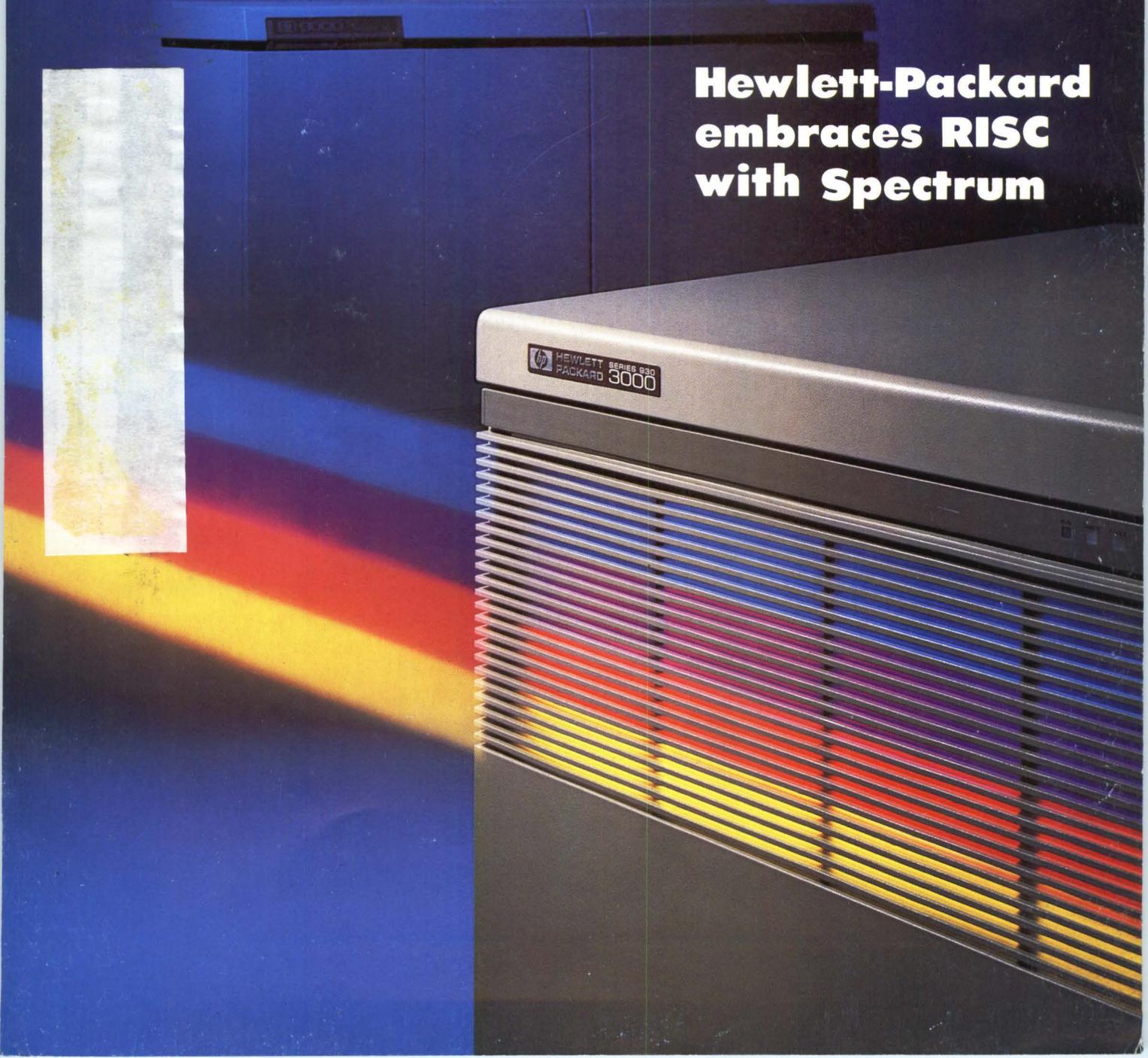
SPECIAL REPORTS:

Expert systems blaze trails to AI success

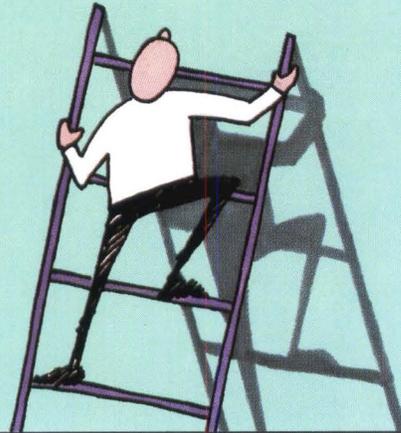
PC compatibles become faster, more adaptable

Portable computer market remains elusive

**Hewlett-Packard
embraces RISC
with Spectrum**



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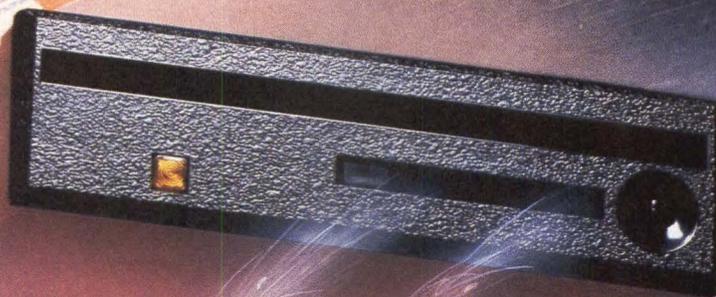
Advanced servo-embedded technology gives Kodak's 3.3 MB and 6.6 MB units capacity and performance unprecedented in flexible drives. Specially preformatted Verbatim media tells the head exactly which track it's over. This accurate track positioning lets us increase track density and still get reliable data transfer. In fact,

this is the *only* reliable way of getting multi-megabytes of data storage from a flexible disk drive.

Kodak drives give you new levels of speed, too. The 3.3 and 6.6 units access and transfer 3 to 6 MB of data in the same time that conventional flexible drives handle only 1 MB. Both drives offer 3 ms track-to-track access and dynamic ramp stepping for fast random access and a transfer rate of 500 Kbit/sec.

Downward read capability puts these drives in a league by themselves. They automatically read any files that have been recorded on standard PC- or AT-type 5 1/4-inch media. That means there's no need for expensive overhauls of existing software or files.

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So if you're ready to move up, remember high capacity doesn't have to be a hard decision anymore. Now you can grow with powerful 3.3, 6.6, and 12 MB disk drives from Kodak.

If you'd like more information about Kodak's advanced disk drives, write to:
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NEWS/INTERPRETER



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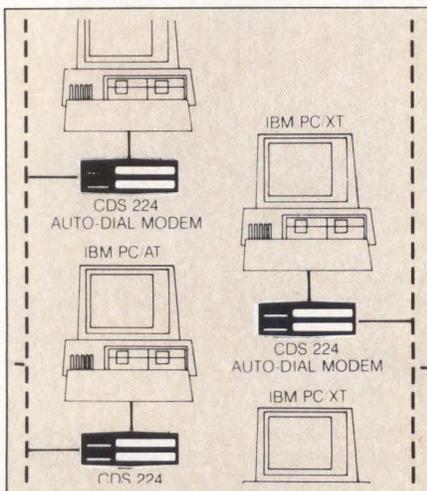
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*Appearing in issues of subscribers who have indicated having DEC computers



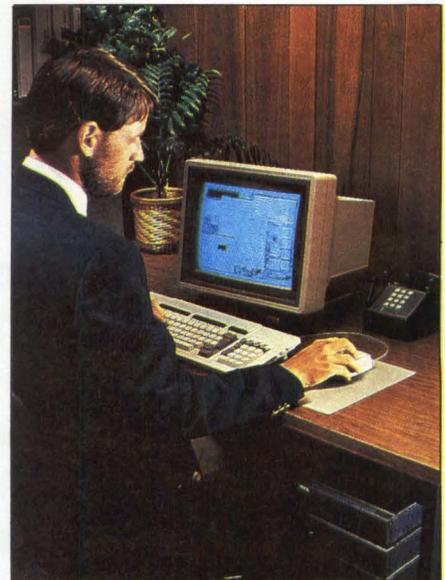
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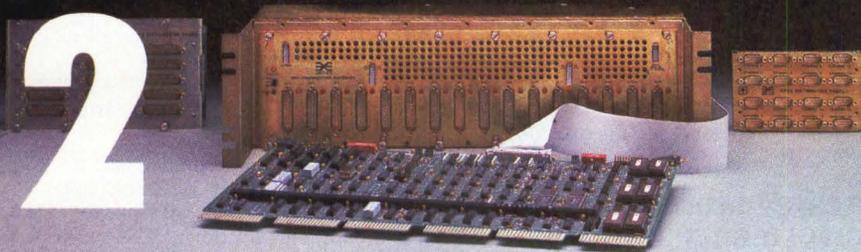
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FIVE MAJOR REASONS DEC SYSTEMS NEED EMULEX COMMUNICATIONS MULTIPLEXERS.

1



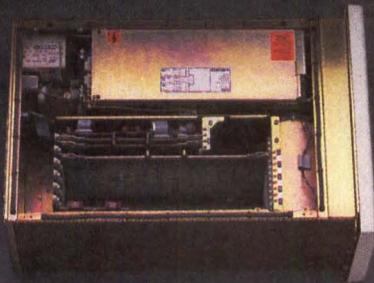
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5

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CIRCLE NO. 5 ON INQUIRY CARD

The Cipher Files.

Upgrading Performance to 6250 bpi.

Cipher Helps the Ultimate Corp. Cache in on GCR.

When The Ultimate Corp. of East Hanover, New Jersey, increased the Winchester capacity of its PICK-based computer system, the company turned to Cipher Data's high-capacity GCR CacheTape® half-inch tape drives for the kind of streaming performance that is usually difficult to maintain with virtual-memory operating systems.



Ultimate's Model 3030 system combines a Digital Equipment Corp. (DEC)-based computer with Ultimate's proprietary, easy-to-use version of the sophisticated PICK operating system. The systems are resold along with application software via an international dealer network.

While the Model 3030's virtual-memory operating system makes it ideal for running concurrent on-line, batch and time-sharing applications, it also presented difficulties for optimizing tape drive performance.

"With a virtual-memory environment, you can't predict host delays that might hinder the performance of real-time devices like streaming tape drives," explains Frank J. Kacerek, Ultimate Vice President of Technical Services. "In fact, streaming tape drives usually must stop to wait for the host or disk drive, drastically reducing streaming performance."

To solve this problem, Ultimate turned to Cipher's proprietary cache-memory tape drive design, which had already proved effective in the lower-density 1600/3200 bits-per-inch (bpi) Cipher CacheTape® drives Ultimate offers with its Model 3030 system family.

Unlike simple buffers, Cipher's cache design uses dynamic RAM and look-ahead algorithms to emulate start/stop interaction between host and device. This allows the physical operations of the tape drive to continue unhindered.

When Ultimate increased the Model 3030's Winchester capacity to just over a

gigabyte, it was an easy task to graduate to the higher-performance, tri-density (1600/3200/6250 bpi) GCR CacheTape drive. The drive offers 270 Mbytes of capacity rather than the usual 180 Mbytes by using 1.0 mil-thick tape rather than 1.5 mil-thick tape.

Kacerek said the GCR CacheTape's low profile design also was convenient for integrating the drives into Ultimate's compact system configuration. The tape drives offer Ultimate 3030 users faster backup times, less tape reel handling, improved data integrity, and compatibility with GCR-based tape libraries.

For more detailed information or a technical article about cache technology, contact 1-800-4-CIPHER, and ask for item # MM-1.

Packing more GCR performance into a smaller box.

Cipher Data had many hurdles to cross when the company set out to package one of the industry's most sophisticated GCR tape drive implementations into one of the smallest, most cost-effective packages.

Cipher first had to streamline chip and board use to achieve a far more elegant design than most GCR drives, dramatically reducing package size while lowering power consumption and heat generation.

First, by avoiding a heavy reliance on the discrete logic most manufacturers use in their GCR tape drives, Cipher has achieved a highly programmable device, with more configuration flexibility than generally available.

For instance, the Cipher GCR CacheTape drive's unique 8-character alphanumeric display helps users determine drive status and tape utilization. Select from 29 configurable options. Control on-board diagnostic test sequences. And even select transfer rates that improve tape and host interaction and optimize effective throughput. All using ordinary English messages and without touching a dip switch.



Cipher and Spectra Logic plug GCR CacheTape into MicroVAX II.

Cipher Data's Spectra Logic Division of Mountain View, Calif., has introduced a multifunction disk/tape controller that enables Cipher's GCR CacheTape drive to be used with the popular Digital Equipment Corp. (DEC) MicroVAX II computer.

The Spectra 25-M can be used to interface the GCR CacheTape drive to the MicroVAX II and DEC's Q-BUS minicomputers. It is the highest performance disk/tape controller of its type available today.

For more information and literature on the complete line of Spectra Logic controllers, contact 1-800-4-CIPHER, and ask for item # MM-2.

Maximizing data integrity in an imperfect world.

Cipher also closely examined data integrity issues, widening the GCR interchange bandwidth to ensure data interchange compatibility with any other GCR tape drive. Regardless of how well these other drives comply with ANSI specifications.

The Cipher GCR CacheTape drives also automatically rewrite and reread any records with errors, significantly reducing the burden on the operating system. And an enhanced two-track bi-directional software error recovery technique improves the recovery rate of read data that would often be lost with other GCR drives.

Cipher uses a signal conversion system under microprocessor control to optimize tape speed control and minimize the instantaneous speed variations that plague most tape drive designs. And a patented autoloading capability means computer users will never contribute to a data integrity problem related to improper tape loading or handling.

SCSI plug-and-play performance improvement.

Cipher offers either the standard Cipher/Pertec interface or the intelligent Small Computer System Interface (SCSI) with its tape drives.

With SCSI, integrators can write a single set of software drivers for any of Cipher's half-inch reel-to-reel tape drives, preserving design and equipment investments as disk capacities and tape storage requirements increase.

For more information or technical articles about GCR CacheTape and SCSI tape integration technology, call 1-800-4-CIPHER, and ask for item # MM-3.

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CIRCLE NO. 6 ON INQUIRY CARD

EDITORIAL

PC MAKERS BATTLE FOR MARKET SHARE



To overcome the personal-computer market slump, leading U.S. manufacturers stress vertical market niche strategies, increased product functionality and improved distribution channels. Over the past two years, the personal computer market has been plagued by depressed growth rates, reduced sales and product proliferation. The result has been worker layoffs, production cutbacks, operational losses and company closings. In contrast, in 1986 the personal-computer makers will learn from past mistakes and introduce fewer new products, focus on standards and enhance performance functionality—all at lower unit prices.

As U.S. manufacturers cut prices, however, they enter unfamiliar territory already occupied by foreign competitors, especially from Asia. The going could get rough. By keeping manufacturing costs low, Asian companies have unobtrusively and successfully invaded the U.S. personal computer market. Indeed, they have captured about 20 percent of the \$22 billion-a-year personal computer business, claims market-researcher IDS America Inc. And that's only the beginning, say many industry analysts. What's more, several major U.S. companies are selling computer products that have been built overseas. More important, though, Asian vendors have increased sales during a slump period for many U.S. computer makers.

Today's computer buyers have become price conscious. They are purchasing cheaper Asian-built IBM-clone computers that run most standard software packages. Consequently, units manufactured by Epson America Inc., Leading Edge Products Inc. and Sharp Electronics Corp. have gained significant market share over the past year.

In addition, the frantically-paced computer market of the early 1980s has settled down. Standardization, in the form of the IBM Corp. PC product line and its associated operating systems, has coerced competition into offering lower prices and higher performance as a means of survival.

So, what are key U.S. manufacturers propos-

ing to do to remain competitive and still overcome both the Asian rivalry and the computer market downturn? Here's some statements made by prominent U.S. company officials as culled from the trade press.

John Sculley, president and chief executive of Apple Computer Inc., believes that the computer market is moving toward communications, systems solutions and better user interfaces. During 1986, Apple will increase R&D spending by more than 50 percent, expand the Apple IIe and Macintosh product lines, work closely with outside suppliers and target such vertical market segments as desktop publishing and communications. The company will also broaden its value-added reseller efforts by enabling more third-party equipment to work with Macintosh computers.

William C. Lowe, president of IBM's Entry Systems Division, notes that IBM will continue to make technological hardware advances for better price/performance. In software, he sees steady improvements in ease of use and in coupling personal computers more closely with intermediate and large processors.

John Boyd, sales vice president for AT&T Co.'s Computer Systems Division, says that companies must offer a selection of computers, including supermicrocomputers and minicomputers, as well as connectivity solutions. More and more users, asserts Boyd, want to link personal computers through local area networks, including units from different vendors. And multiuser, multitasking personal computers will grow in popularity because users want more functionality and low-per-user-cost by linking terminals to one computer.

U.S. manufacturers, therefore, can combat overseas competition and improve personal computer sales by concentrating on their strengths: advanced product technology, system integration and vertical market niches.

George V. Kotelly

George V. Kotelly
Editor-in-Chief

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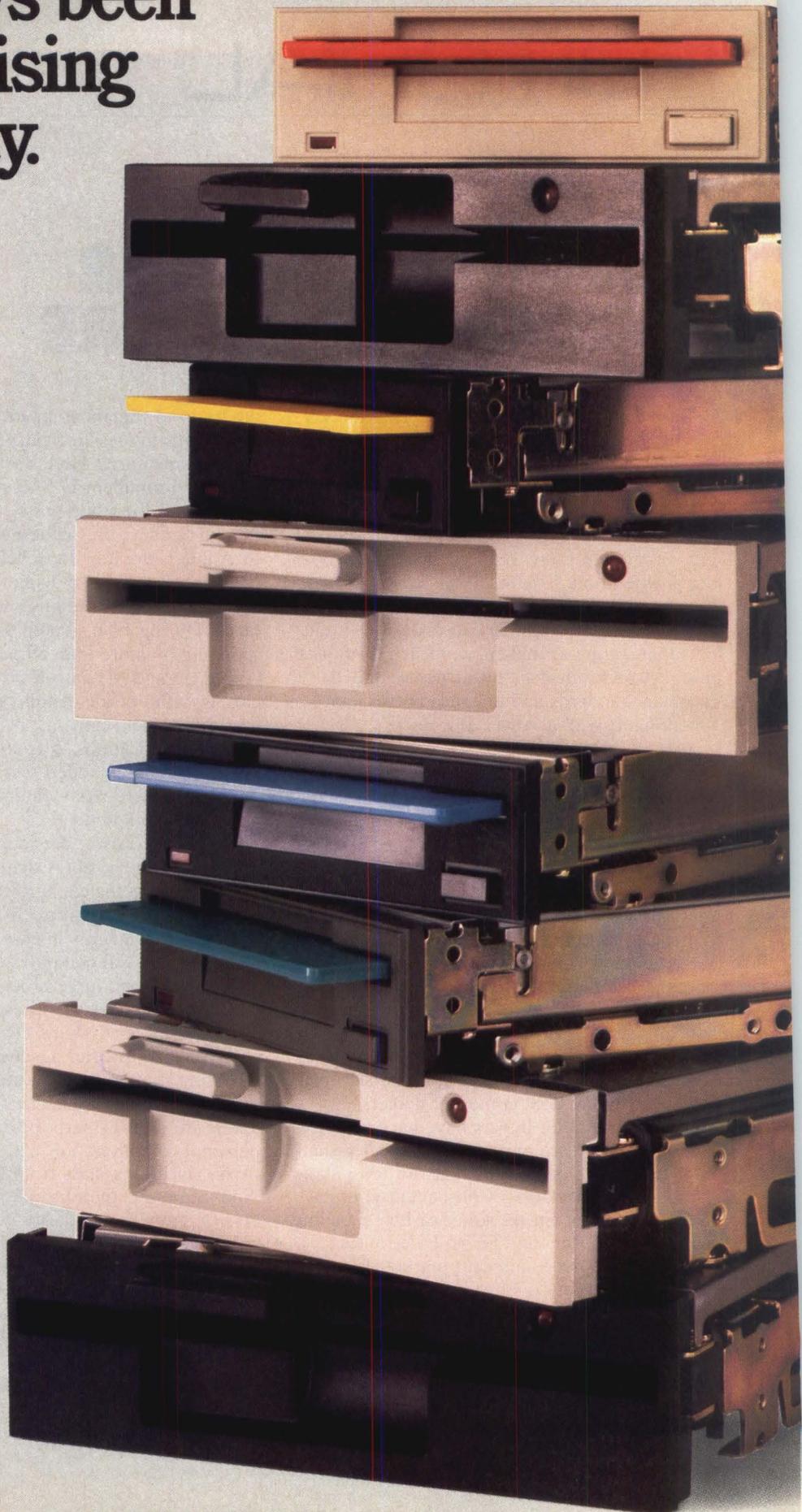
To be sure of consistent quality, top performance and absolute reliability to meet all your data storage requirements, there's just one company to call. Fujitsu America. (408) 946-8777. Or—for detailed information—write to the Flexible Disk Products Group at 3055 Orchard Drive, San Jose, CA, 95134-2017.

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CIRCLE NO. 9 ON INQUIRY CARD

LETTERS

DISCIPLINED JAPANESE

To the editor:

In your editorial, "Look at the Japanese from the corner of your eye," (MMS, December 1985, Page 11) you draw some interesting contrasts between U.S. and Japanese cultures and conclude that control is the element that makes the Japanese different. In consulting for a major Japanese trading company for some time now, I see the contrast somewhat differently. I see the issue as one of discipline rather than control.

The Japanese organizations I know of, and many of the individuals therein, show a high degree of self discipline. They are able to concentrate their efforts, invest time and energy and slowly (but surely) produce results.

The apparent complexity of the Japanese distribution channel may appear as a barrier to free trade. But is Japanese distribution more complex than the distribution channel for personal computers in the United States? (Or for cars, for that matter.)

An outsider might conclude we were restricting free trade with our inscrutable U.S. distribution channels.

The point is that the Japanese have mastered U.S. distribution channels in many product categories because they were disciplined. They learned our language, culture and way of doing business. They took the time to invest in business relationships that would produce results. And they persisted.

I'm not saying that the Japanese market—or any domestic market—is fair to outsiders. But I believe a significant part of the U.S.-Japanese trade balance could be restored if we focused on longer term business relationships and invested more time in trying to understand Japanese customers and distributors.

James H. Geisman
President
Marketshare Inc.
Wayland, Mass.

CLARIFIES LANGUAGE

To the editor:

I would like to clarify a point you made in your article, "Thermal printing heats up color hard-copy market" (MMS, January, Page 103).

When discussing rasterizing computers that drive color thermal printers, it is implied that the Lasergraphics line of controllers only accepts a "proprietary language that must be incorporated into the application."

In fact, the "proprietary language" (known as Lasergraphics Language, or LL) has become a de facto standard of sorts in the mainframe graphics market. More than 90 percent of mainframe graphics applications already support LL. Some are ISSCO's Tell-a-Graf, SAS Insite Inc.'s SAS-GRAPH, Precision Visual Inc.'s DI-3000 and IBM Corp.'s GDDM.

Furthermore, for those applications that are pen-plotter oriented, we support a full implementation of Hewlett-Packard Co.'s Graphics Language (HPGL) for the 7475 plotter. Other rasterizer vendors claim to be HPGL-compatible when in fact they have only implemented a very small subset of the HPGL commands. Typically, this includes only pen-up, pen-down, move and draw. Lasergraphics has implemented all of the HPGL commands (there are more than 70), including area-fill, cross-hatching and all of the communication-protocol commands (known as the ESC. commands). Lasergraphics rasterizers are truly plug-compatible replacements for HP plotters.

Support of LL and full HPGL thus makes Lasergraphics rasterizers immediately compatible with essentially all graphics-application packages. Few, if any, other rasterizers can claim this.

Stefan Demetrescu
Vice President
Lasergraphics
17671 Cowan Ave.
Irvine, Calif. 92714

CORRECTION

The telephone number for CGX Corp., Acton, Mass., was listed incorrectly in "Users get more for less in graphics terminals" (MMS, November 1985, Page 114). The correct number is (617) 263-3222.

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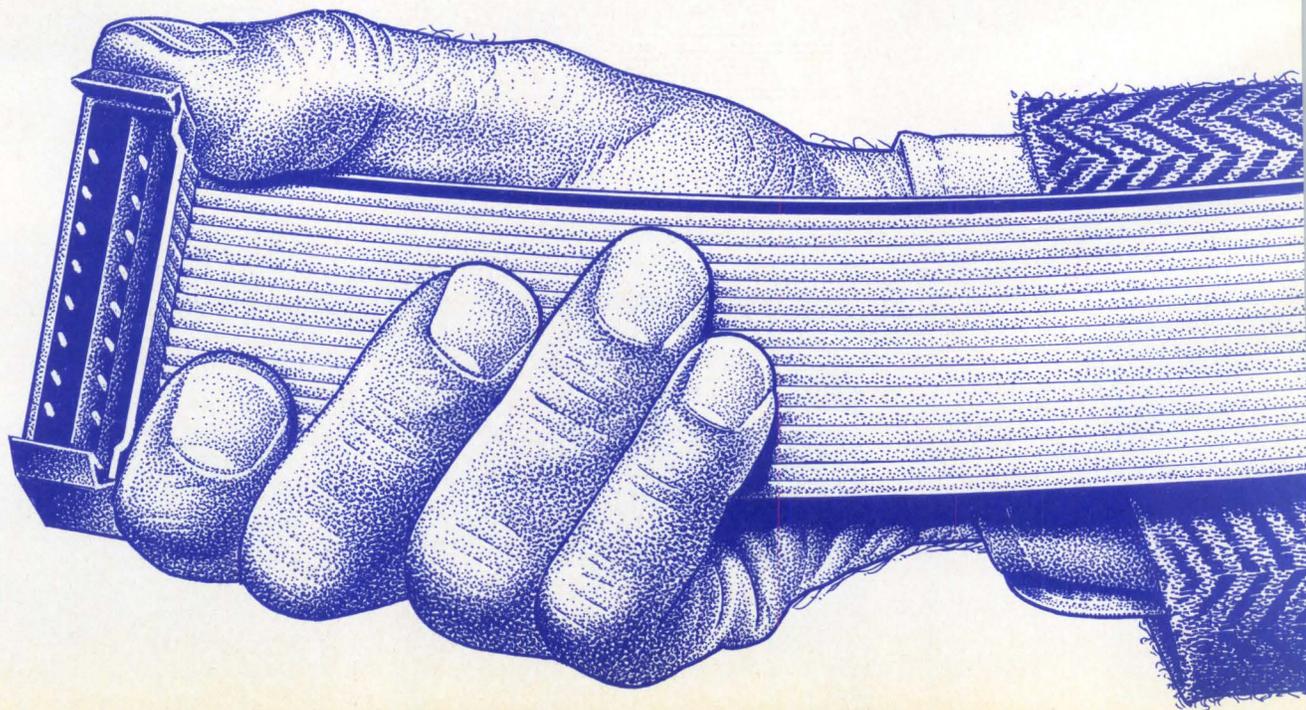
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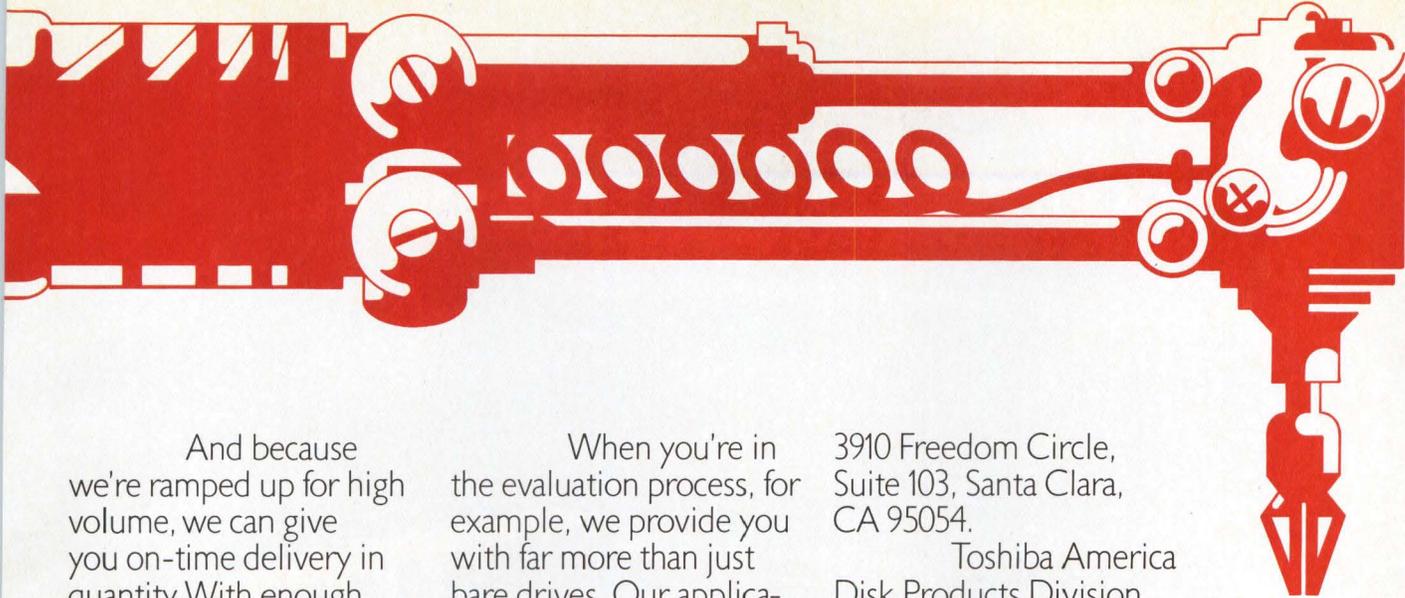
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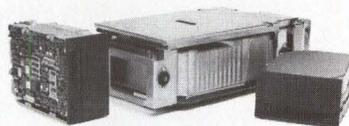
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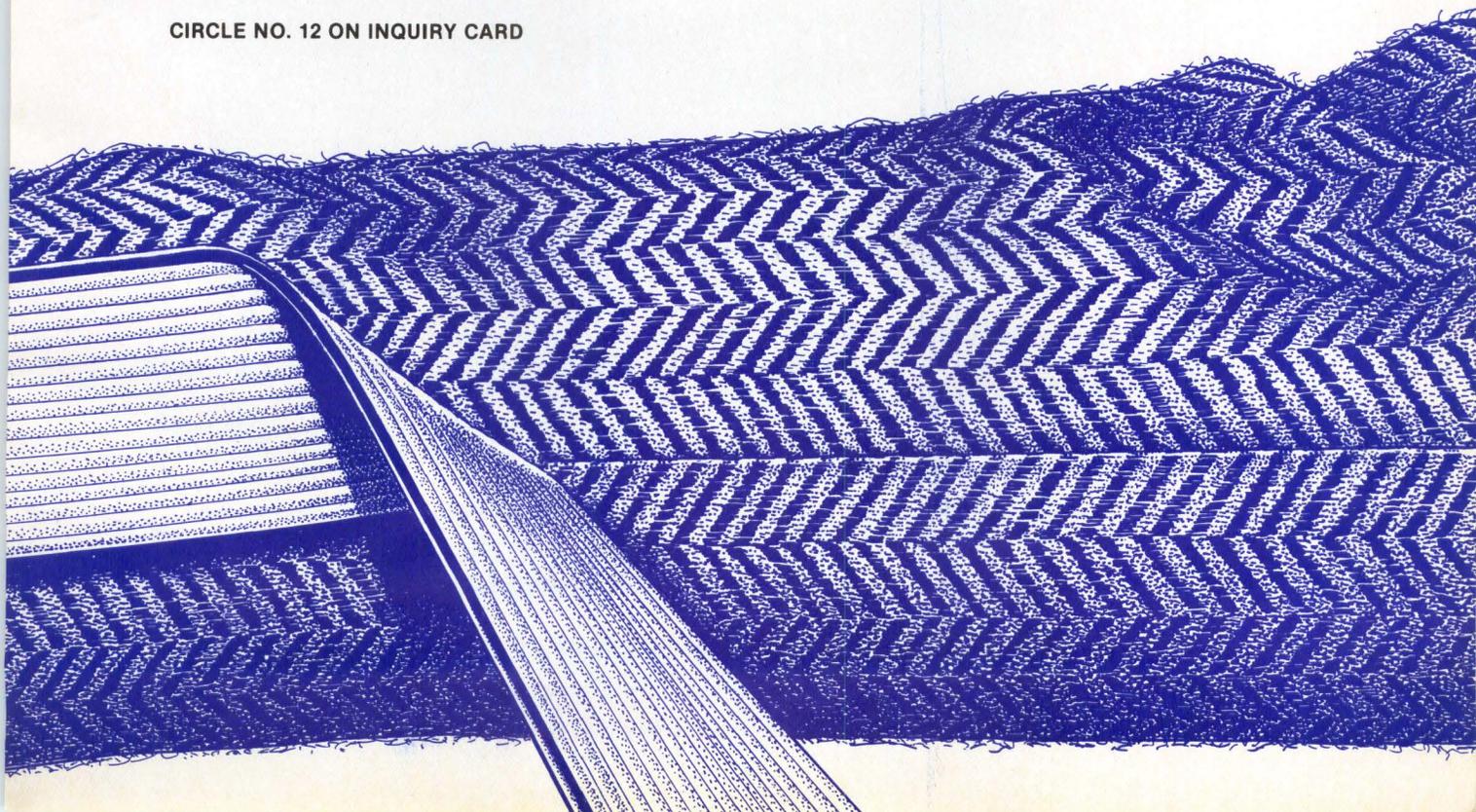
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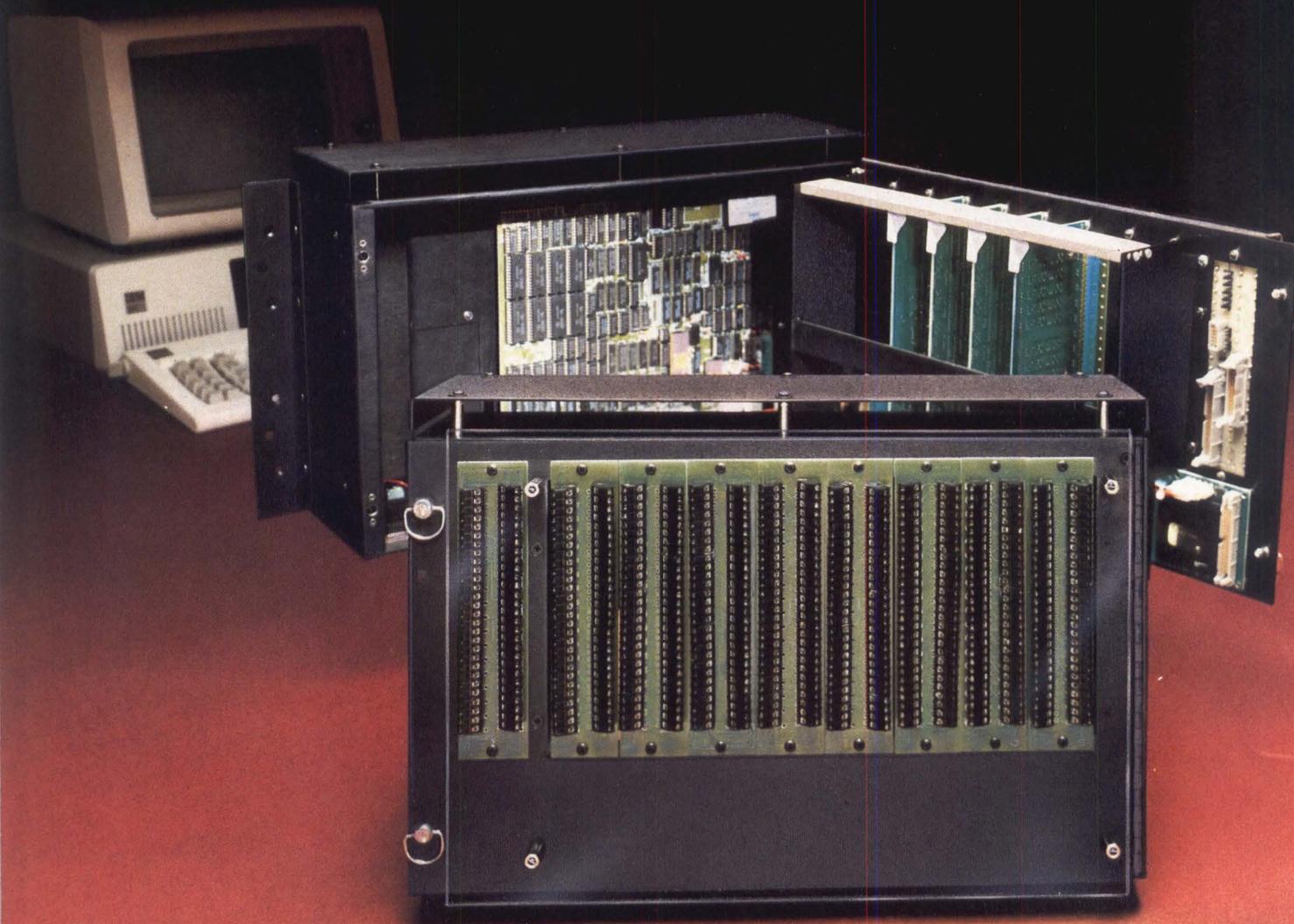
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CIRCLE NO. 13 ON INQUIRY CARD

BREAKPOINTS

APOLLO GIVES BIRTH TO A SECOND GENERATION

Apollo Computer Inc. has released a new generation of technical workstations with its Series 3000 and the DN570 and DN580. The new machines are based on Motorola Corp.'s 32-bit, 16-MHz MC68020 CPU and have an MC68881 floating-point coprocessor, said to provide superior processing speed and graphics capabilities. Priced under \$15,000, and available in monochrome and color, the Series 3000 Personal Workstation offers the open architecture of an IBM Corp. PC/AT bus. The high-end color DN570 and DN580 are priced from \$29,900. All new machines are compatible with Apollo's existing products. —*Lynn Haber*

AT&T GOES ITS OWN WAY IN FILE-SHARING PROTOCOLS

More than 50 UNIX vendors are touting the network file system (NFS) protocol for transparently sharing files among machines on a local area network. But AT&T Co., Summit, N.J., has decided to use its own remote file sharing (RFS) protocol for the job. RFS will be part of UNIX System V, Version 3.0, scheduled for release in June. Laurence M. Brown, AT&T supervisor of UNIX operating systems networking, says RFS is superior because it supports UNIX 100 percent. He adds that NFS "isn't 100 percent UNIX, and that causes performance degradation." —*Carl Warren*

BRITISH TELECOM EXTENDS A HAND TO MITEL

Common carrier British Telecommunications Plc., London, could gain a strong foothold in the U.S. information-technology market if its plans to acquire a controlling share in Canadian private-automatic-branch-exchange manufacturer Mitel Corp. are successful. At least one analyst says British Telecom could provide Mitel with the money it needs to strengthen its U.S. presence in the markets for PABXes, message-switching equipment and local-area-network interfaces. British Telecom chalked up pretax profits in 1985 of around \$2 billion on revenues of \$11 billion. —*Keith Jones*

HONEYWELL OFFERS THE INTEGRATED BUILDING

Calling it "future-proofing" of commercial buildings, Honeywell Inc., Minneapolis, has tapped its background in both computers and climate-control to offer an integrated architecture for environment control, telecommunications and office systems. Called "Enterprise Management," the strategy describes standard communications protocols and a distributed architecture to accommodate competitive systems and existing equipment. Honeywell will install and support AT&T Co.'s wiring system, Premises Distribution System, and is offering its own CampusNet, a communications architecture for college campuses, among its new services. —*Bruce MacDonald*

HAS IBM SET THE INTERCHANGE STANDARD FOR QUARTER-INCH TAPE?

IBM Corp. may have set the de facto standard in quarter-inch, tape-cartridge file interchange with the introduction of the RT PC. The RT uses a modified version of Cipher Data Products Inc.'s 55M-byte Model 540 streaming tape with a QIC-02-type hardware interface and a QIC-24-compatible physical tape format. That's the same drive offered in IBM's System/36 minicomputers, and analysts speculate that IBM may also offer the quarter-inch tape drive with the PC/AT. IBM's move should give a boost to the entire tape-drive industry. Says analyst Lee Elizer of Freeman and Associates, Santa Barbara, Calif.: "On one hand they [IBM] have used de facto industry standards [QIC], and on the other are establishing an interchange format for a broad range of machines. It won't make any difference whose drive is used as long as it conforms to QIC."—*Carl Warren*

ZAISAN SAYS TAKEOVER NEAR

Company executives at Zaisan Inc., Houston, the financially troubled manufacturer of integrated voice/data computer terminals, report that a California electronic-equipment manufacturer has agreed to purchase the company. Zaisan, which filed for Chapter 11 bankruptcy last July, recently submitted to the bankruptcy court a plan of reorganization. The company is still shipping its ES.3 voice/data workstation.—*Stephen Shaw*

U.S. COMPUTER SHIPMENTS TO RISE 16 PERCENT THIS YEAR

Shipments of U.S. computer equipment should rise 16 percent in 1986, over 1985, to almost \$62 billion, according to the Department of Commerce. But much of those shipments will come "off the shelf" because of large inventories, and employment of computer production workers will show little growth. According to the current version of Commerce's annual look at U.S. industry, "1986 U.S. Industrial Outlook," shipments of superminicomputers will increase 18 percent, to \$14 billion; packaged minicomputer software, 28 percent, to \$8.7 billion; and personal computers, 18 percent, to \$12 billion. In 1985, shipments of personal computers were up 20 percent. Revenues from personal computer software are projected to increase 37 percent, to \$3.7 billion.—*Stephen Shaw*

AT&T REVEALS MORE ABOUT SATELLITE DATA SERVICE

In a recent filing with the Federal Communications Commission, AT&T Co. has provided additional details about a new service that would allow large corporations and other users to bypass local telephone companies for data and video communications. AT&T intends to lease satellite transponders from RCA American Communications Inc., Princeton, N.J., beginning April 1 to offer one-way, digital data-transmission services at throughput rates ranging from 9.6K bits per second (bps) to 1.5M bps. Two-way data services will also be available, ranging from 1.2K bps to 56K bps. Customers will use rooftop, micro earth stations—dish antennas—as small as 4 feet in diameter.—*Stephen Shaw*



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Equinox Local Multiplexers let you connect clusters of async terminals to host computers located thousands of feet away over a single new or existing 4-wire cable. Use them instead of running miles of cable and buying dozens of line drivers. For small terminal clusters use two Equinox LM-8s to connect eight terminals. For up to 48 terminals use two LM-48s.

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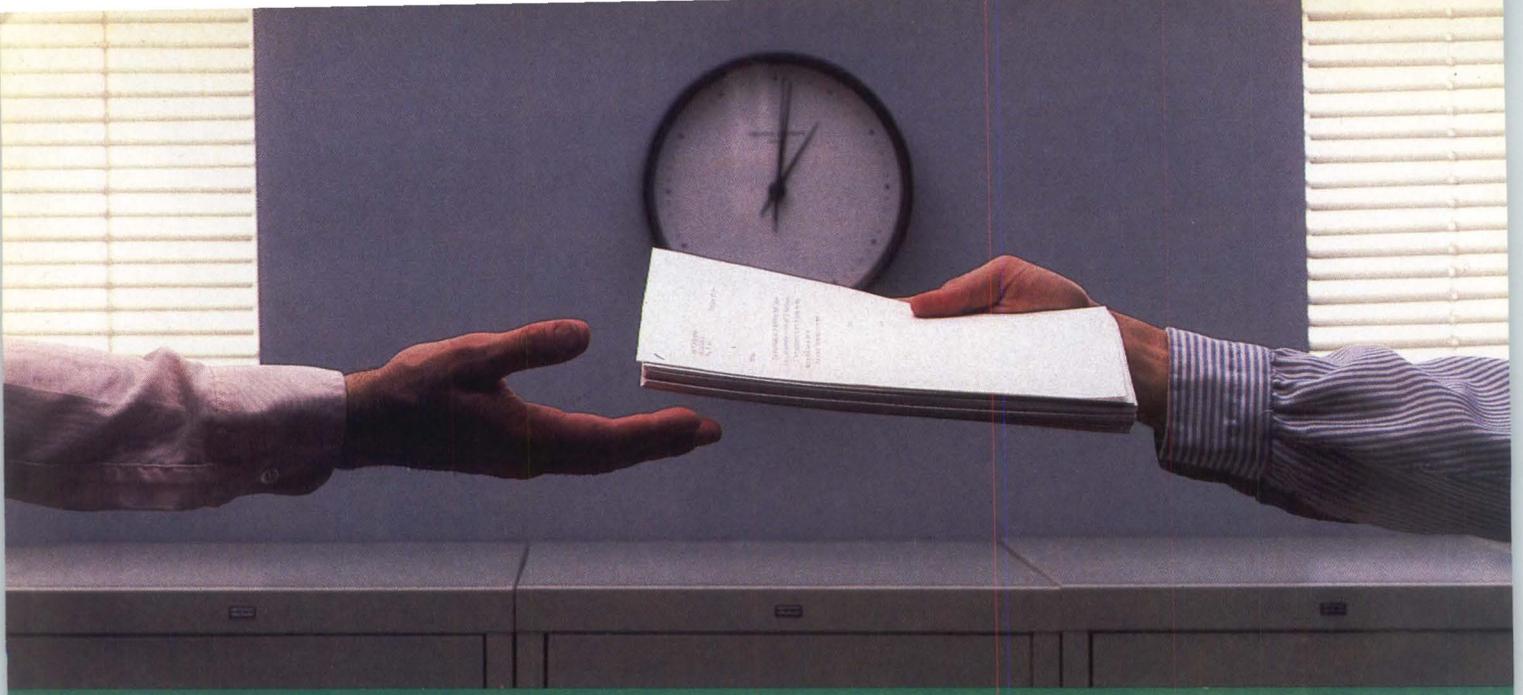
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2400 bps modems: Do you Really need another speed?

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- The MultiModem224 is available in both desktop and IBM PC™ internal card versions. (There is also a rack-mounted version for central sites.) And as a bonus, we provide free offers from ten of the most popular on-line information services, including CompuServe™, Dow Jones™ and The Source™.
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Weighing in between 23.6 and 26.2 pounds (depending on the configuration), **Compaq Computer Corp.**'s new Compaq Portable II is 17 percent to 20 percent lighter than the popular Portable 286, with which it is fully compatible. The Intel Corp. 80286-based machine runs at 6 or 8 Mhz and is available with one or two third-height, 360K-byte flexible disk drives or a combination of a flexible disk drive and a 10M-byte hard disk drive with an integrated controller. The Houston company says the three models will be priced between \$3,299 and \$5,000.—*Dave Simpson*

Available this month, the 32-bit VAXlab Realtime Workstation from **Digital Equipment Corp.** uses the company's MicroVAX II CPU and is being steered by DEC toward such applications as acoustic research, experiment analysis and image processing. Both single- and multiuser versions are available at prices from \$29,055.—*Lynn Haber*

Look now for shipments of **Concord Data Systems Inc.**'s CDS V.32 Trellis modem. The 9,600/4,800-bit-per-second unit from the Marlboro, Mass., company is said to be the first commercially available full-duplex, dial-line modem to offer trellis coding in compliance with the Comité Consultatif International Telephone et Telegraphie V.32 standards, which call for the highest possible dial-line speeds. The modem also operates on leased lines. The end-user price is \$3,395.—*Bruce MacDonald*

A new micro-to-mainframe link from **Ungermann-Bass Inc.**, Santa Clara, Calif., enables IBM Corp. PCs and PC compatibles to communicate with IBM hosts, Digital Equipment Corp. minicomputers and shared personal computer devices. The 3270 Personal Connection software is available in two models, both of which require Ungermann-Bass' Net/One Personal Connection Network Interface Unit. With the \$95 Model I, a PC emulates an IBM 3278 or 3279 terminal. Model II, priced at \$595, enables a user to connect to multiple host sessions.—*Lynn Haber*

NOTES FROM OVERSEAS: Expect two new laptop computers from **Toshiba America Inc.** of Tustin, Calif. The Japanese company's European subsidiaries have already unveiled the T2100 and T3100, both of which use gas-plasma, flat-panel screens and 3½-inch flexible disk drives. The T3100 is configured around the Intel Corp. 80286 microprocessor and is said to offer power comparable to the IBM Corp. PC/AT. Neither machine offers total IBM PC compatibility, however. End-user prices in Great Britain are approximately \$4,500 for the T3100, which includes a 10M-byte rigid disk drive, and \$3,000 for the T2100.—*Keith Jones*

British software house **Imperial Software Technology Ltd.**, London, is targeting large software-development projects for its language-independent support environment, Istar. Portable across any machine running UNIX System V, Istar has already been endorsed by Gould Inc., Fort Lauderdale, Fla., and Ada compiler vendor Alsys SA., La Celle Saint-Cloud, France, for use with projects written in Ada. The product also supports C, COBOL, FORTRAN and Pascal and will be available in the United States sometime this year. —*Keith Jones*

CONVEX MOVES SUPERCOMPUTER INTO OEM CHANNEL

In a move away from direct sales into vertical markets, Convex Computer Corp., Richardson, Texas, is now offering system integrators and OEMs stripped-down versions of its C-1 supercomputer. The Convex 6430 and 6435, priced in OEM quantities at \$240,000 and \$290,000, respectively, have no peripherals or controllers. However, they come with Convex's vector processor, says product manager Jeff Wilson. Convex decided on the OEM route after striking a deal with Digital Computers Limited of Tokyo, which resells Digital Equipment Corp. VAX machines in Japan. "We figured a lot of our work on documentation, packaging and pricing [for the Japanese OEM deal] was reusable," says Wilson.—*Mike Seither*

ENMASSE UNVEILS TRANSACTION-PROCESSING MULTIPROCESSOR

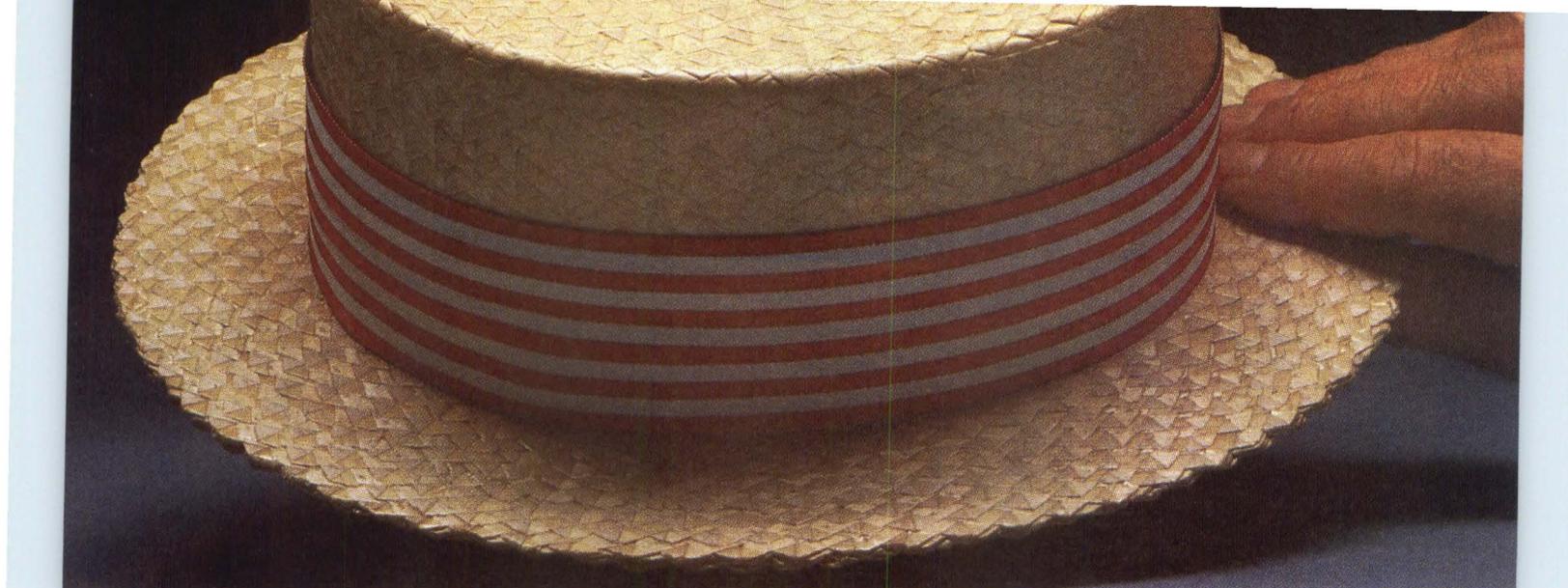
EnMasse Computer Corp., Acton, Mass., has put the power of multiprocessors into the commercial transaction-processing market with its new E/CS. A single E/CS contains one file processor and as many as 24 application processors, each with up to four I/O processors. An expanded system can contain up to four tightly coupled CPUs (file processors), which are in turn loosely coupled to the application processors via a 32M-bit-per-second bus. The system supports as many as 768 users, operates under AT&T Co. UNIX System V and runs C or COBOL programs. An entry-level E/CS costs \$60,000 including all software and supports eight users; a typical system for 48 users is \$146,000.—*Dave Simpson*

HITACHI TARGETS PC ADD-ON MARKET

The year-old Industrial Division of Hitachi Sales Corp. of America, Compton, Calif., plans to launch add-on products for IBM Corp. PCs. These include eight monochrome and color monitors that range from \$149.95 (Model MM1218D, monochrome) to \$899.95 (Model CM1457A, color monitor with a 30.8-kHz sweep frequency). Hitachi also will ship two versions of ROM compact disk drives, Model CDR-1502S (standalone) and Model CDR-2500, designed for direct mounting on a PC. National sales manager Eric Kamayatsu says sales of compact disk drives will be slow (maybe 40,000 units this year nationwide) until vendors agree on a standard file format. "An agreement on a standard format could change that overnight," he says.—*Carl Warren*

TECH FILES: A QUICK LOOK AT NEW PRODUCTS AND TECHNOLOGY

New support for the IBM Corp. PC comes from Natick, Mass.: **Prime Computer Inc.** has expanded its family with a host of PC-compatible products to be introduced this month. PC Option enables Prime PT200 terminals to function as PC/XTs; PrimeLink allows PCs to host file transfer; Prime Information/PC, a version of Prime's Information database management program, runs on MS-DOS and PC-DOS; and Prime's third-party database management system Oracle is available for both the Prime 50 series and PCs, PC/XTs and PC/ATs. Prime has said it intends to support IBM's Document Interchange Architecture, Document Content Architecture and Distributed Office Support System.—*Lynn Haber*



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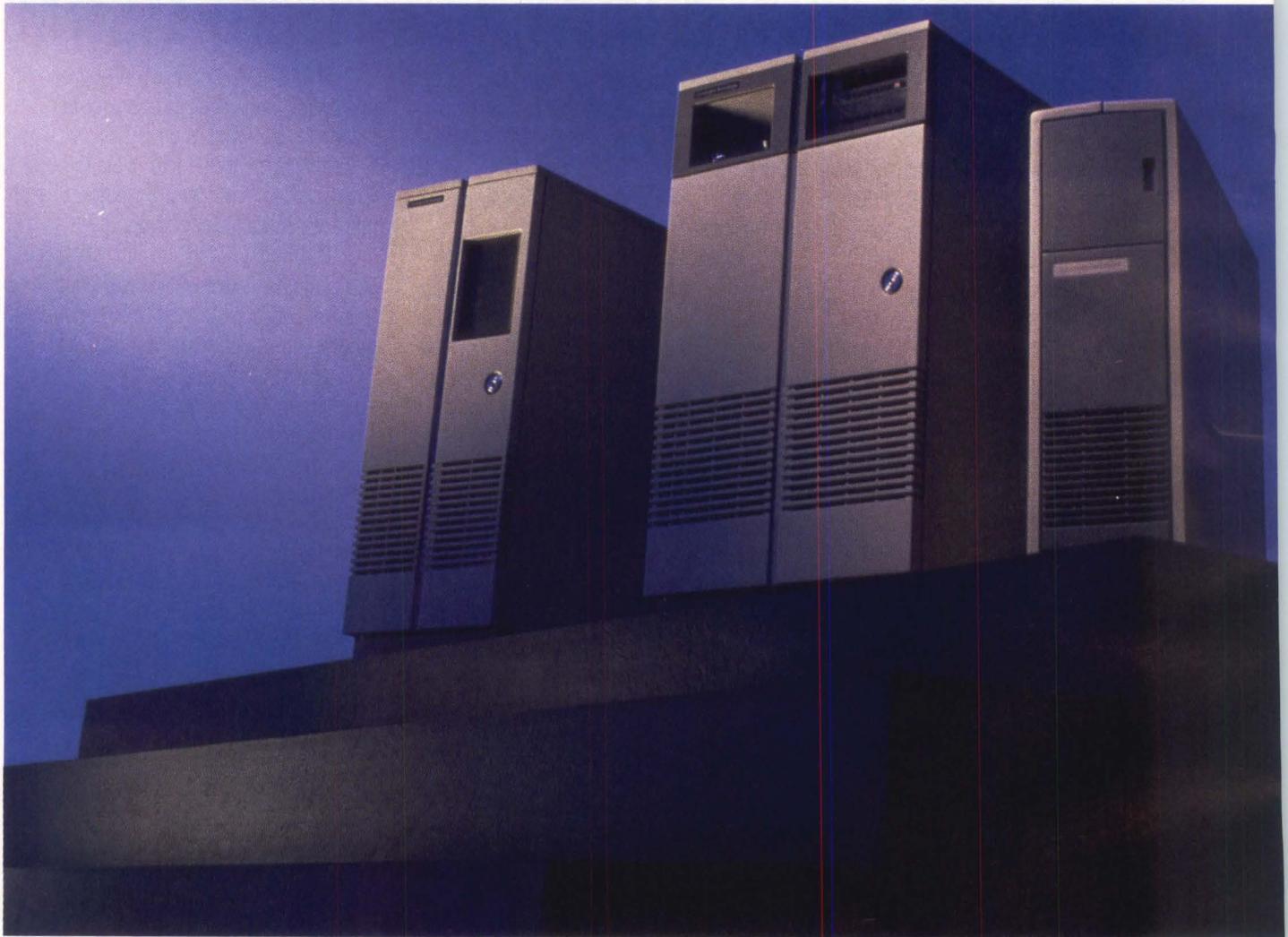
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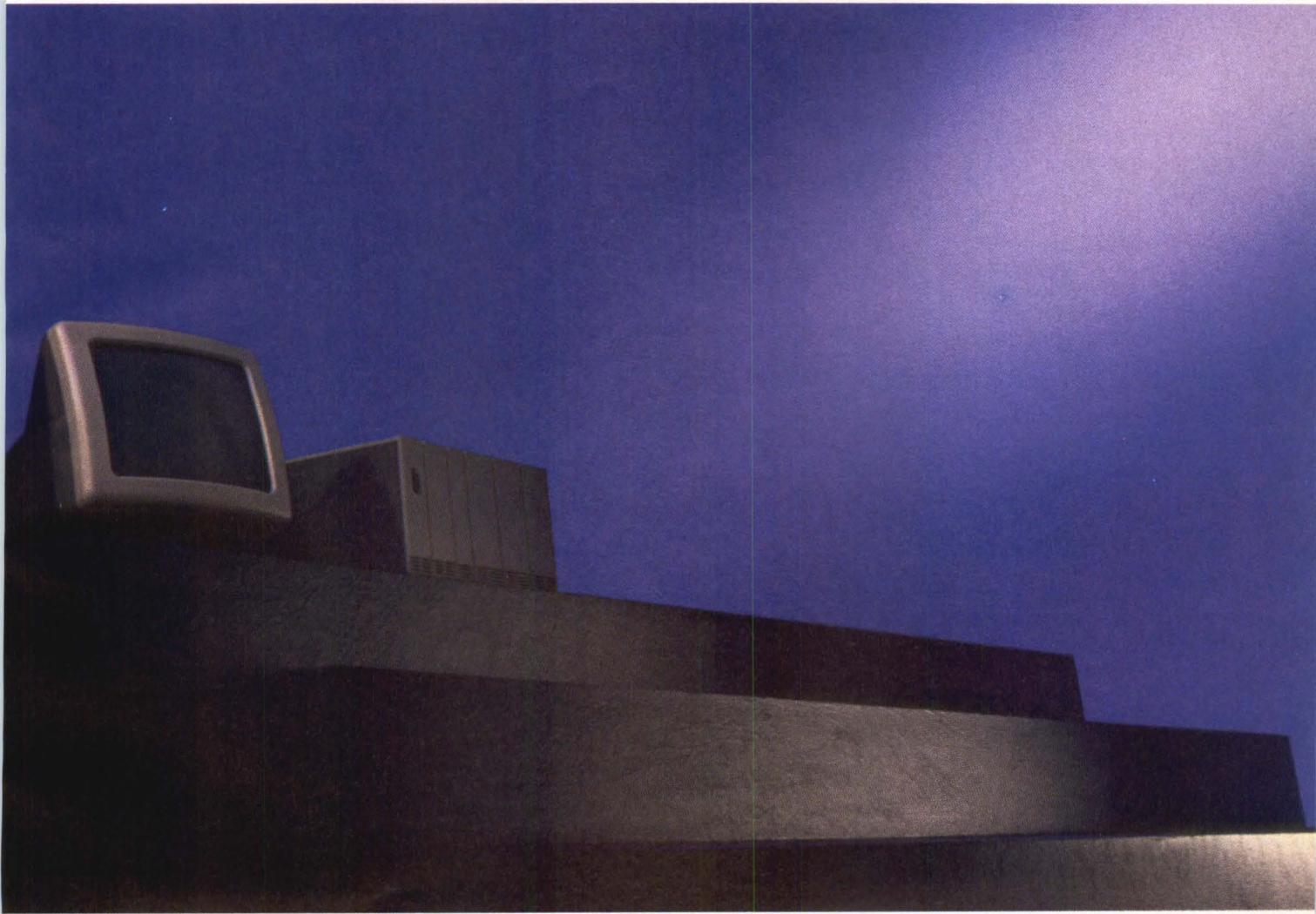
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CIRCLE NO. 18 ON INQUIRY CARD

Hewlett-Packard embraces RISC architecture with Spectrum

Mike Seither

Associate Western Editor

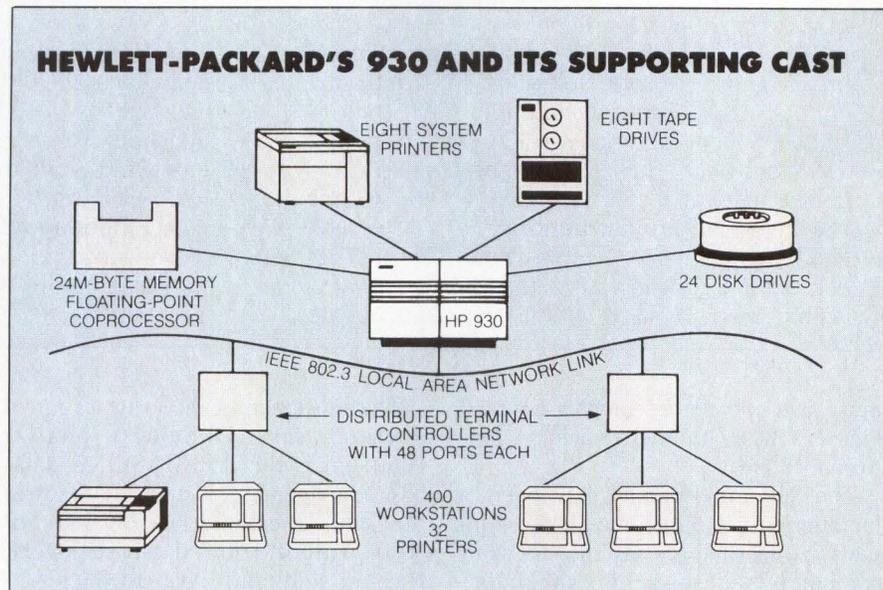
Hewlett-Packard Co. says it has laid the technical foundation of its computers for the rest of this century with two reduced instruction set computers (RISC) announced late last month. In the shorter term, the two systems, Series 930 and 950, become the high end of the HP 3000 line of minicomputers and will run all software for those machines. Thus, they will enable OEMs and system integrators to smoothly upgrade to larger systems.

Code-named "Spectrum," the RISC systems are the result of a four-year development effort by the Palo Alto, Calif., company to produce an affordable RISC machine.

The RISC architecture and code-compatibility with the HP 3000 line will not apply to HP's personal computers, like the recently announced Vectra. However, Vectra can communicate with the HP 3000 machines and other HP computers via links like AdvanceNet LAN (MMS, November 1985, Page 44).

The Series 930 is the first HP machine available to system integrators and OEMs. HP will begin taking orders for the 930 this month for delivery by year's end. A bare-bones Series 930 runs at 4.5 million instructions per second (MIPS) and costs \$225,000. That price includes 16M bytes of memory (24M bytes maximum), two I/O channels, an IEEE 802.3 local area network link, the revised MPE XL operating system and utilities, a system dictionary and the new ALLBASE/XL database management system.

HP claims that all applications software written for HP 3000 computers will run on the Series 930 and 950, as will all peripherals the company now sells for HP 3000 systems.



Hewlett-Packard says that customers can immediately use existing HP 3000 software simply by restoring the programs to the Series 930, because the object code is compatible with the new machines. Under those circumstances, though, users will see an insignificant performance increase. However, when the programs are re-compiled for the RISC architecture, performance should double for most applications, HP officials say. So, to facilitate this, a new set of HP high-level language compilers, for COBOL, FORTRAN and Pascal, offer full compatibility with compilers for the previous MPE V operating system.

"Hewlett-Packard is taking great care to protect its customers' software investment," says Gwendolyn Peterson, an analyst with Dataquest Inc., the San Jose, Calif., market research company. "They have also provided an excellent growth path for a huge installed base of HP 3000s." In the United States, nearly 25,000 HP 3000s are estimated to be operating.

It is against IBM Corp. and Digital Equipment Corp. (DEC) minicomputers that Hewlett-Packard plans to position the RISC systems. Bill Walker, HP 3000 product manager, claims the 930 and 950 provide equivalent system throughput at half the price of the DEC VAX 8600, and at about one-third the price of the IBM 4381.

To make these new RISC machines technically competitive, HP implements what it calls its "precision architecture" with transistor-to-transistor logic (TTL) (see "What makes HP's Spectrum tick," Page 30). TTL technology is only a way station, however: The RISC architecture will appear in HP machines on a single VLSI chip by 1987, when HP plans to bring out the 6.7-MIPS, \$325,000 Series 950, says Nancy Anderson, marketing manager for the computer systems division.

That the 930 achieves the performance it does while using TTL reflects the soundness of its RISC architecture, says Anderson, noting that both the DEC VAX 8600 and the IBM 4381

What makes HP's Spectrum tick

Interest in reduced instruction set computers (RISC) has gained momentum in recent years as a result of the discovery by both university and industry researchers that traditional complex instruction set computers (CISC) operate inefficiently. Such machines, with as many as 300 or more instructions—like load, store and branch—use simple instructions most of the time. So, in effect, up to 80 percent of a CISC's time is spent executing 20 percent of its instructions.

Some RISCs have as few as 60 instructions. The precision architecture on the first Spectrum computers by Hewlett-Packard, Palo Alto, Calif., has 142 instructions, compared with 230 on its traditional HP 3000 machines. But HP has gone beyond merely reducing instructions in designing its RISC machines:

- **Fixed-length instructions.** HP's instructions are all 32 bits long, in the same format. This increases the efficiency of pipelining, the process of overlapping instruction processing so that one instruction can

begin to execute before an earlier one has finished.

- **Load/store design.** Under this control scheme, only load and store instructions access memory. Loads move data from memory to the CPU registers, while stores move data from registers back to memory. HP says that this technique combines with its optimizing compilers to assure that data used most often is managed within registers, minimizing memory-access time.

- **Hardwired instructions.** The CPU implements instructions directly. Typically, CISC systems' complex instructions decode in an intermediate control/store function; RISC's make better use of machine cycles.

- **Single-cycle operation.** An instruction executes efficiently with every cycle of the computer's clock.

- **Extended addressing.** HP's architecture supports virtual address space up to 18 trillion bits. Addressing can be scaled from 32 to 48 to 64 bits. The Series 930 uses 48-bit addressing.

must use the faster emitter-coupled logic (ECL) technology to achieve performance parity.

The HP 3000 family has been a lucrative source of income for the company. Some analysts say that the four computers that make up the line—Systems 37, 42, 58 and 68—together account for almost a third of HP's fiscal 1985 computer-product revenue of about \$4.3 billion. According to the company itself, sales of HP 3000 computers rose 30 percent last year, amid the slump in most of the rest of the computer industry. Revenues from those orders, however, rose only 8 percent, chiefly because the big sales were in the less expensive 3000s, like the Systems 37 and 58.

Most industry analysts agree that HP lacks power at the top of its mini-computer line. Until now, HP's most powerful machine was the System 68. At a rated processing speed of about 1 MIPS, it's been no match for the VAX 8600 (4.4 MIPS) or the System 4381-2 (2.7 MIPS).

"What we're really providing is a phased migration," says HP's Anderson. "Customers can re-compile at a pace that will allow them to keep their business running. There really is an acceptance period with new hardware. We believe this will increase the comfort level."

The most significant software introduction, says Dataquest analyst Peterson, is the ALLBASE/XL database-management system. It features the same user interface as the HP 3000's TurboIMAGE database system. But, in addition, ALLBASE has a structured query-language interface for relational access, which allows data to be recalled more flexibly.

Responding to customer surveys that indicate a concern about system down-time, HP has armed its RISC computers with "high availability" features. One such design allows concurrent backup of data while the system is running.

Hewlett-Packard's move toward RISC reflects a growing industry trend, recently supported by IBM's announcement of its RT PC line, which includes the RISC-based RT PC 6151 model 10, a 32-bit desktop workstation. IBM claims to have invented RISC architecture, but the field is occupied as well by companies like Pyramid Technology Corp., Mountain View, Calif., and Ridge Computers Inc., Sunnyvale, Calif., which have successfully marketed minicomputers built around RISC principles. And Mips Computer Inc., a Mountain View start-up company, expects to introduce a RISC-based microprocessor for the OEM market later this year.

In addition, Fairchild Semiconductor Corp. of Palo Alto, Calif., introduced last November its Clipper, a three-chip RISC-based microprocessor system also targeted at OEMs. And the RISC-based Power 32 processor from Computer Consoles Inc., Reston, Va., has shown up recently in systems built by Harris Corp., Fort Lauderdale, Fla., and Sperry Corp., Blue Bell, Pa.

As for HP, company officials say the Series 930 and 950 are only the first of many RISC computers to come. HP's Anderson says that by this summer the company will introduce RISC technology in its manufacturing (HP 1000) and technical (HP 9000) computer products.

"It's becoming clear that the RISC approach is a good way to get high performance," says industry consultant Andrew Allison of Los Altos, Calif. He considers Hewlett-Packard's newest machines "seminal products" that will put to rest the notion that RISC architecture is of little practical interest except to academic researchers.

"When you get 4 to 6 MIPS on a single chip, that poses some interesting pricing problems for IBM, DEC and other supermini manufacturers," says Allison. "It will become difficult to sell a 4-MIPS processor for \$400,000." □

Pick look-alikes pounce on billion-dollar market

Michael Tucker, Associate Editor

At the moment, Pick seems unstoppable.

Despite the predictions of some industry pundits that Pick would fade away before more general-purpose systems such as UNIX, the business-oriented operating system from Pick Systems, Irvine, Calif., has not just maintained market share: It's actually gained users. "We're growing at a phenomenal rate," says Richard Lauer, Pick Systems' vice president of sales and marketing. "We estimate that, right now, Pick is a billion-dollar-a-year market in terms of all hardware and software sold by all vendors."

However, Pick could become a victim of its own success. Several companies market products that allow Pick-based software to run on other operating systems. Prime Computer Inc., Natick, Mass.; IBM Corp. Rye Brook, N.Y.; and AT&T Information Systems (ATTIS), Morristown, N.J., have products that allow Pick to run as a job on their own operating systems. Pick Systems, itself, markets a Pick operating system for the IBM PC/XT and PC/AT.

Pick's power derives from its origins. Whereas the UNIX operating system grew haphazardly, Pick was created by one person, Dr. Richard Pick. While UNIX's authors were chiefly interested in building a strong software-development environment, Pick was interested in data management. And, whereas UNIX's balkanization is legendary, Pick remains firmly under the control of its creator. It is completely standardized.

In addition, Pick includes an English-like programming language derived from BASIC. Moreover, Pick has been successfully ported to everything from mainframes to the IBM PC. It is correspondingly rich in application software.

As a result, Pick is a superb environment for the kind of database-management system applications that, along

with word processing, make up most of what business people do with computers.

Despite these strengths, Pick hasn't received the best possible press. In the early days of the computer boom, it was often overlooked in the battle among proprietary operating systems. Later, when it became clear that such systems as UNIX from ATTIS, CP/M from Digital Research Inc. and MS-DOS from Microsoft Corp. were the wave of the future, many industry analysts dismissed Pick as simply outclassed. The feeling was that, even though Pick might have significant advantages, the sheer marketing muscle of ATTIS behind UNIX and IBM/Microsoft behind MS-DOS would overwhelm the far smaller Pick Systems.

But Pick confounded the pundits because the calculations left out the one group whose input actually counted—the buyers. End users continued to choose Pick over more elaborate systems that had features they didn't need, couldn't understand and couldn't afford. Naturally, software developers wrote for the market, and current estimates of the number of business applications now available for Pick run into the thousands.

It is that wealth of software, as well as Pick's native strengths, that attracted the attention of so many computer vendors. Products that allow Pick to run as a job on other operating systems are now a growth industry—to the possible detriment of Pick itself.

IBM explores the Cosmos

If IBM did not lead the rush to Pick-compatibility, its mass is at least legitimizing the movement. Last December, IBM announced the remarketing of Revelation, an "enhanced version" of Pick from Cosmos Inc., Seattle, Wash. Revelation runs over MS-DOS and PC-DOS to give IBM PCs a Pick shell. Revelation users get Pick's famed user friendliness, plus a database-management facility and the



Richard Pick no longer sees his Pick operating system and UNIX as competitors: "A Pick on top of UNIX appears to make a great deal of sense, and is technically feasible."

ability to run most, if not all, Pick-based software. "Revelation isn't an operating system," says Steve Kruse, vice president of marketing for Cosmos. "What it is, is a relational product that gives the user the facilities of Pick on top of MS-DOS."

Pick Systems receives some royalties on every copy of Revelation, but all is not wine and roses for the company. Some analysts have called the Cosmos-IBM agreement the beginnings of a long-term strategy by IBM to win away Pick's entire customer base.

Kruse disagrees. "Frankly," he claims, "the people I dealt with [at IBM] didn't even know Revelation had a connection with Pick. The relationship came about because they were looking for products that ran on their local area networks—which Revelation does."

Prime already sells a Pick shell, called Information, for its operating system. Information gives Prime's customers many of Pick's strengths—particularly its English-like programming languages—plus the traditional attributes of Prime's hardware and support.

Pick Systems investigated Information for copyright violations but apparently found nothing offensive in the Prime product. Indeed, the two companies have become rather close. "I really can't say too much," says Lauer, "but there's a potential for something to happen. I don't mean that in a dark sense. I think it's possible we [Pick and Prime] will work out something."

Meanwhile, even ATTIS, parent and chief advocate of UNIX, is trying to get into the Pick market. In a recent agreement with VMark Computer Inc., Natick, Mass., ATTIS will re-market VMark's UniVerse, an operat-

ing environment that allows Pick-based software to run on UNIX.

VMark's approach is similar to Cosmos': providing essentially a Pick shell. Pick application programs can then run on ATTIS' UNIX System V or Berkeley UNIX Version 4.2. Moreover, the Pick applications can take advantage of UNIX's development and communications facilities. The result is a powerful blend, and, when the agreement was made public last fall, ATTIS announced that the UNIX-applications shortage had been overcome at last.

Not everyone sees the ATTIS-

VMark agreement in so positive a light, however. Last year, when ATTIS announced its intention to remarket UniVerse, Pick Systems sued VMark for copyright violations. No judgment has been announced.

The long-term effects on Pick Systems of Pick-compatible products like Information, Revelation and UniVerse remain unclear. Pick partisans are frightened that the pundits have finally been vindicated—that Pick will be absorbed by other operating systems. If this should happen, however, Pick's billion-dollar-a-year market would require a long time to digest. And even

then, union with other software packages might not be so bad a fate. Pick users are already calling Pick the best business-related, fourth-generation language on the market, and Dr. Pick, himself, has argued that "a Pick on top of UNIX appears to make a great deal of sense, and is technically feasible." Pick Systems and ATTIS have, in fact, begun to eye each other with interest.

Explains Pick Systems' Lauer, "I think ATTIS as a company understands there's a lot of potential for Pick and UNIX to coexist. A mixture like that would be a really terrific product." □

ANSI prepares high-speed ring standard for network backbone

Keith Jones, European Editor

While the computer industry in Europe and the rest of the world awaits the first shipments of IBM Corp.'s Token-Ring Network, work is near completion in the United States on a token-passing ring standard that calls

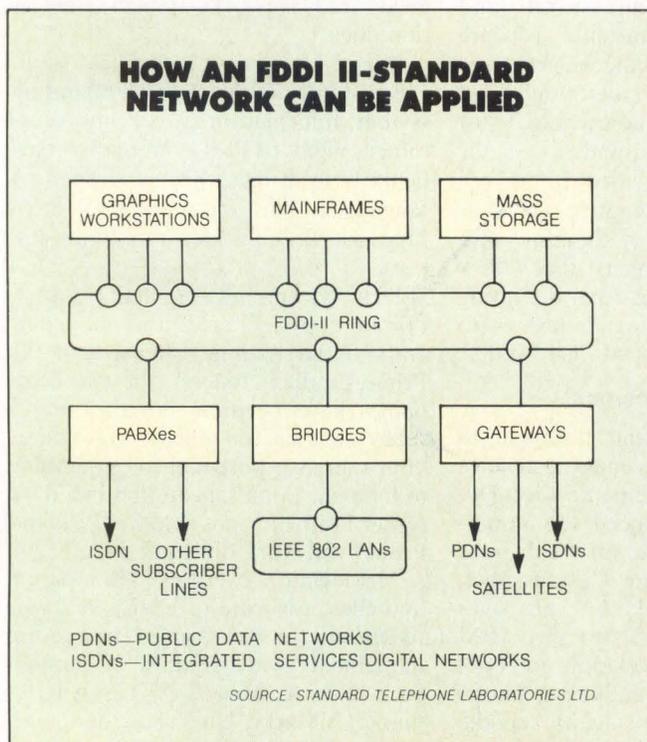
for speeds 25 times faster than the IEEE 802.5 standard which forms the basis of the IBM ring. Currently under development by ANSI and called the Fiber Distributed Data Interface (FDDI), the standard specifies a speed of 100M bits per second (bps).

That speed already is important in

linking mainframe computers with disk drives and other mass storage devices, says Terence Bentley, a communications-industry analyst at the Yankee Group, Boston. Such high speeds will become increasingly important, he adds, as workstation performance improves: for example, in communication between advanced graphics-oriented desktop workstations with bit-mapped screens that are able to transfer images of typically 2M-bit capacity in a few seconds. "Existing personal computers cannot justify 100M bps; but three years from now FDDI will be playing a significant role in LAN technology," he predicts.

European interest in FDDI—and especially in an enhancement called FDDI-II—is at least as great as U.S. interest, says Keith Caves, a senior principal research engineer at Standard Telephone Laboratories Ltd., Harlow, England, and a member of ANSI. The work on FDDI is being done by ANSI X3T9.5, and European members of the committee include Siemens AG, Munich, and L.M. Ericsson, Stockholm.

FDDI-II adds protocols to FDDI for supporting real-time transmission of digitized analog information, such as voice and slow-scan video between stations. European common carriers are introducing public switched digital net-



The FDDI standard being prepared by ANSI will run at 100M bps, facilitating communication between desktop graphics workstations as well as between mainframe computers and mass storage devices. The FDDI-II enhancement will add to FDDI the ability to support real-time voice communication between workstations and to connect to Integrated Services Digital Networks and satellite links.

works that combine data with voice and other digitized analog information in a concept referred to as the Integrated Services Digital Network (ISDN).

FDDI-II in place of PABX

Caves anticipates gateways being established between FDDI-II rings and public data networks and satellite telecommunications links. FDDI-II will also be able to link with an ISDN and other types of subscriber telephone lines via a private automatic branch exchange. He says the capability of FDDI-II to connect more than 1,000 voice workstations means it could be used in place of a PABX. And, he adds, common carriers could use it as a form of public LAN. Donald Roworth, technical director of BICC Data Networks Ltd., Hemel Hempstead, England, a European LAN vendor represented on X3T9.5, says FDDI-II is regarded in Europe as a local form of ISDN.

National Semiconductor Corp., Santa Clara, Calif., plans to develop an FDDI-II chip set as soon as the standard is stable. Eugene Milligan, manager of business and product planning for Magnetic Peripherals Inc., Oklahoma City, believes FDDI-II will reach the same level of standardization as the current FDDI within 18 months and will be "a fully fleshed-out document" before then.

As for FDDI, Bentley believes it will be key in serving as a backbone bridge between slower LANs. IBM is already moving in that direction, he says, developing an FDDI 16M-bps backbone token ring that will be able to connect several Token-Ring Networks. "Some of IBM's customers need to connect thousands of workstations—far more than can communicate over one Token-Ring Network," he explains.

One company already offering a high-speed ring conceptually similar to FDDI, although not conforming to the standard, is Proteon Inc., Framingham, Mass., with its ProNET-80. Proteon chairman Howard Salwen says the company is introducing gateways to enable ProNET-80 to act as a backbone for slower networks employing several different protocols, including IEEE 802.4 and the public digital

switching protocol, T1 carrier. Proteon offers a gateway for 802.3 Ethernet networks, as well as gateways to Proteon's own token-passing ring networks, ProNET-4, which is IEEE 802.5-compatible, and ProNET-10. Salwen, a member of ANSI X3T9.5, says Proteon will bring out FDDI-based products, but not until 1990.

Standard Telephones's Caves says FDDI products can be launched well before then, however. Advanced Micro Devices Inc. (AMD), Sunnyvale, Calif., is expected to launch an FDDI chip set sometime this year. AMD is also represented on ANSI X3T9.5.

Caves doubts that chip technology presents any serious obstacles to the wide adoption of FDDI, a view shared by X3T9.5 committee chairman Milligan of Magnetic Peripherals.

Milligan says two major parts of FDDI are sufficiently stable to have been adopted last November as working documents by the International Standards Organization (ISO).

FDDI follows the bottom two layers of the Open Systems Interconnection model specified by the ISO. The two documents adopted by ISO describe protocols at the physical layer and the Media Access Control (MAC) protocols at the data link layer. Both have reached the public review stage within ANSI. Still to reach that stage is another physical-layer document, the Physical Media Dependent sublayer, which will specify the precise type of fiber-optic cabling to be used.

According to Milligan, FDDI-II protocols will be designed to allow FDDI-compliant workstations to be used on an FDDI-II ring. □

Xerox proves it moves ideas into the market

Lynn Haber, Associate Editor

Armed with its low-cost 1185 and 1186 artificial-intelligence workstations, Xerox Corp., Stamford, Conn., is now better positioned to bring AI technology to the commercial marketplace than is any other AI workstation manufacturer, contend industry analysts. They contend also that competition for these special-architecture machines will come, not from other AI workstation makers, but from more traditional workstation vendors such as Digital Equipment Corp. (DEC), Apollo Computer Inc. and Sun Microsystems Inc.

"Xerox, because of the company's reputation and the price of the workstations, is in a very competitive position to enter the commercial AI market," says Rosann Stach, associate director of software-industry service at Dataquest Inc., San Jose, Calif. "They're the first AI-machine maker to take a look at the needs of the commercial user."

Priced at \$9,995, the Xerox 1185 is the industry's lowest cost AI-application delivery system designed especial-

ly to run LISP, the most widely used AI programming language. The 1186, the company's application-development workstation, is priced at \$15,865. Stach maintains that these machines are comparable to \$50,000 AI devices marketed by companies such as Symbolics Inc., Cambridge, Mass.

According to Xerox, both the 1185 and 1186 can be configured to support IBM Corp.'s PC-applications software and are able to run on the the Xerox Network System (XNS), the company's local area network for interconnecting office systems. Additionally, the AI workstations interface with the IBM PC, IEEE 488 and Multibus-compatible peripherals, as well as Xerox's 4045 Laser CP printer. The AI applications also interface with programs written in C, FORTRAN and Pascal on DEC's VAX computers.

"The Xerox products, while not as high in performance as Symbolics' machines, are adequate for what most people need to do," maintains Stach. She says that products from companies like Symbolics and Lisp Machines Inc., Andover, Mass., are high-performance, complex units, priced higher

and targeted more toward research markets.

According to Gary Moskovitz, general manager of Xerox Artificial Intelligence Systems division, the low-cost workstation will help spur AI growth in the commercial marketplace by making AI technology more affordable to corporate and third-party developers. Last September, for example, Xerox announced that it had signed a contract with Applied Expert Systems Inc. (APEX), Cambridge, Mass., to supply 1,000 1186 workstations. The Xerox machine provides the hardware and the operating-system environment for APEX's PlanPower expert-system workstation that enables financial planners to collect and analyze data and to produce comprehensive, personalized financial plans.

Dataquest's Stach asserts that it's a

myth that users need expensive, special-purpose LISP or Prolog machines to develop or deliver a general class of expert systems. "Users can develop expert systems on general-purpose machines aided by LISP environments," she says. She explains that the LISP language environment offers users special tools for freedom and flexibility in design.

When special-architecture machines, such as AI workstations, become a cost-effective solution for the user, Stach adds, you begin to see them take off in the marketplace. "When the cost per user makes sense, the commercial market will look at the special-purpose machines," she says. Additionally, the ability to integrate the system with other products, the availability of third-party software and company support are important to

product viability in the marketplace.

Xerox introduced some of the first AI workstations in 1981 with the 1100 series. In fact, Xerox's research work has been recognized in research and development circles as some of the most advanced in many product categories, including electronic printing, LANs, AI and workstation design. But analysts also say that many of the ideas emanating from the company's Palo Alto Research Center (PARC) in California have remained relatively disconnected from their source of origin. In other words, Xerox hasn't been the one to bring them to market. The company is working to change that.

According to William J. Spencer, vice president and manager of PARC, a popular theme in the business press a few years ago was that Xerox was unable to capitalize on its development

The AI single chip gets real

The Xerox Corp. 1185 and 1186 are among the least expensive artificial-intelligence workstations on the market. But they could face price competition soon. AI machines are shrinking to single chips that integrators can install in more conventional computers. Last year, Texas Instruments Inc. (TI), Dallas, announced Compact LISP Machine (CLM), a single-chip LISP-processor that could be incorporated into larger systems. At roughly the same time, AT&T Bell Laboratories, Holmdel, N.J., announced that it had built the first expert system on a chip.

Dedicated LISP machines differ from conventional computers in that they tag individual pieces of information with identifying labels. These labels allow the machine to do considerable preprocessing of each piece of information, and therefore applications can run much faster than in conventional processors.

TI's CLM grew out of research conducted for the Pentagon's Defense Advanced Research Projects Agency (DARPA). DARPA saw a need for a single-chip LISP engine that could serve as a processor for battlefield computers. TI, which has had a long presence in the AI market, won the contract and developed the chip. The company has announced its intention to incorporate the chip into its own line of AI workstations in the near future.

What isn't clear is whether TI will make the chip available to other developers. "We have publicly stated that we will be incorporating the chip into the Explorer Workstation," says Gene Matthews, associate director of TI's Corporate Science Laboratory. "We have not announced that we will be including the CLM in our semiconductor catalog. That isn't to say

we categorically will not do so, merely that no decision has been made whether to put the chip in our semiconductor catalog."

However, if TI does decide to sell the microprocessor, developers could use it to produce an entirely new line of LISP-based offerings.

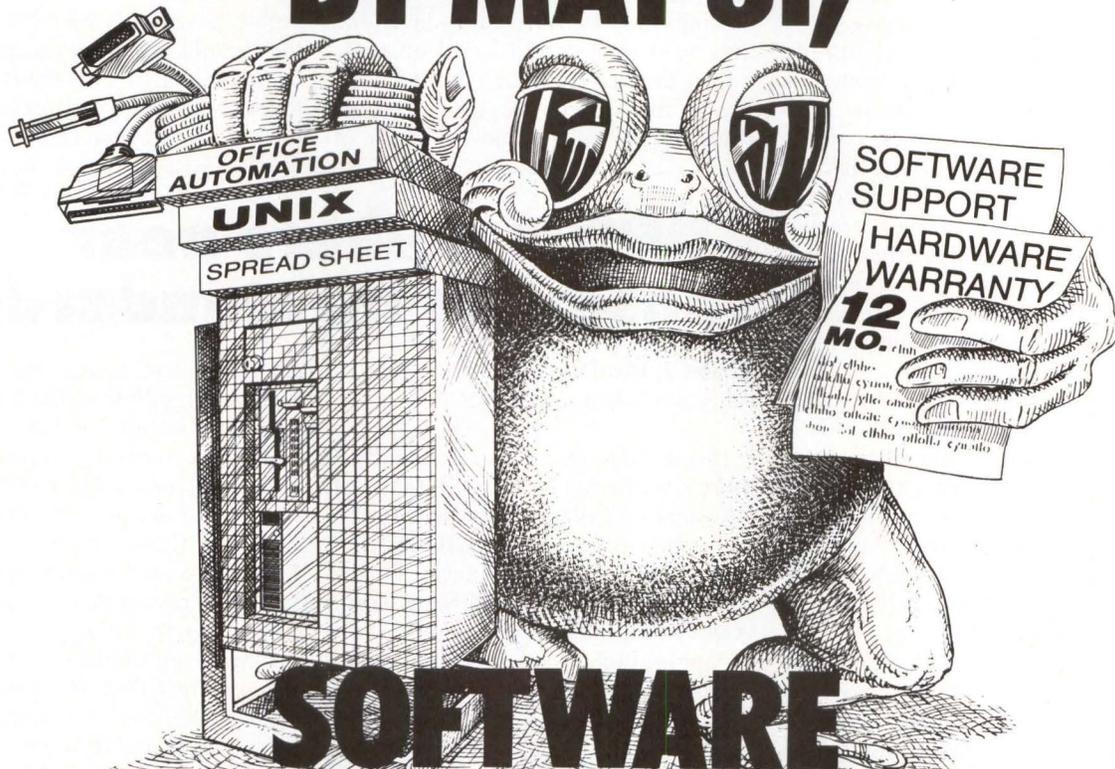
Even if TI doesn't release the CLM to developers, the chip is proof that AI machines can be shrunk to component size. Some semiconductor vendor is certain to offer them as part of a regular catalog. Integrators could use them to produce very inexpensive LISP engines, coprocessors, add-in boards and so forth.

But the real promise of single-chip AI hardware may be best glimpsed in an experimental chip recently produced by Bell Laboratories. Last December, researchers at AT&T's Machine Perception and Robot Intelligence Department announced that they would put an expert system on a chip. The CMOS, 8,300-transistor chip contained an inference engine, 16 rules in its own RAM and the ability to work with inexact, or "fuzzy," logic. Since its knowledge base is encoded in silicon, the chip can reason much faster than can software expert systems, which continually have to pull up information from mass memory. AT&T is therefore looking at real-time applications for the chip—particularly in robotics.

AT&T's chip isn't meant as a commercial product, but it shows what can be done with the technology. System integrators may someday be able to exploit board- and component-level products based on expert-system processors, just as today they configure components centered on microprocessor chips.

—Michael Tucker, Associate Editor

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work. "I think those articles written in the early '80s were a bit overblown," he asserts. But he concedes that Xerox is looking toward getting more products to market than it had previously.

Brian Boyle, president of Novon Research in San Francisco, says that Xerox used to practically give their technology away by putting it into the public domain, but he now contends that the company appears to be redirecting its thinking, citing the company's OEM strategy with the 1185 and 1186 as an example. "Xerox was a laboratory for other people. It could have aptly been called the Apple [Computer Inc.] Research Center or the Symbolics Research Center," he quips. "I think they're not going to be so generous anymore."

Founded in June 1970 at the Stanford University Industrial Park in Palo Alto, PARC's first decade was considered by some as its heyday. Its goal was to "devise and test a system that could become the architecture of information." The advances that came out of PARC between 1971 and 1977, such as electronic printing, Ethernet, the bit-mapped workstation with icons and mouse, the MESA software programming language and the Star workstation—considered by many analysts a watershed in the application of computers—had a profound impact on modern technology.

Follow that technology!

In 1979, Xerox announced that its future products would communicate via Ethernet, then a 3M-bit-per-second (bps) LAN. In 1981, DEC and Intel Corp. joined Xerox in supporting a speeded-up, 10M-bps Ethernet. Ethernet became the basis for the IEEE 802.3 LAN standard.

Today, there are over 35,000 installed Ethernet networks worldwide. Xerox had quickly made public the technical specifications for Ethernet and offered low-cost licenses to encourage other vendors to provide products for the network. Over 200 vendors now offer Ethernet-related products, including DEC, which has distributed over 20,000 licenses for its Ethernet-based DECnet LAN. Xerox handles the marketing for its XNS.

PARC's icons and the mouse were

other commercial successes. They were first implemented on the experimental Alto workstation designed in 1973 for in-house use. By 1979 there were over 1,000 Alto machines used throughout Xerox. The Alto also incorporated bit-map display and windowing. In 1981, Xerox introduced the Star 8010 workstation based on technology derived from the Alto. In 1983, Apple introduced the Lisa personal computer, which employed much of

the technology Xerox pioneered on Alto and Star. That technology appears today in Apple's Macintosh.

"Xerox's research efforts have had tremendous secondary value," says Novon's Boyle. And he gives credit where credit is due: "The way I see it, Apple gave tools to naive people so they could do what average people could do. Xerox gave smart people the tools to do what had previously been virtually impossible to do." □

CDROM makers near consensus on standards

Bruce J. MacDonald

Assistant Managing Editor

People no longer ask so frequently if there's a market for CDROM. Last November's Comdex show saw half a dozen new compact-disk systems from such manufacturers as Hitachi America Ltd., N.V. Philips and Sony Corp. And system integrators offered a host of applications, such as the *Grolier Encyclopedia*. The technology's low cost per megabyte and potential for combining text with graphics are gaining tangible support.

The question now concerns the file-format standard. There is no industry consensus: How should data be arranged on a disk? Where and how should a table of contents be placed? Where should multiple bootstrap information be located so that different operating systems can find the code and boot the disk?

But what promised to be a major battle, with rival camps forming to promote their various file formats, looks as though it will be amicably resolved, and a major hurdle for CDROM overcome. It may not happen as soon as people expected—many have anticipated that a resolution would emerge early this month at Microsoft Corp.'s conference on CDROM technology in Seattle. That now looks somewhat premature. But industry analysts and CDROM companies say an agreement between the major players is close at hand. At stake in these various standards proposals,

of course, is a big market. Linda Helgerson, editor of the *CD Data Report* newsletter, believes that the worldwide market for compact disks alone will reach \$170 million by the end of the decade, and that CDROM drives will add another \$14 million. Sony Corp. of Japan expects that fully half of its revenues will come from CD technology by 1990.

One major question remains, and it is key to the CDROM industry: What is IBM Corp. doing? It is generally acknowledged that IBM will introduce its own CD reader sometime this summer, together with a library of applications—although the applications will come from other vendors. Whatever file format IBM incorporates could obviate any agreement that once-rival CDROM companies are working hard together to achieve.

The goal of a file-format standard is to make sure that applications stored on the high-capacity disks can run on different CD readers, without the need for additional cumbersome data required to modify the operating system of the host computer (see "How to understand file formats," Page 38). As newsletter editor Helgerson says, both users and information providers want to know that disks will be interchangeable before they invest large sums of money. The physical structure of a compact disk is not an issue, as it has already been set by Sony and Philips.

Digital Equipment Corp. led the move toward a standard last October



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when it announced its Uni-File format. According to Helgeson, the company has put an inordinate amount of work into the file-format structure and interface in order for it to work in an IBM PC-compatible environment. DEC's goal, she explains, was to establish a standard in the marketplace prior to IBM's anticipated entry. But Reference Technology Inc., Boulder, Colo., and TMS Inc., Stillwater, Okla., were simultaneously working to create a standard by sharing information on their respective formats, STA/F File and LaserDOS. Other companies, including Microsoft and LaserData, were also at work on formats.

Catch the open window

Then, in a show of considerable cooperation—although all stood to gain by agreement—those five companies and six other hardware and software vendors with interests in a format met in an ad hoc group at Lake Tahoe, Nev., in early November. Known as "High Sierra" after their meeting-place, the group now comprises a dozen companies: Activenture Corp., Apple Computer Inc., DEC, Hitachi, LaserData, Microsoft, Philips, Reference Technology, 3M, TMS, and Yelick Inc. Their goal is to put together a de facto file-format standard—which they believe is key for market accept-

ance of CDROM technology—by the end of March.

In so doing, they hope to speed up the formal standards process conducted by the National Information Standards Organization (NISO) and get their products to market faster. NISO, which was to begin consideration of the High Sierra proposal in early February, will draft the standard for eventual approval by ANSI and hopes its work will be completed by the end of the year, says NISO executive director Pat Harris. According to *CD Data Report*, there is reluctance within NISO to "turn the formal standards-writing body into a rubber stamp" for the High Sierra Group's interests, which some committee members feel is happening. Harris, however, denies that High Sierra is trying to coerce NISO.

Functional specifications for a format are also being offered to NISO by the Information Industry Association. The IIA acts as an advisory group to the publishing industry and wants to make sure that its interests are considered when the technical specifications are drafted. The cry for standards has even been heard in Europe: The Optical Disk Forum, which met for the first time in January in Luxembourg, is providing input on format standards to the IIA.

At least one information provider, Online Computer Systems Inc. of Germantown, Md., feels the "best format" is irrelevant. Online is working with International Computaprint Corp. (ICC) of Fort Washington, Pa., to put R.R. Bowker's *Books In Print* and *Ulrich's International Periodicals Directory* on CDROM for libraries. Both Online and Bowker, as well as Cahners Publishing Co. of Newton, Mass., are owned by Reed International of London. According to Online president Bill Ford, "It should be the publishers who are driving this [standards] process...All the vendors want to get a format established that conforms to their particular system so that they can say that their system is the standard. I don't think we'll ever get that agreement."

Analyst Andrew Seybold of Seybold Publications Inc., Torrance, Calif., agrees: Put applications first. "If somebody came to me and said, 'If I want to buy a CDROM, what do I do,' my answer would be to buy an application, not a reader. Whatever reader that application takes, they should buy. My tendency would be to hole up and wait until the industry settles down a little."

It remains questionable whether a settlement will occur if an approved High Sierra-NISO standard differs significantly from any possible IBM file-

How to understand file formats

When information is stored or recorded on magnetic or optical media, it is done so that it can be retrieved—read. Two formats are important to recording: physical and file. The former defines how the tracks and sectors are laid out on the disk media. For example, on an IBM Corp. PC 5¼-inch flexible disk, there are 48 tracks per inch, with 9 sectors per track, each of which contains 512 bytes of information. This sector blocking is determined when the disk is formatted—the electrical equivalent of scribing the exact beginning and ending marks of the sectors.

The file format, on the other hand, defines how tracks and sectors are used to store information. The file format specifies exactly how the logical information is mapped to the physical format. Provisions are made to keep information about the record-starting sector, size and possibly the creation date. This information is used by the file manager of the operating system to locate the data when requested.

File formats aren't critical to non-removable storage devices such as hard disks except in regard to per-

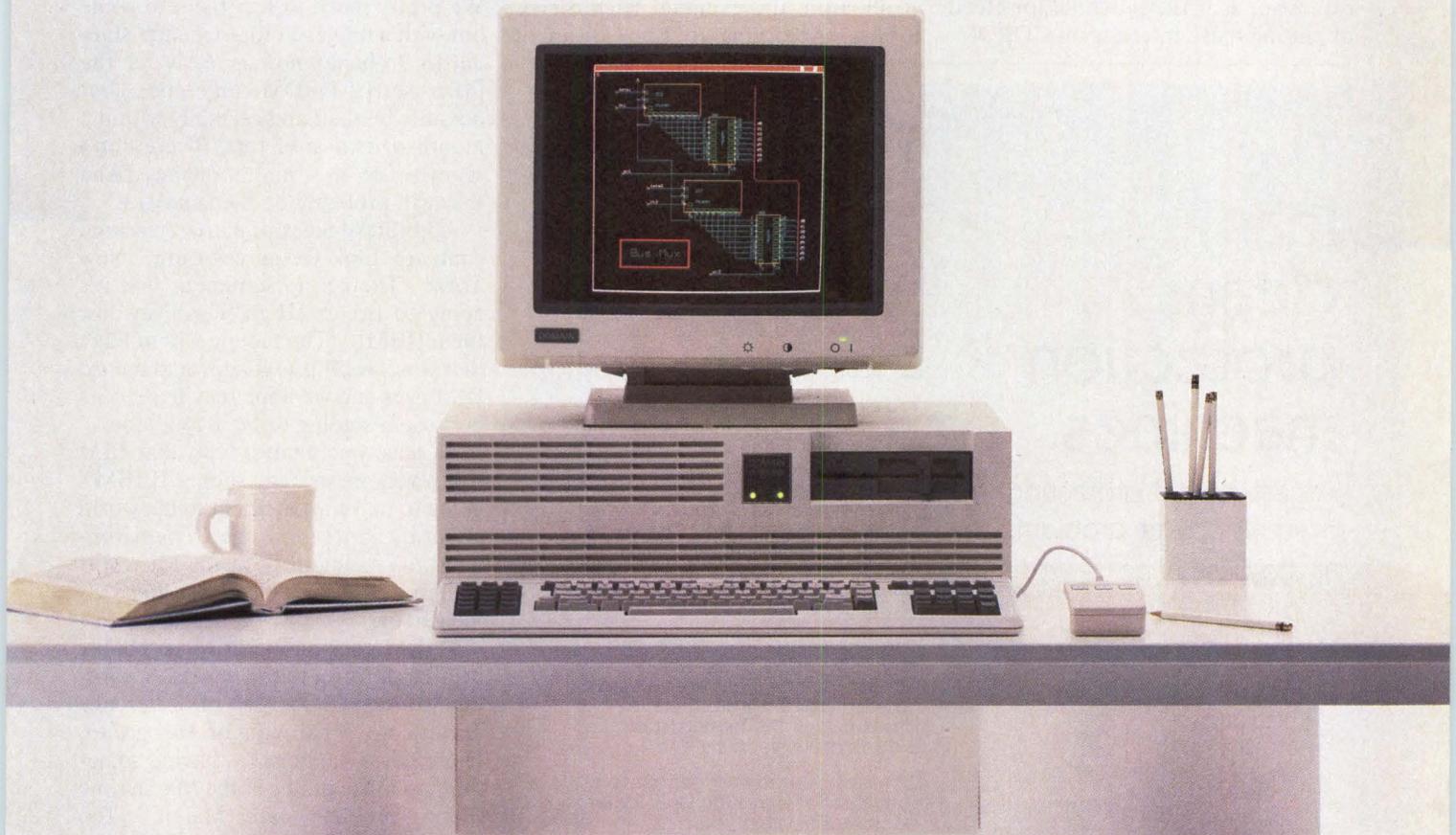
formance, but they are to flexible disks and optical media. The file format determines how and even whether the information can be read, or written, on machines from different vendors. Hence, standards become important.

For example, data stored on a Sony or Philips CDROM disk can't be read on drives which don't use the Sony/Philips file-format structure. That format divides each disk into logical blocks of 512 bytes each, numbered from 0 to 1,200,419. Each physical CDROM disk sector contains 2,048 bytes of data, so there are four logical blocks per physical sector.

Files on the disk are read using virtual block numbers, with the first block on each file being the virtual block number. Because the virtual blocks and the logical blocks are equivalent, there is a one-to-one mapping from one to the other that is transparent to the application program. The operating system, by way of a device driver, handles the mapping and determines the location of specific data.

—Carl Warren, *Western Editor*

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format proposal. While IBM will not confirm its involvement in CDROM, Reed International's publishing group says International Computaprint is working with IBM on the translation of Bowker's library databases to CDROM. Reed's publishing interests, particularly through R.R. Bowker, are extensive, as is the potential for Reed of putting those interests on CDROM.

One has to ask whether Reed would proceed without knowledge of IBM's intentions. In actuality, Reed would be an ideal candidate to provide the library of applications which IBM can be expected to offer with its reader.

But analysts feel that whatever IBM produces will not differ significantly, if at all, from the eventual High Sierra format. According to Les Cowan of

optical market researchers Rothchild Consultants, San Francisco, "We all have a feeling in the industry, and with absolutely no hard evidence, that Microsoft—in this area the front man for IBM—and Digital and the other players seem to be reaching an amicable accord through the High Sierra Group. We pretty much expect them to come out with a universal file-structure standard. Probably not as early as the [Microsoft] CDROM conference...but possibly by then and certainly within a month or two after that. There don't seem to be any major hitches. And that will probably be the standard."

Adds Steve Sieck of market research company Link Resources Corp., New York: "There's no sentiment that it's going to be 'us [High Sierra] against them [IBM].' [The feeling within High Sierra is] 'we'll use whatever standard IBM uses and we hope they'll use ours because it's going to be a good one.'"

At least one analyst feels that IBM will reveal its strategy soon. "If IBM's going to make a statement to the world about its structure in the CD environment, it's going to be at the Microsoft conference," says *CD Data Report's* Helgerson.

If IBM goes public, it will probably beat High Sierra to the punch. According to John Einberger of Reference Technology, chairman of the group, High Sierra "anticipates having something to make public in the March time frame—probably late March." Too late for the conference, perhaps, but still in time to settle one of CDROM's major differences.

Another key question remains to be answered, however: Where does CDROM fit with write-once and erasable optical media? According to Link Resources' Sieck, DEC is vigorously promoting its Uni-File format within High Sierra because it contains specific support for writing to disks, "which is going to be a lot more important in the long run to DEC than read-only media." Although still some way off, write-once systems pose perhaps the biggest threat to CDROM: If the cost of write-once technology drops quickly enough, copying data onto write-once media could cost less than volume replication on CDROM. □

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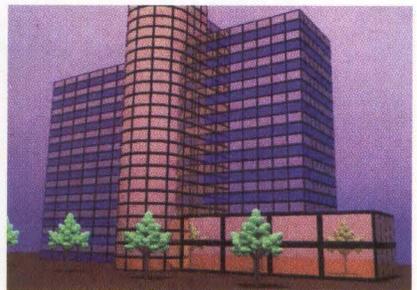
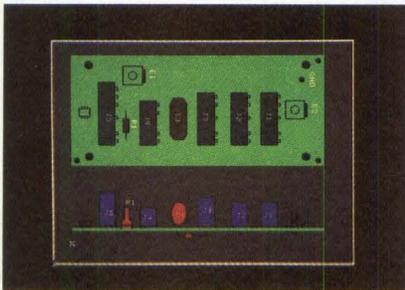
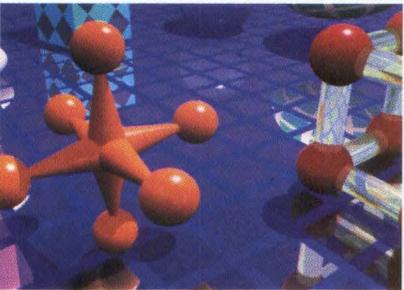
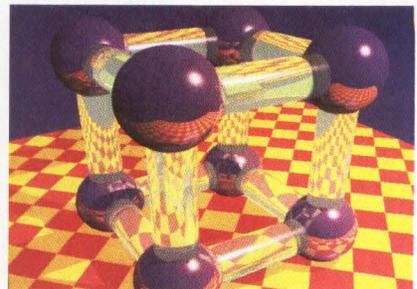
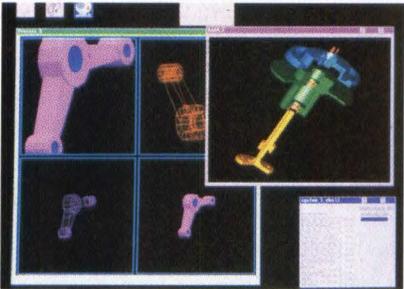
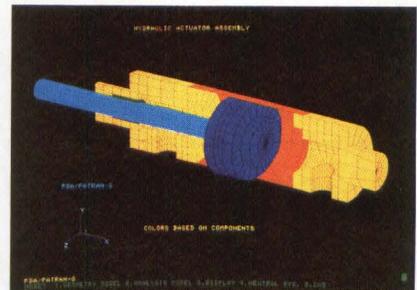
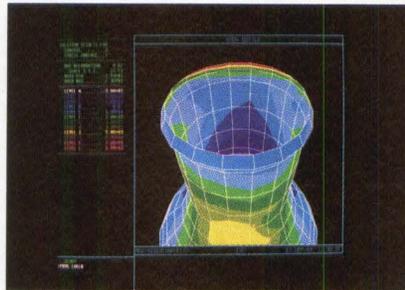
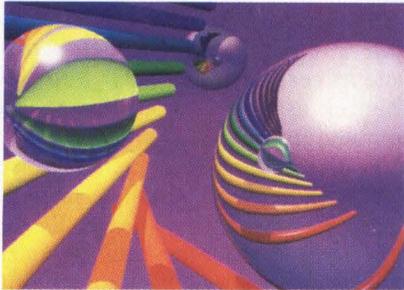
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Europeans reconsider LU 6.2/OSI protocol

Wendy Rauch-Hindin
Special Features Editor

The traditionally anti-IBM Corp. European computer manufacturers may have unintentionally dreamed up the ultimate strategy for IBM to take

market share from both European and American manufacturers. Their proposal, developed within the European Computer Manufacturers Association (ECMA), centers on IBM's Systems Network Architecture's (SNA) Logical Unit 6.2 interface as the basis for an

open systems interconnection (OSI) transaction-processing protocol. If adopted, this protocol would allow IBM to bypass the upper layers of the OSI protocol suite model, market its existing products with few changes as OSI and get a two-year jump on its competitors.

Belatedly realizing the consequences, the competitors are now trying to derail what they started. ECMA and International Standards Organization members attending a January ISO meeting in Geneva decided to re-examine the proposal before resolving the issue at a meeting this month. After all the discussion of the past six months, the only companies that voted for the LU 6.2-OSI merger were IBM and NCR Corp. Even Groupe Bull officials, the chief pushers of the proposal, seem to be looking for a way to change position, while saving face.

The love-in between OSI and LU 6.2 began in 1984 when IBM reached an out-of-court settlement with the European Economic Community (EEC) after an 11-year antitrust battle. Among the issues was a suit for copyright access to LU 6.2 and SNA, on the grounds that they were becoming de facto standards. In Europe, competitors depend on timely IBM information to interconnect their products with IBM's SNA products. IBM at first fought the suit but in the end entered into an "EEC Undertaking" (consent agreement) in which IBM agreed to produce, within a reasonable amount of time, updated manuals containing the formats and protocols languages that describe and specify LU 6.2 and SNA.

ECMA was initially delighted with the decision. Its thinking was to make about 90 percent of LU 6.2 into a standard to be known as Connection-Oriented Transaction Processing (COTP). This standard would provide a mature transaction-oriented protocol for European computer manufacturers. It would also force IBM to freeze part of LU 6.2, thus giving other computer manufacturers competitive equality. But a number of computer manufacturers, particularly in the

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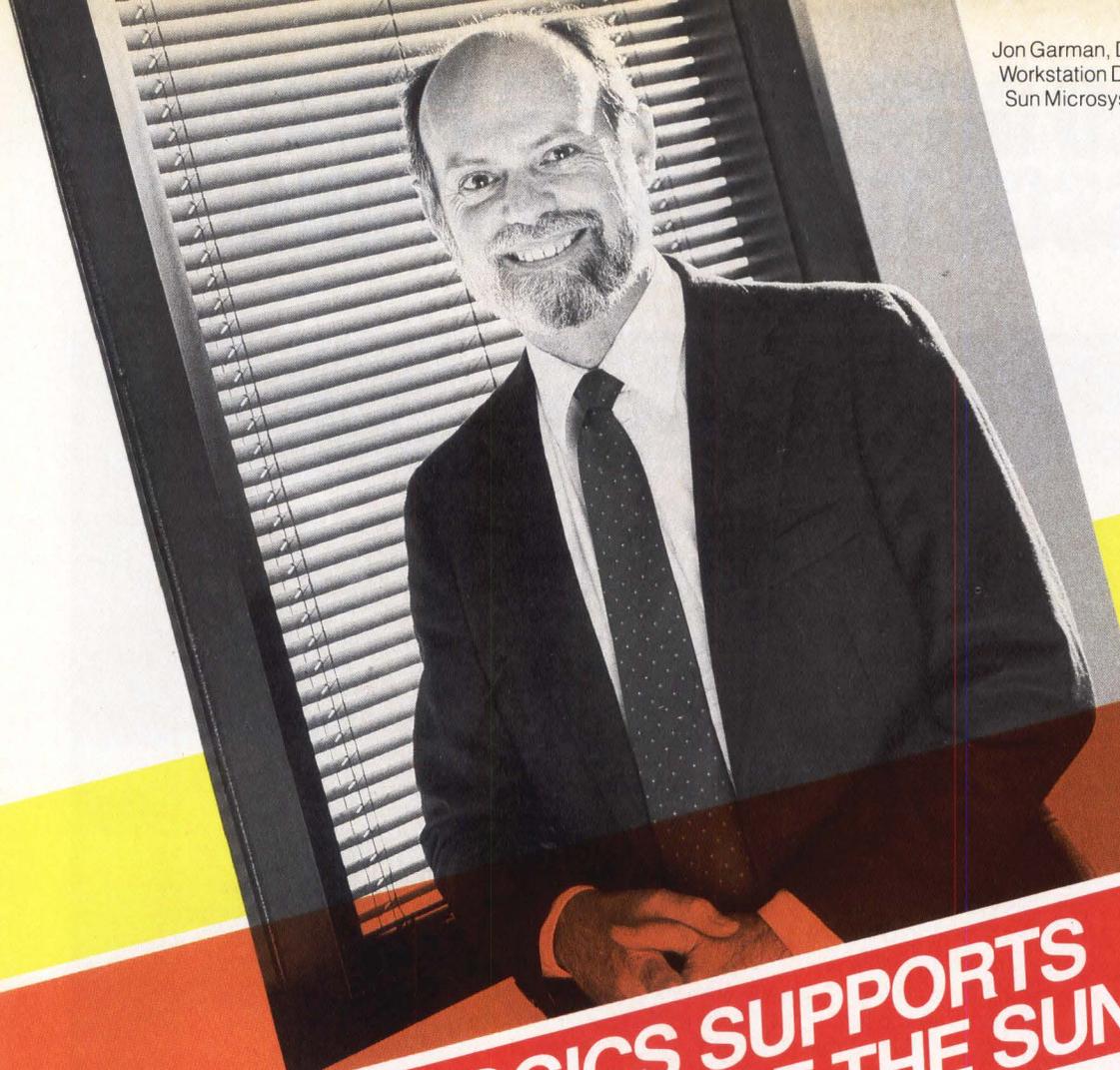
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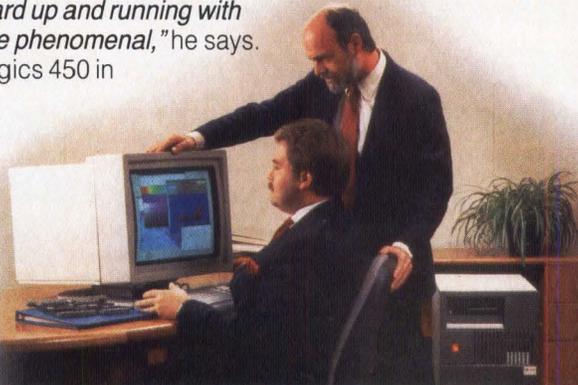
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United States, aren't so sure about the equality.

From the OSI model's perspective, COTP is an application protocol that sits on top of OSI's Common Application Service Elements (CASE). CASE is an application-level protocol that ensures that only relevant programs talk to each other. COTP uses none of the CASE facilities, or the OSI Session, or Presentation protocols: layers 5 and 6. These services are replicated in LU 6.2. An OSI session manager module, however, links COTP with OSI's lower layers.

The replication would allow IBM, in effect, to attach LU 6.2 to its OSI Transport-protocol (Layer 4) products to manufacture OSI-conformant, transaction-processing products. Other U.S. computer manufacturers estimate that it would take them two years to bring out similar products. IBM still needs full OSI for other applications. But this is a small problem compared

to what IBM would gain in the transaction-processing business.

The transaction-processing business makes up approximately 85 percent of all computer-to-computer applications, and IBM dominates this business. OSI could move quickly into the transaction-processing arena by adopting COTP. This adoption, moreover, could give IBM new competitors in key market areas like banking and airline reservations. However, the headstart IBM would get if COTP were adopted would likely enable it to leapfrog these competitors. In any case, IBM's cooperation with ECMA's efforts to standardize LU 6.2 was indicated by a Dec. 13, 1985 letter from IBM to ECMA.

Ironically, neither IBM nor ECMA proposed LU 6.2 to ISO. It came to ISO's attention when a Groupe Bull member of ECMA showed up at three technical-expert meetings, first in Helsinki in September, then in Raleigh, N.C., in November and, lastly, a week

later in Toronto with the informal ECMA COTP document. At each meeting, he tried to get the document accepted as a work item because a work item almost always leads to a standard. The document was rejected each time because only governing and member bodies, such as ECMA and ANSI, have the power to request work items; individual members do not.

Technically bad idea

In Helsinki the Groupe Bull member sounded out the ISO participants, who bluntly told him it was a technically bad and impolitic idea. But the Raleigh meeting was the dramatic one. There, say attendees, when COTP came up for discussion the room suddenly filled with IBM staffers. They were trying to help the Groupe Bull member introduce the COTP as a work item. They didn't succeed because the proposal had not been blessed by ECMA.

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Another reason it failed is the COTP proposal has technical problems. For example, commitment, concurrency and recovery (CCR) is particularly important to transaction-processing. OSI has an approved CCR standard. The ISO CCR "rapporteur" (reporter and liaison) plus an ECMA group and some ISO members did a technical comparison between LU 6.2 and the

OSI CCR protocol. After study, they felt that the OSI CCR is more powerful, more flexible and does everything that LU 6.2 can do and more. The evaluators flagged some differences, such as a heuristic timer on recovery procedures and certain user-interface features, which ISO intends to incorporate into the ISO standard.

Also, a DIN position paper on trans-

action-processing standardization claims that the ECMA proposal is only an interface to cooperating transaction-processing, rather than a definition. The paper states that COTP doesn't define the meaning of cooperating transaction-processing interactions, such as "logical bindings; jobs to be remembered, managed and scheduled; and activities to be resumed, recovered and rerun after failures. These are all concerns of the COTP users."

Further elaborating on these differences, Hoyt Kesterson, an engineer at Honeywell Inc., Phoenix, Ariz., and rapporteur for the ISO Presentation Group, adds, "It shouldn't be left to each customer-transaction routine to decide what should be done when a system roll-back request is received."

Architecture mixes services

Kesterson claims that, architecturally, LU 6.2 is not a good protocol. "Presentation and application services are mixed together because LU 6.2 is something that has grown with IBM and SNA for a long time." Many ISO members agree with Kesterson, adding that their analyses show that LU 6.2 has less capability than the current upper layers of OSI.

Despite the potential advantages for IBM, there is no indication the company instigated the COTP incidents. "There is no IBM proposal concerning LU 6.2 that has been presented to either ECMA or ISO," an IBM spokesman says. "Many IBMers turned up at this meeting simply because IBM has cut travel budgets and this meeting happened to be held in Raleigh, where IBM has a large communications division."

Few people outside of Groupe Bull and ECMA claim to understand why they pushed LU 6.2 as an OSI standard. ISO is expected to rework the ECMA proposal, which contains constructs but doesn't say what to do with them. In addition, it will use the COTP work to produce a document that defines the meaning of the services and interactions. Finally, it will integrate the new document into the architecturally appropriate Session, Presentation and CASE protocols to achieve transaction-processing within OSI. □

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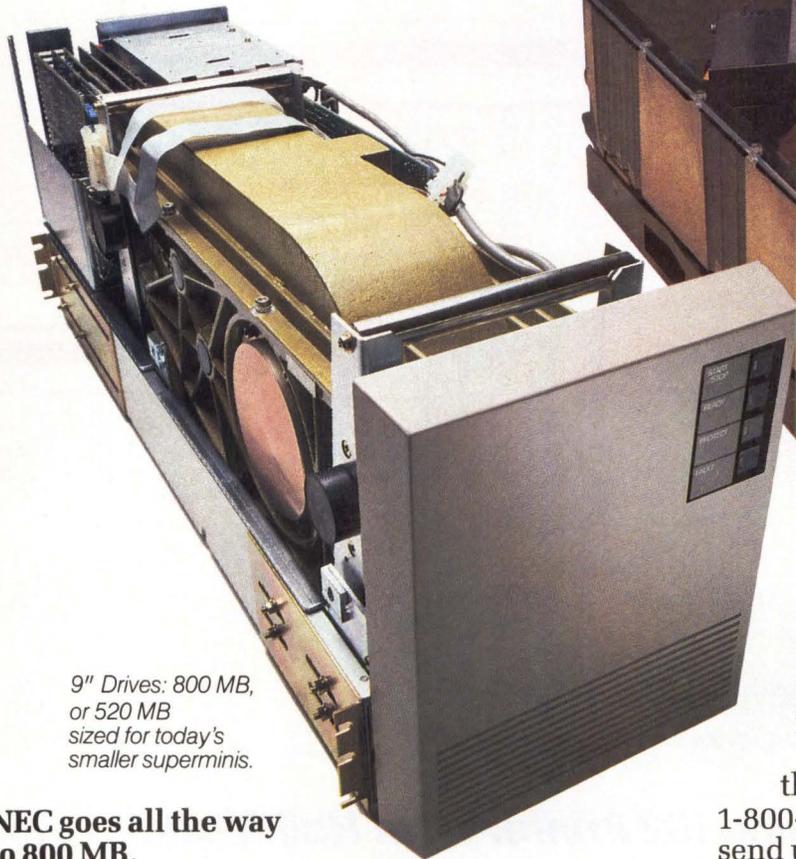
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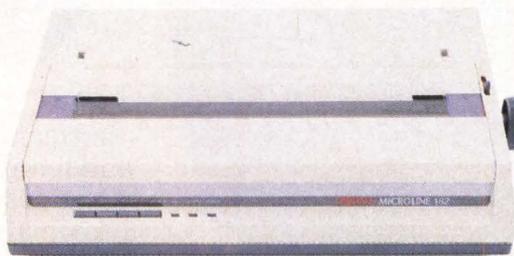
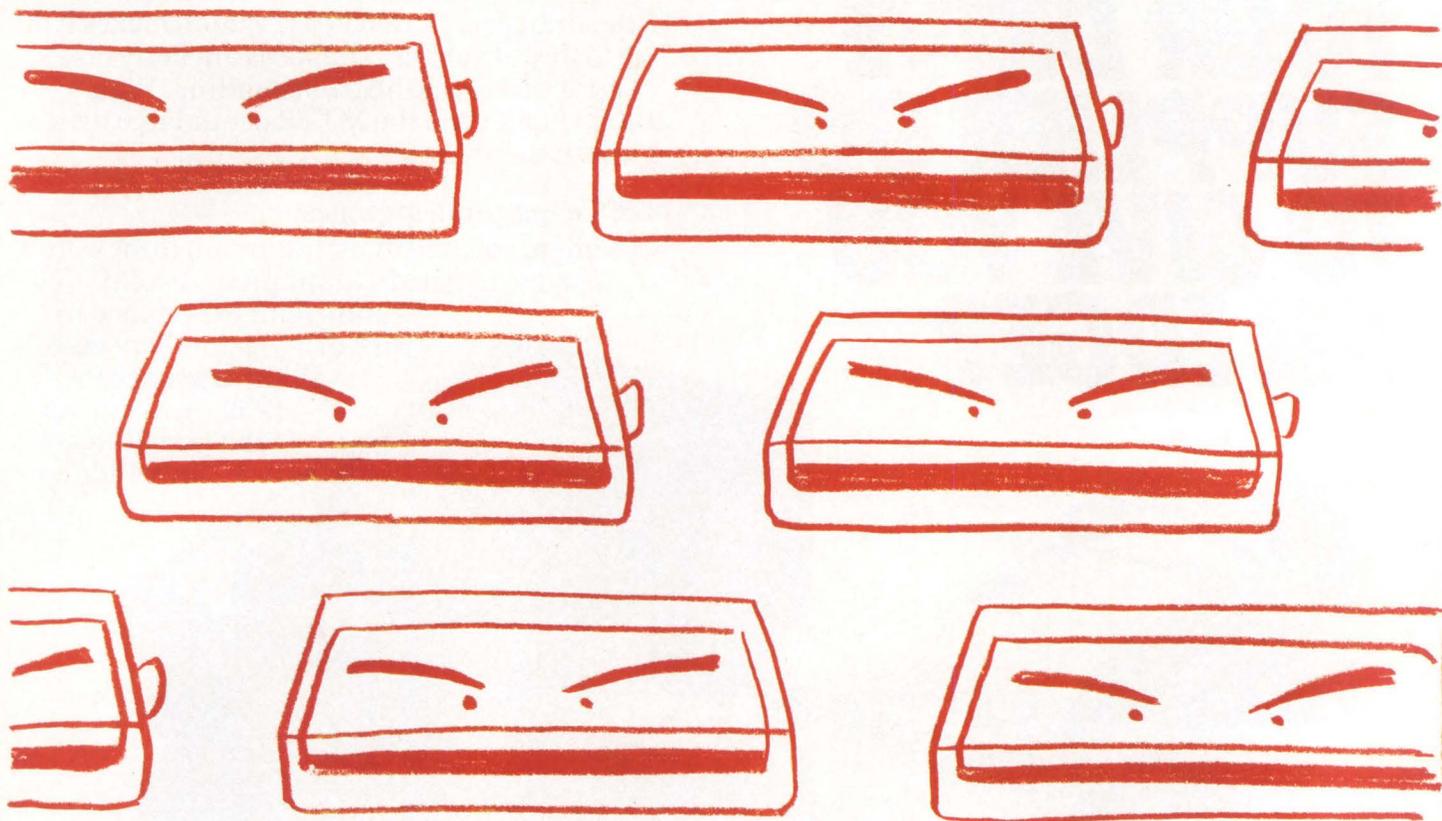
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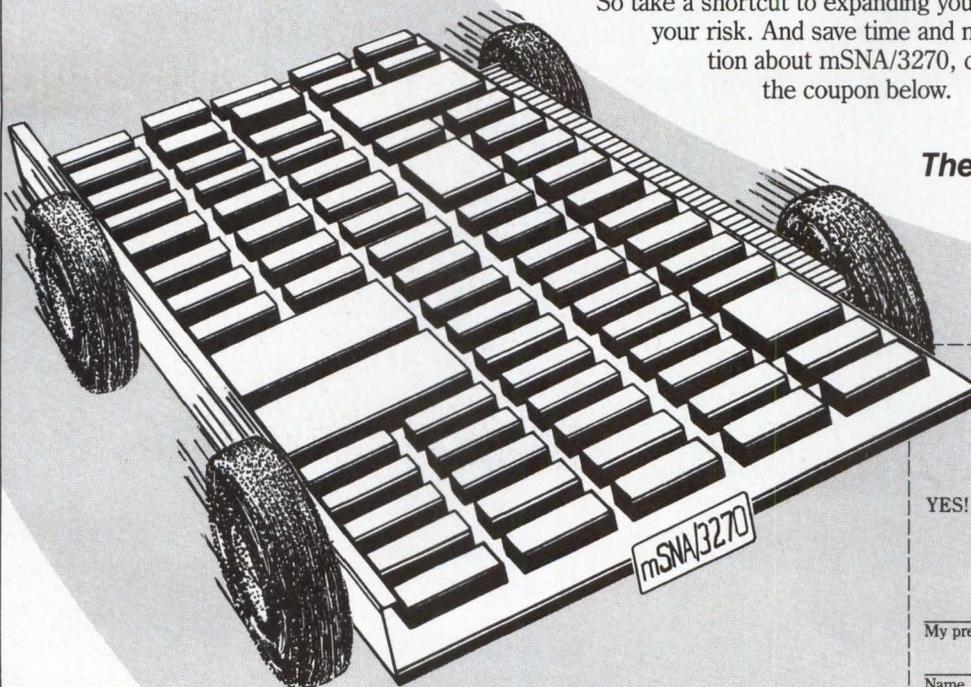
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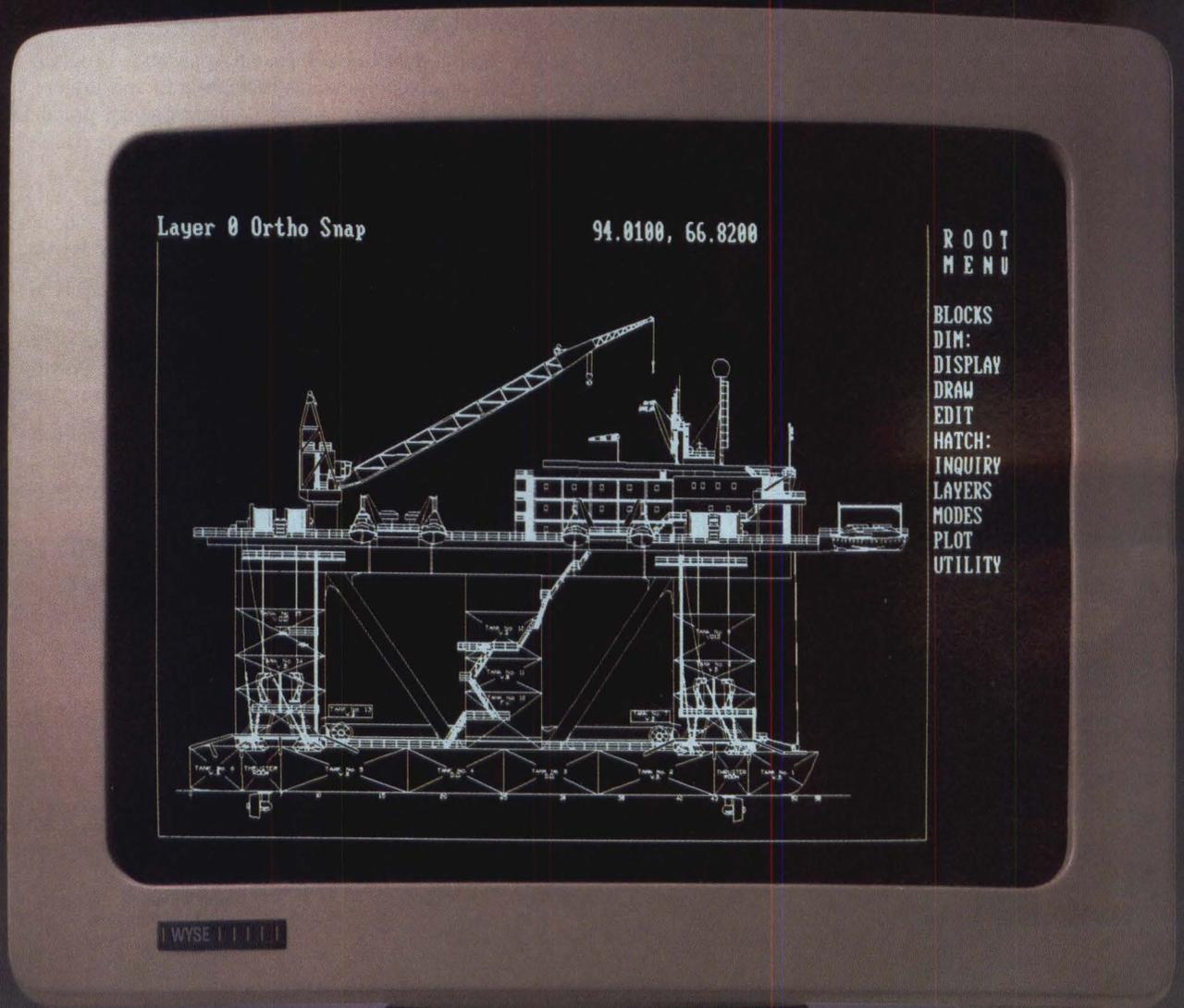
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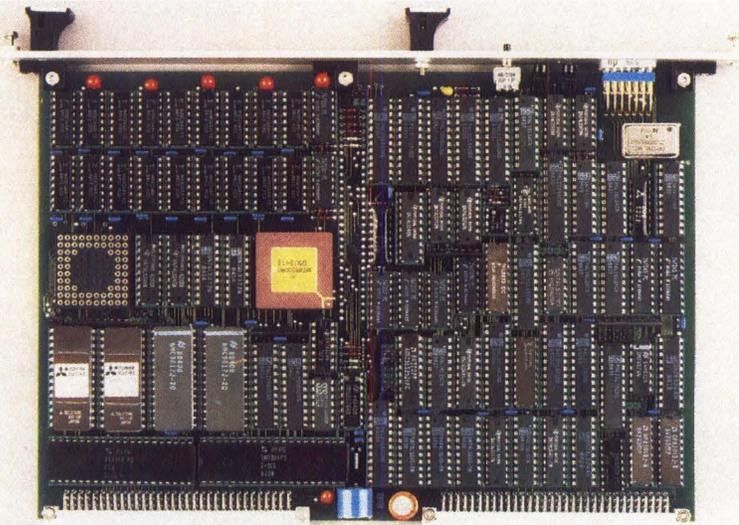
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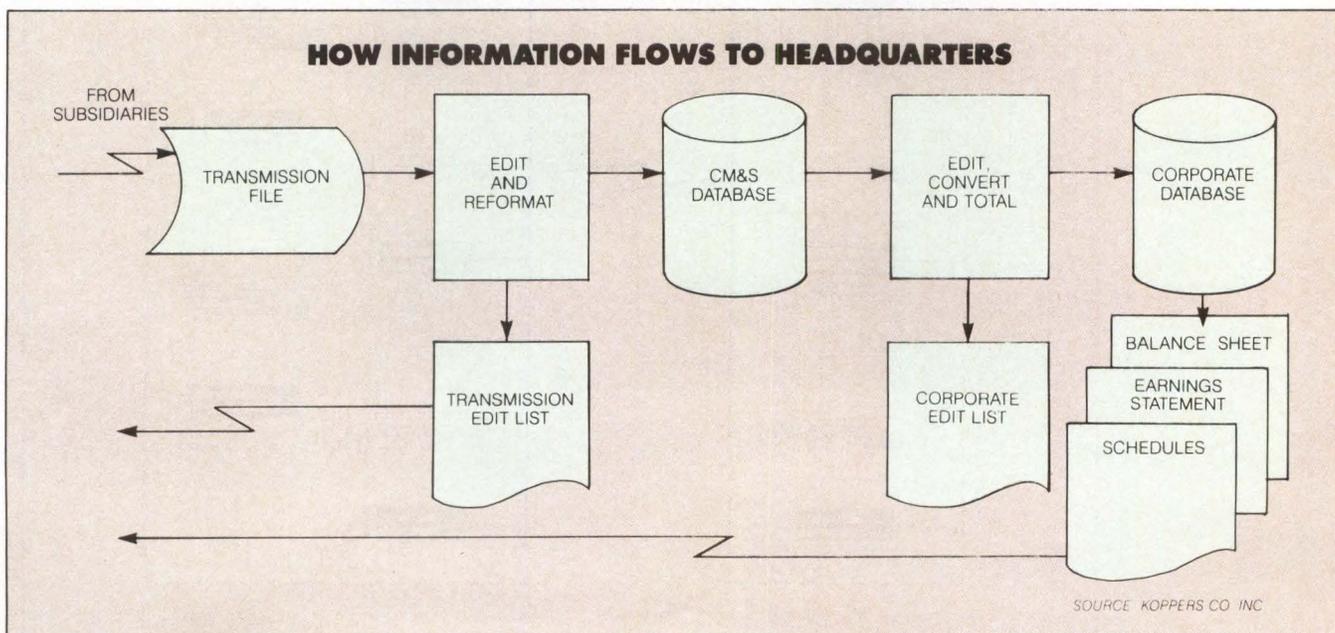
Jim Rothrock, Concord Data Systems Inc.

Koppers Co. Inc., Pittsburgh, a Fortune 250 company, produces raw materials and performs heavy construction. Until recently, Koppers and all its subsidiaries compiled financial reports manually. However, mailed reports from Koppers' subsidiaries were taking too long to reach headquarters.

Last year, Koppers' largest division, the Construction Materials & Services (CM&S) unit, installed a high-speed telecommunications network to remedy the situation. The network links

CM&S' subsidiaries to Koppers' home offices via regular telephone lines. With direct access to CM&S' numerous financial databases nationwide, Koppers management not only gets data faster but can better track and control the division's operations and meet government and public reporting requirements.

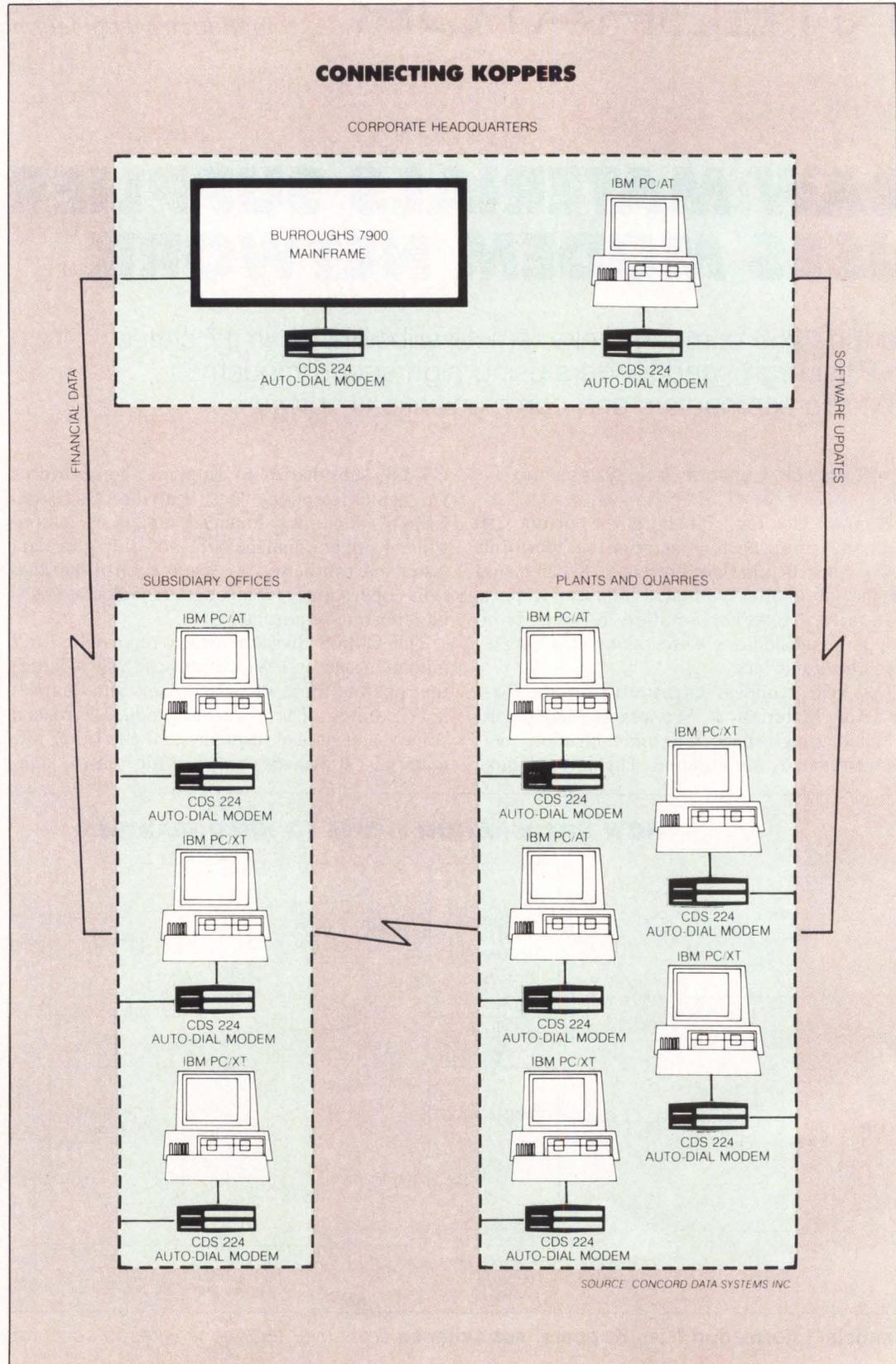
The CM&S division, which reported \$707.7 million in sales in 1984, comprises 18 subsidiaries that operate more than 160 plants and quarries in 17 states. The division produces crushed stone, sand, gravel, asphalt, coal and other raw materials. It provides material for houses, high-



Financial information from Koppers' subsidiaries flows over telephone wires to corporate headquarters.

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Installations at Koppers' subsidiaries and field offices comprise an IBM PC/AT or PC/XT and a 2,400-bps CDS 224 auto-dial modem that transmits data over regular dial-up telephone lines. The subsidiaries transmit directly to a Burroughs 7900 mainframe in Pittsburgh.



ways, railroads, pipelines and bridges and performs engineering and maintenance services. To control all these operations, Koppers' corporate accounting department tracks the finances of CM&S' subsidiaries, which in turn must submit monthly cash statements, trial balances, profit-and-loss statements, consolidated raw data, expense schedules and other reports.

This data from the subsidiaries and their field sites are incorporated into the many corporate-level financial reports Koppers generates for government, stockholders and the public. As a major corporation with federal, state and local government contracts, Koppers must issue detailed tax statements and quarterly and annual reports to the Securities and Exchange Commission and other government agencies. What's more, because its common stock is traded on the New York, Midwest and Pacific stock exchanges, Koppers must issue monthly profit reports to the public and to the stock market. The volume of Koppers' financial reporting dictated an integrated information system that can promptly deliver data from widespread sources.

Retyping causes bottlenecks

Furthermore, Koppers' management called for a telecommunications network to provide timely information needed to help monitor trends in the field and to better track operations. David Bertenthal, Koppers' management-information-systems (MIS) director, points out that a long time lag in getting financial information to headquarters sharply limits that information's usefulness. The collected data shows managers how the subsidiaries react to common economic conditions, how well they manage their businesses and cash flow and whether they are properly capitalized. It also helps managers identify and try to prevent potential problems. "If the data comes in a month late, any problems will have most likely escalated," says Bertenthal.

Before the telecommunications system was installed, CM&S subsidiaries manually compiled financial reports, collecting the necessary data from the records of on-site plants and quarries. After merging the data, employees would retype the information in the proper format, using special keypunching forms or a computer, if one were available at their subsidiary. They then mailed the completed documents to Pittsburgh, where workers in the corporate accounting office entered the data onto a Burroughs Corp. 7900 mainframe computer. This process took one to two more days and required three people to handle the incoming paperwork—a mail clerk, a clerk who logged in the reports and routed them to be keyed in and a keypunch operator. All told,

Spec summary

- **Model:** CDS 224 auto-dial modem
- **Manufacturer:** Concord Data Systems Inc., 397 William St., Marlboro, Mass. 01752
- **Data rate:** 1,200 or 2,400 bits per second
- **Transmission mode:** Full duplex
- **Synchronization:** Asynchronous/synchronous
- **Calling mode:** Auto-dial/auto-answer
- **Diagnostics:** Local and remote, digital and analog loopback, self-test
- **Price:** \$450 per connection

it took two to three weeks before corporate management gained access to the data.

It became obvious to Koppers that these bottlenecks could be eliminated if subsidiaries could transmit information electronically without retyping. To convert to a fully automated system, Koppers supplied 14 CM&S subsidiary offices with IBM Corp. PC/XT or PC/AT microcomputers. The company chose the IBM equipment because many of its subsidiaries had IBM mainframes installed, which would be compatible with the PCs. Next, the company equipped each office with full-duplex, dial-up CDS 224 auto-dial modems from Concord Data Systems Inc., Marlboro, Mass. The CDS 224s, distributed by American Datacomm, Pittsburgh, provide remote communications between the IBM computers and the corporate mainframe. Koppers chose the CDS 224 auto-dial modems because they can support 2,400-bit-per-second (bps) communications over regular dial-up telephone lines, eliminating the need to lease additional equipment from the telephone company.

Software eases communications

Finally, Koppers selected the MicroGate 3780 synchronous communications software package from Gateway Microsystems Inc., Austin, Texas, to set up the modems and implement batch data transfer from the subsidiaries to headquarters. American Datacomm recommended MicroGate because it would work well with the built-in programs of the Concord modems. Other reasons for choosing MicroGate were its PC compatibility and that it allows a PC to emulate an IBM 3780 computer, which exactly fits the company's requirements. What's more, it offers unattended-mode command files and multilevel user-help screens.

To allow both corporate offices and subsidiaries to use the on-line data services, Koppers also provided Crosstalk communications software from Microstuf Inc., Roswell, Ga. The company

The prevailing dial-up modem speed of 1,200 bps was too low for the volume of batch transmissions the company required.

chose Crosstalk because of its ease of use: Users simply connect their modems and are on-line in minutes. What's more, it provides auto-dial and auto-answer support for most modems and allows for disk-to-disk transfer of program and data files between compatible systems. In addition, Bertenthal finds Crosstalk a good package for debugging database applications.

Concord installed the equipment within a week, and full implementation of the software took two more weeks. Gateway and Microstuff ironed out bugs within another month. The hardware has been running reliably, Bertenthal says. Koppers had no major problems with installing the hardware. The main problems emerged in building software programs for file transfers. Teaching people to use the software was a major hurdle because very few had experience with computers.

Modem relieves data backlog

With 14 of 18 subsidiaries and a growing number of plants on-line, CM&S has relieved much of its information backlog. Using the telecommunications network eliminates delays caused by slow mail delivery and data routing and handling. Headquarters personnel no longer have to handle paperwork and re-enter data. "The data goes right into our mainframe computer, and no one has to touch it," says Bertenthal. Everyone at the management level then has immediate access to financial reports and summaries. The network also substantially reduces the volume of paperwork—organizing and typing reports—the subsidiaries perform. This not only saves time but also encourages subsidiaries to get their reports in on schedule. "Before, some offices used to spend a day just typing reports," Bertenthal says. "Now they can just send the raw data. The information is already on their computers. They just transmit the file to the home office."

Under the new system, subsidiaries' databases tie directly to the corporate office. The subsidiaries simply cull the raw data from their general ledgers, format it to headquarters' specifications using a numerical account structure and transmit it directly over telephone lines from the PC/ATs and PC/XTs to Pittsburgh. The Burroughs mainframe then generates the reports using Koppers' internally created accounting software.

System provides more detail

In addition to subsidiary offices, some 20 plants and quarries are equipped with PC/XTs, PC/ATs, modems and communications software, bringing them on-line to both their respective subsidiary office and directly to Pittsburgh. This

immediate dial-up access allows subsidiaries to pull data directly from the on-site computers and incorporate it into their files without spending hours playing telephone tag, waiting for data to arrive from field offices and then rekeying the information.

Before the telecommunications system was installed, processing, keypunching and formatting data from each site took two to three weeks, Bertenthal estimates. As a result, Koppers had to make do with financial summaries incorporating data from all sites rather than individual reports from each plant. However, with databases linked via modem, subsidiaries can now easily "capture" detailed information on its plants and quarries and send it on to headquarters. According to Bertenthal, the availability of specific data on the activities, profits and losses for each field site means that corporate management can now review operations at the plant level. "Before, we received information only on subsidiary operations as a whole," he explains.

In addition, the telecommunications system helps ensure data integrity at both the plant and subsidiary levels. Because information is keyed into the system only once, the error rate is much lower.

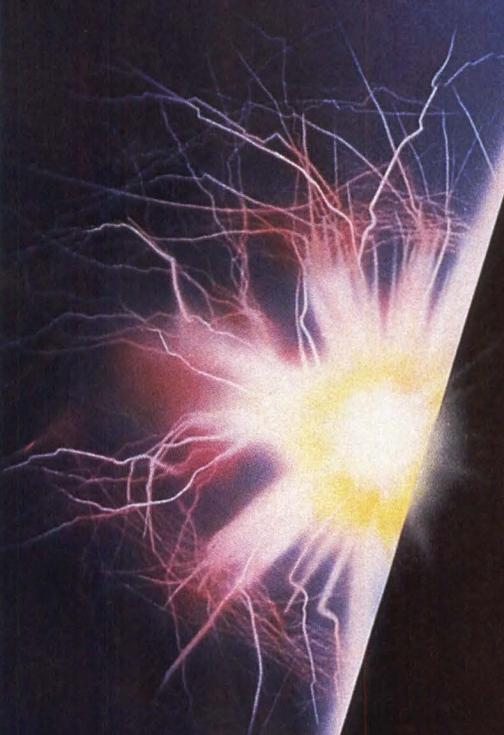
Speed is key

Because the files sent from CM&S' subsidiaries to headquarters are often lengthy, with some documents running 200 to 300 pages, Koppers wanted a high-speed system. In addition, information transfer is usually done only once a month—not enough to justify the cost of leasing numerous dedicated lines. As a result, the MIS department wanted to use regular telephone lines for data transmission.

Koppers felt that the prevailing dial-up modem speed of 1,200 bps was too low for the volume of batch transmission the company required and would result in excessive long-distance charges. On the other hand, after testing some 4,800-bps modems, the company decided that the higher speed units could not accurately transmit to remote field locations unless the company resorted to leased lines.

Koppers then tested Concord's CDS 224 auto-dial, which was the first commercially available 2,400-bps modem. Koppers found it was able to double transmission speed and thus save as much as 50 percent in connection charges compared with 1,200-bps modems—without leased lines.

Reliability was also a key factor in Koppers' decision to purchase the CDS 224. For example, the 224's automatic adaptive-equalization feature adjusts the modem's receiver to compensate for telephone-line distortion, thus ensuring that



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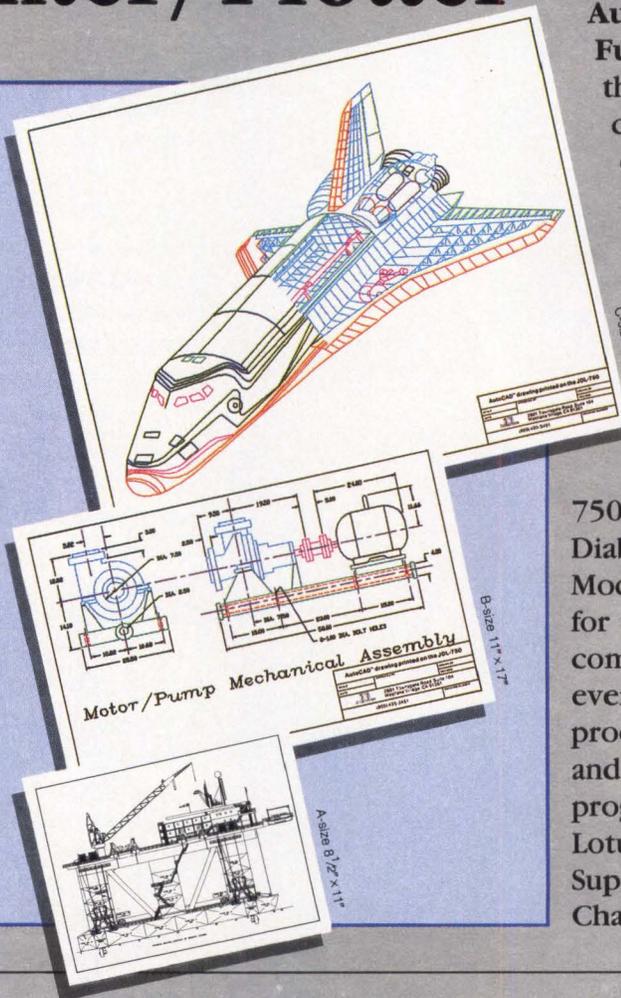
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subsidiaries would not have to retransmit data. What's more, the CDS 224 can "fall back" to 1,200 bps in cases of extremely poor line conditions or when communicating with databases or modems operating at the lower speed. Analysts at the corporate office and at some subsidiaries use the modems at 1,200 bps in asynchronous mode with the Crosstalk communications software for on-line communications with Dow Jones, Dun & Bradstreet and other financial databases and software bulletin boards. Koppers uses the data from these external sources to help make investment decisions and credit checks of companies with which they do business.

The ability to fall back in speed was just one facet of the CDS 224's flexibility. For example, it communicates in both synchronous and asynchronous modes, making it suitable for both batch and interactive on-line communications. In addition, the modem's auto-dial and auto-answer features allow users to communicate 24 hours a day without operator intervention at either end. What's more, offices can program the modems to transmit low-priority data at night

when telephone rates are considerably lower, saving on connection charges.

Modems fill other applications

Koppers has not yet performed a detailed cost/benefit assessment of the telecommunications system. However, Bertenthal is confident that, with the time savings, improved information flow and curtailed use of expensive overnight mail services, Koppers will soon recoup its installation costs—approximately \$450 per connection for the modem hardware and \$625 for the MicroGate software. Meanwhile, the company continues to boost cost-effectiveness by finding additional uses for its modems. □

Jim Rothrock is vice president, marketing, at Concord Data Systems Inc., Marlboro, Mass.

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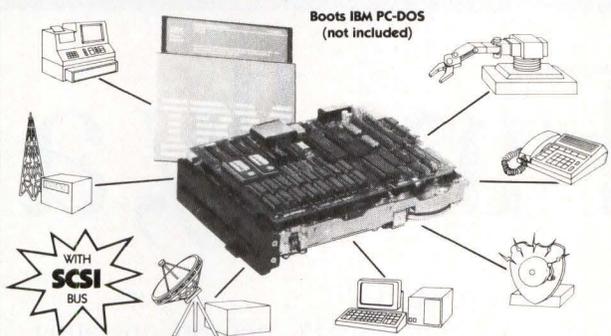
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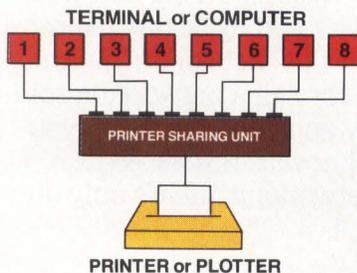
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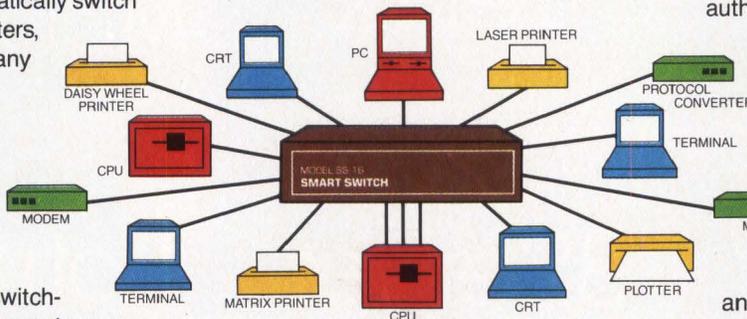


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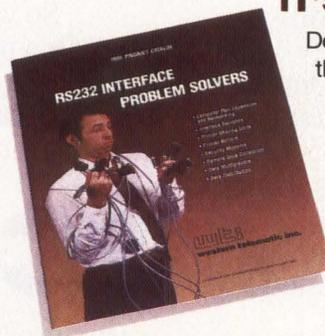
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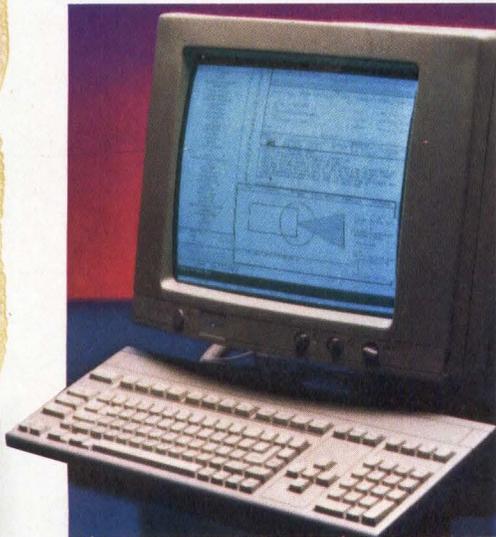
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CIRCLE NO. 36 ON INQUIRY CARD

MINI-MICRO SYSTEMS/March 1986

FEATURE HIGHLIGHTS



p. 69 Hot stuff for AI

EXPERT SYSTEMS BLAZE TRAILS TO AI SUCCESS.69

Armed with expert-system generators and vertical-market expertise, value-added resellers are taking advantage of the hottest segment of the artificial-intelligence market—expert systems. At the low end of AI, expert systems are popping up on personal computers; at the high end, VARs exploit powerful AI-specific machines.

PC COMPATIBLES BECOME FASTER, MORE ADAPTABLE. 83

The key to success in the PC-compatible market is one-upping IBM by giving users and system integrators increased performance and the flexibility to adapt the machines to specific requirements, rather than by simply cloning compatibles.

LAN STANDARDS EFFORTS BEGIN TO PAY OFF 93

It's a gradual process, but one thing is certain in the local area network arena: Proprietary networks will fall victim to international standards. Spear-headed by General Motors' MAP strategy and the ISO/OSI reference model, international standards are progressing from fantasy to fact.

PORTABLE MARKET REMAINS ELUSIVE 101

Despite improved displays and more ingenious packaging, portable computers aren't coming close to fulfilling the far-fetched forecasts of market researchers. Slow sales are due, in part, to marketing miscues and misunderstood user requirements.

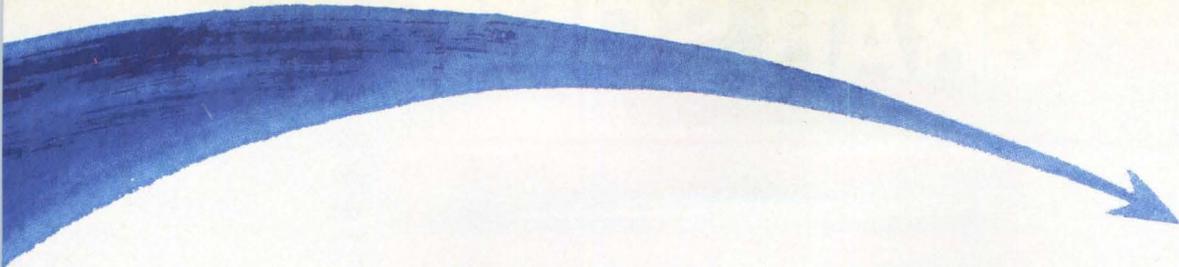
INTERFACE '86 EXPANDS COMMUNICATIONS FOCUS . . 111

Approximately 350 exhibitors and more than 15,000 attendees will be on hand at the Interface '86 conference at the Georgia World Congress Center, Atlanta, March 24 to 27.



p. 101 Slow times for portables





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EXPERT SYSTEMS BLAZE TRAILS TO AI SUCCESS

At the low end of the artificial-intelligence market, expert systems are appearing on PCs; at the high end, the market is witnessing the 'OEMization' of AI

Michael Tucker, Associate Editor

Artificial intelligence continues to be a riddle wrapped in an enigma for developers and analysts alike. After years of hype and counter-hype, with industry observers alternately describing the technology as the wave of the future and as a total bust, system integrators are still uncertain whether AI is a solid market.

However, expert systems, the branch of AI that attempts to reproduce the expertise of human specialists, are giving AI an unaccustomed taste of commercial profitability. Taking advantage of this trend, value-added resellers are using expert-system generators to produce specialized expert systems for vertical markets.

PC-based systems flower

Most expert systems consist of an inference engine that does the actual "reasoning," a development facility that assists a developer to codify the expertise of human specialists and a knowledge base of rules and facts gleaned from those experts. All three components are, by themselves, extremely demanding of computing power and together they can overwhelm very large machines.

Originally, many analysts thought that, to do genuinely useful work, an expert system would have to contain so much information that it simply wouldn't fit into anything as small as a desktop machine. Three things have changed that perception. First, programmers began to focus on making smaller expert systems. KDS Corp., for instance, writes its expert-system generator—also called "KDS"—in assembly language. As a result, the KDS product works like much larger expert-system generators but still fits comfortably in an Intel Corp. 8088-based environment.

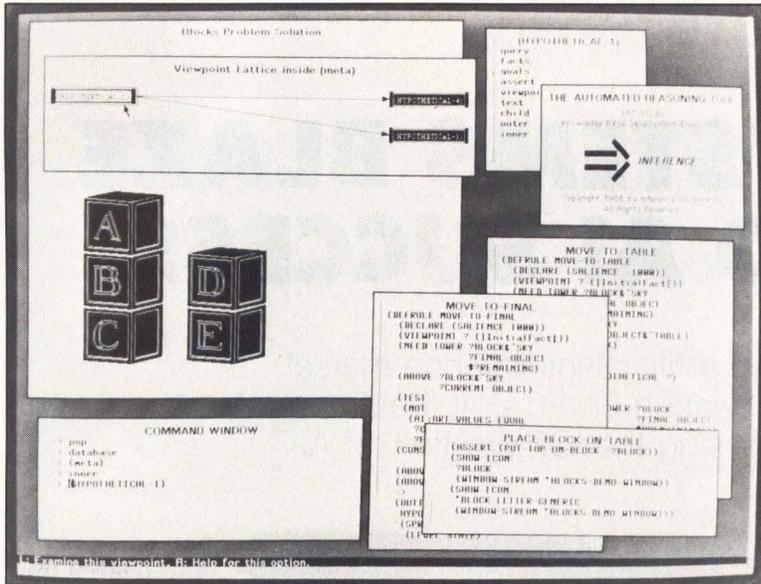


One company remarketing the Xerox 1186 at the high end of the expert systems market is APEX, which uses the machine as the vehicle of its PlanPower financial expert system.

Second, hardware power has itself increased enormously over the last few years. The introduction of 32-bit systems, for example, is certain to have lasting and even revolutionary effects on the AI market. Increased power is migrating expert systems from mainframes and minicomputers to the desktop environment.

Third, and most important, developers began to make significant discoveries about the kind of problems that expert systems could address. Gradually, developers realized that, although requiring specialized knowledge, most of the decisions that propel office work aren't big ones. Rather, they are small, tedious and repetitive, such as in establishing budgets, judging low-level investments, keeping track of clerical supplies and filling out forms properly.

Because of these developments, expert-system generators (shells) for the IBM Corp. PC, PC/XT, PC/AT and compatibles have sprung up everywhere. Less than two years ago, shells were academic curiosities and PC-based shells a contradiction in terms, but now it is difficult to list,



A high-end, expert-system generator, *Inference's Automated Reasoning Tool (ART)* has been used in applications ranging from newspaper layout to aerospace.

much less describe, all the expert-system generators currently on the market. Their one common characteristic is that they target a market of in-house system integrators building expert systems for co-workers performing specialized services.

KDS, for example, is being used by Financial Network, an investment, money-management and brokerage firm in Albuquerque, N.M. Sandy Corless, one of the firm's senior partners, notes, "Basically, we're using it for two things: to train new brokers by letting the system compare their investment choices with those of experienced brokers in the knowledge base, and to check ourselves for consistency in our own recommendations. In effect, we're using the product to do things that we simply wouldn't have the person-power to do otherwise."

A number of companies have entered the market specifically for the purpose of bringing expert systems to PCs. Aion Corp., for example, develops commercial applications for 8088-based expert systems. Its expert-system generator, the Application Development System (ADS), produces expert systems that can access and exploit information from more traditional applications, such as spreadsheets and database managers.

New players enter the shell game

Products like KDS and ADS are from familiar sources—traditional PC-product developers adapting an AI technology to their products. This situation leads some analysts to argue that AI has become simply one fad among many, and that producers of consumer software are latching onto expert systems in a desperate attempt to give their products some distinguishing charac-

teristic—just as they previously had latched onto games and integrated software.

What stands against that interpretation, however, is that some new players are starting to show up in the expert-system shell game. Developers who before were not even remotely connected to the PC world, or who had established themselves as vendors of solid business software, are suddenly debuting expert-system generators.

Radian Corp., for example, has marketed for some time its Rulemaster, an "expert" system generator for UNIX-based minicomputers and multiuser microcomputers. Last June, Radian redesigned Rulemaster to fit into the PC/XT and PC/AT. Expert systems generated on the PC-version of Rulemaster have been used successfully in such applications as fault prediction, chemical analysis and meteorology.

Another company that has come to the PC market is Expert Systems International. Traditionally, ESI has been known as a producer of AI products in the minicomputer range. Their offerings include, for instance, a number of Prolog interpreters and compilers running on the Digital Equipment Corp. line of VAX computers. In October 1985, however, the company announced an expert-system generator, the Expert System/Prolog (ES/P) Advisor, for the PC and compatibles. It says much about the viability of PC shells as commercial products that only as an afterthought did the company modify ES/P Advisor to run on the much-more-powerful MicroVAX II.

"The majority of our development work [on ES/P Advisor] has been done with the IBM PC in mind," says Jonathan Grayson, ESI's technical director. "I believe that expert systems and PCs will be extremely useful to one another. Obviously, the PC is limited in many aspects—like memory—but there are many, many tasks that can be automated with them."

But, the real acceptance of expert systems as commercial software may be seen in products that combine expert systems with more traditional applications. One example is Guru, from Micro Data Base Systems Inc. MDBS is known primarily for database management systems such as KnowledgeMan and KnowledgeMan II for business PC users. Last year, however, MDBS entered the integrated software arena with Guru, which combines standard business software—a spreadsheet, a text processor, etc.—with an expert-system generator. Users could build systems that would allow, for example, a financial analyst to decide the worth of an investment using a specially tailored expert system for advice, then perform additional calculations and modeling with the spreadsheet and, finally, write

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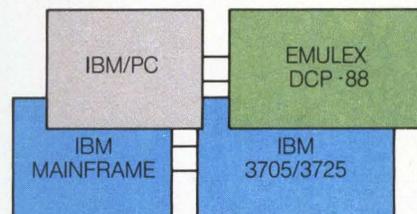
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the results with a text processor.

So far, PC-based expert-system generators have been most successful as end-user products. In theory, of course, expert systems could be the VAR product supreme, with developers purchasing generators and remarketing their individual expertise in specialized vertical markets. However, as yet, no such information-publishing market has developed, and VARs remain legitimately cautious about incorporating such products into their offerings.

Yet, gradually, that may be changing. For some years, Human Edge Software Corp. has marketed two expert-system generators for the IBM PC, Expert Edge and Expert Ease—which were among the first expert-system generators for personal computers.

Last year, Human Edge announced the "Certified Developers Program," under which Human Edge works with selected developers to

produce expert systems for vertical markets. The developers then remarket the applications themselves, or do so with the assistance of Human Edge acting in the capacity of a publisher. As of last December, roughly a dozen such applications were nearing completion.

If the Certified Developers Program is a success, and other shell vendors follow suit, the result could be an entirely new market for VARs. Groups or individuals could publish their expertise in much the same way that they now might write and publish textbooks.

High-end market beckons

If IBM PCs represent the low-end market for expert systems, then the high end is represented by AI applications running on machines specially modified for AI applications. Moreover, whereas the PC-based market is still struggling to prove itself, the high end has no such problems.

LISP architecture says a mouthful

Most of the work in artificial intelligence has been done on conventional processors. In fact, it's possible that more pioneering research into AI was done on the Digital Equipment Corp. VAX than on any other machine.

But, in the late 1970s, a new class of processor came into being—the so-called "dedicated LISP engine." These machines can run LISP, or any AI application, much faster than conventional machines because they use "tagged architecture." In this approach, every computer word is tagged with a few additional letters that describe its function and type. The processor can then route that information to its destination without having to read all of it. This is important because most AI applications, and expert systems in particular, must deal with immense collections of data—and, more often than not, they fail when they can't process the information quickly enough.

Most American LISP machines have their origins in research done in the 1970s at the Massachusetts Institute of Technology Artificial-Intelligence Laboratory. In the early years of this decade, the researchers split into two groups. The first formed Symbolics Inc., which became the leading maker of LISP workstations.

The second formed LISP Machine Inc. Originally, LMI stayed out of the direct market, working under contract to larger companies. When Texas Instruments Inc. got into the AI business with the TI Explorer Workstation, they did so with LMI technology, and the TI's Explorer Workstation is produced under license to LMI. By 1982, LMI had decided to enter the commer-

cial workstation market on its own and began production of the Lambda series of machines. The company recently introduced a three-user version, the Lambda 3X3.

The market continues to gain players. Last year, Xerox Corp. introduced two low-cost AI workstations, the Xerox 1185 and 1186. At \$9,995, the 1186 may be the cheapest LISP machine on the market.

However, the future of LISP machines remains unclear. First, conventional processors are getting much better at running LISP. Programmers are finding they can tag words in software as well as in hardware. Second, processors are dropping rapidly in size and price. It is becoming increasingly easy to embed LISP processors in standard technical workstations. Notes Paul Armstrong, group manager for AI and data management for Apollo Computer Inc., "In the end, LISP machines are going to be chips inside other people's workstations."

Makers of LISP machines seem to regard that prophecy as a promise rather than a threat. Several of them are clearly tooling up to enter what would be a new market for them. LMI, for instance, has recently introduced a new product known as "Lambda-OEM," a LISP machine that integrates into conventional computing systems. The Lambda-OEM gives the buyer a LISP processor, a card cage, an architecture that lends itself to multiple processors, an integral Multi-bus and assorted software tools. A system integrator could, for example, use the Lambda-OEM to produce an "AI server," a departmental machine that gives LISP capabilities as well as data storage to networks of personal computers.



A sign of things to come for the expert-systems business may be Sperry's Knowledge System, which combines the Texas Instruments Explorer workstation and IntelliCorp's KEE expert-system generator.

Even in the midst of the high-tech slump, AI companies are enjoying a modest boom, with new companies entering the field almost daily.

VARs who decide to enter the upper reaches of AI, particularly expert systems, will find themselves almost alone—with neither the comforts nor the hazards of established customers and competitors. AI VARs will discover that they are working with a relatively small, though growing, number of vendors. Expert-system generators for the high-end market, for example, are not coming from legions of traditional software developers but from a small collection of professional AI companies. Furthermore, the hardware may be limited to a handful of LISP-processor-based AI workstations—such as the 3600 series from Symbolics Inc., the 1185 and 1186 from Xerox Corp., the Explorer from Texas Instruments Inc. (TI), and the Lambda machines from LISP Machines Inc. (LMI) (see “LISP architecture says a mouthful,” Page 73).

Tool makers on the move

Suppliers of high-end expert-system generators are a tight group with close connections to the academic and consulting communities. Indeed, the AI business is so new that the distinction between the end user and VAR channels of distribution isn't clear. The Carnegie Group Inc., for example, is an AI company that VARs might regard as either a competitor or a supplier.

The company might be considered a competitor because it was originally formed by individuals associated with AI research at Carnegie-

Mellon University to take AI technology directly to industry. Last year, for example, the Carnegie Group announced contracts with Ford Motor Co. for \$14 million worth of technology licensing. Essentially, the Carnegie Group is developing expert systems for Ford that will improve the quality of automobile manufacture and repair. Indeed, Ford considers AI technology so vital to its survival that it purchased 10 percent of the Carnegie Group—matching similar investments in the company by Boeing Co., DEC and TI.

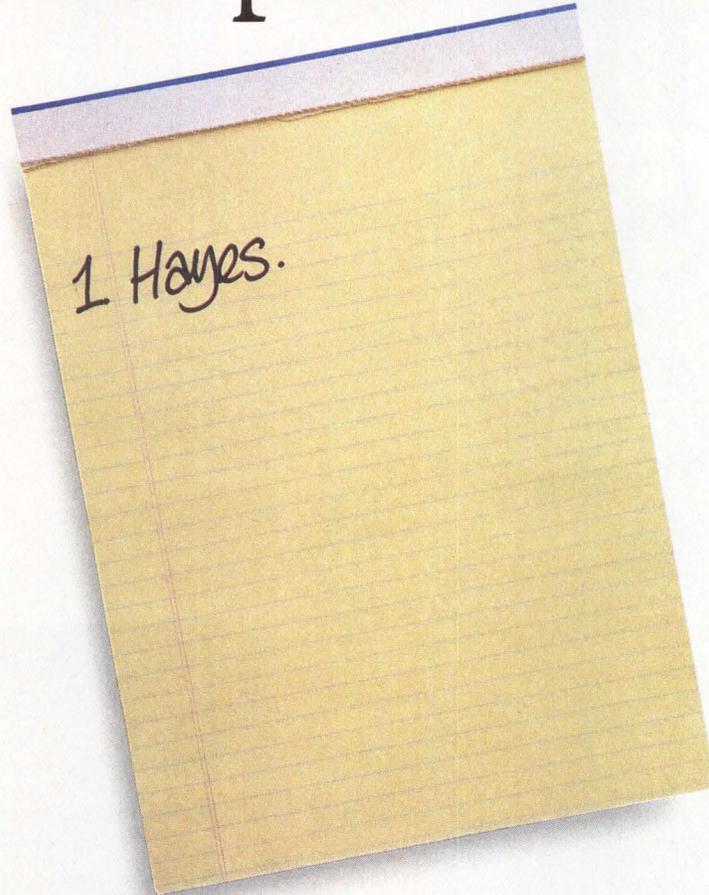
This is the sort of happy position in which VARs would like to find themselves, not their suppliers. Yet, the key word here is still “supply.” The Carnegie Group will quite happily sell VARs the same software tool—Knowledge Craft—that Ford, Boeing and DEC found so attractive. A true AI-applications development environment based on the Common LISP programming language, Knowledge Craft combines an expert-system generator with graphics, window-management functions and extensive database-management capabilities.

Notes company president Larry Geisel, “There are two ways to make money in AI. You can do contract work and, in effect, sell the talent of your experts. The catch, of course, is that there aren't many AI wizards out there to hire. The second way is largely unproved, and that's to be just an AI toolmaker...sell an expert-system generator and let other people build applications with it.” With its consulting services and its Knowledge Craft product, the Carnegie Group is taking both paths.

A company that takes only the toolmaker path is IntelliCorp, which markets an expert-system generator for AI workstations known as Knowledge Engineering Environment, or KEE. Based on Common LISP, KEE has attracted the attention of several major computer vendors—among them Hewlett-Packard Co., which has recently announced extensive co-marketing agreements with IntelliCorp. Essentially, HP is attempting to make its technical workstation, the HP 9000 series 3000, an AI workstation as well. (Indeed, if there is a dominant hardware trend in AI at the moment, it is transferring software to more traditional machines.)

But the sign of KEE's real success, and what may be a glimpse of the long-term future for expert systems, comes from Sperry Corp. In late 1985, Sperry announced that it had purchased KEE, installed it on TI Explorer workstations and that it would remarket the value-added result as the Sperry Knowledge System. Sperry has entered the expert-system business in other big ways as well. For example, it has contracted to develop over 50 expert systems for govern-

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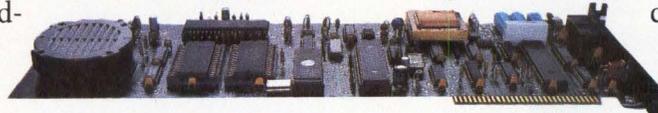
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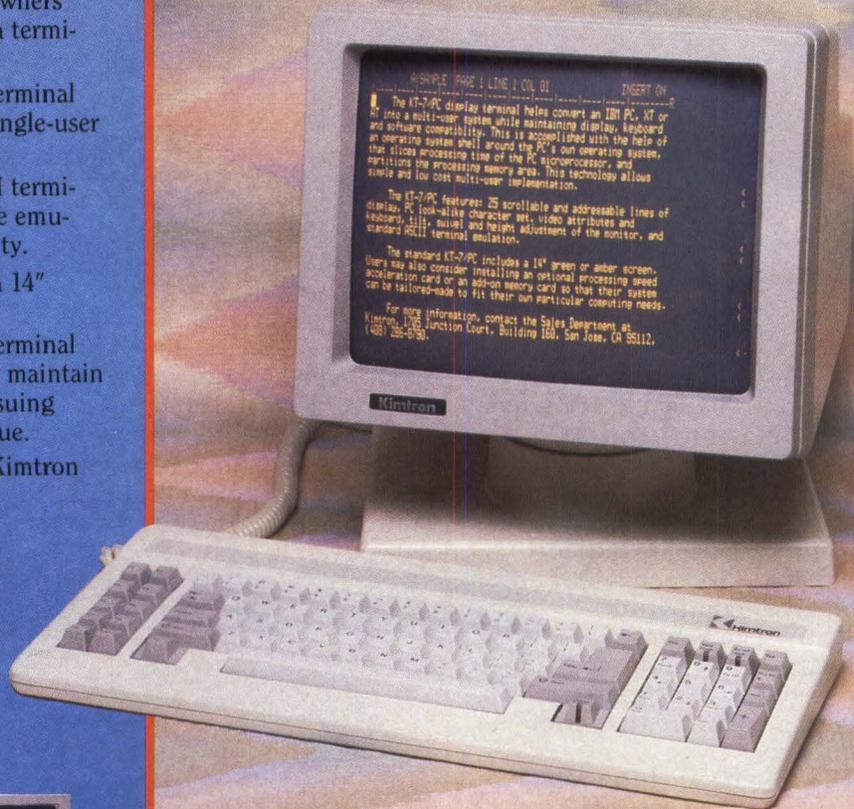
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ment and private-sector clients.

Explains Larry Walker, director of Sperry's Knowledge Systems Group, "In 1984, Sperry made a decision to enter the expert-systems business...by 1985, we'd spent \$30 million on [expert-system] capabilities. Our intention, frankly, is to become a leader in the field. We would like to be the IBM of expert systems."

Still another important tool maker is Inference Corp., whose expert-system generator is the Automated Reasoning Tool (ART). Available for all computers that support LISP, ART has been a favorite with AI developers since it became commercially available in March 1985. Last year, for example, Composition Systems Inc., Elmsford, N.Y., applied the product to one of the most down-to-earth problems yet addressed by expert systems. Using ART, CSI is building the Newspaper Expert System (NEXPERT), an expert system to handle page layout for newspapers.

At the other end of the spectrum, ART is finding applications that are literally out of this world. For example, NASA has recently used ART to build NAVEX, an expert system to assist in the navigation of the space shuttle.

The OEMization of AI

One new wrinkle in the expert-system market has been the appearance of application-specific expert-system generators. For example, although LMI markets both ART and KEE for its Lambda AI machines, the company recently wrote and began marketing its own expert-system generator—called PICON, for process-industrial control. Unlike ART and KEE, which LMI regards as general-purpose expert-system generators, PICON is meant expressly for real-time industrial applications. It's also compatible with General Motor Corp.'s Manufacturing Automation Protocols and, via MAP, can be networked through an entire factory.

PICON could be installed in a plant, for example, to monitor installations, discover problems as they occur, alert human operators to difficulties and suggest ways of dealing with them.

LMI has encountered some difficulty in convincing VARs to incorporate PICON, or AI in general, into their systems. Therefore, in 1985, the company took vertical-market applications directly to several major end users—notably Texaco Corp., where PICON was used to monitor a petrochemical plant in Port Arthur, Texas. LMI says the project is meant only as a "demonstration" to VARs that there really is a market for expert systems. Apparently the demonstration worked. Soon after, Honeywell Inc. an-

nounced that it would cooperate with LMI in bringing PICON to its customers in the industrial process-control market.

Another company selling a vertical AI application is Applied Expert Systems Inc. (APEX), with its PlanPower, an expert system for financial planning and analysis. Running on the Xerox 1186 workstation, PlanPower is sold directly to large financial-services organizations, such as banks, brokerage houses and money-management firms.

PlanPower is not a generator. Rather, it is a complete expert system with its own financially oriented knowledge base. "We had to write all our software ourselves," says Dr. Norton Greenfield, APEX's director of software development. "We'd have preferred not to, naturally, but you just can't find it [financially oriented software] in LISP...the good part is that we've written an entire layer of business software that can be accessed by either the expert system or the user."

Expert systems seek the big time

In short, today the AI business seems to be a little less mysterious. The AI market, at least as represented by expert systems, is showing signs of real strength. In fact, makers of expert-system generators seem to be among the most active software developers around, even in the midst of the high-tech slump. If the presence of sellers were proof of buyers, then no one could possibly doubt AI as a market.

VARs who enter the upper reaches of AI will find themselves almost alone.

Prolog promotes itself

LISP is, of course, the programming language of choice in most U.S. artificial-intelligence applications. But LISP has competition—particularly from Prolog.

Prolog, which takes its name from "Programming Logically," was developed as an alternative to LISP in Europe in the 1970s. It is now, in fact, the leading European AI language. Gradually, it's making inroads in the United States as well—notably among AI developers who prefer not to go with dedicated LISP engines.

One U.S. company marketing a Prolog compiler is Quintus Computer Systems Inc. In 1985 alone, Quintus announced remarketing or distribution agreements with Apollo Computer Inc., C. Itoh Data Systems, Digital Equipment Corp. and Xerox Corp.

Some Prolog partisans cite this as evidence that eventually LISP will give way to Prolog. More moderate analysts, however, avoid debating the issue. "Neither is going to replace the other," says Paul Armstrong, group manager for AI and data management for Apollo. "There will always be situations in which one or the other language will be the better choice."

If developers can now regard AI as something other than a total enigma, neither should they rush into it blindly.

Unfortunately, that isn't the case, and bankruptcy courts are crowded precisely because supply and demand aren't the same thing. If developers can now regard AI as something other than a total enigma, neither should they rush into it blindly. The expert-system market still retains some disquieting features. Specifically, if IBM PC-based systems form the market's low-end, and LISP-based, AI-workstation applications define the high end, there doesn't seem to be a middle.

In time, of course, that will change. Already, LISP machines are beginning to enter mainstream computing. At the same time, expert-system generators—originally developed for dedicated AI machines—are migrating to standard technical workstations. There, they will not run nearly as fast as on dedicated LISP engines, but they might take advantage of all the benefits of traditional computing, such as an established customer base. Apollo Computer Inc., for example, recently announced a heavy commitment to AI for the middle market.

Explains Paul Armstrong, Apollo's group manager for AI and data management, "LISP architecture machines are targeted for a specific aspect of the market—the heavy LISP users, the

hackers, the wizards, the heavy R&D applications and so on. We wish to address a much larger market...the users who wish to smarten up their existing applications. Most users want to put intelligent front ends on top of the FORTRAN, COBOL, or whatever code. The 'middle market' isn't a dirty expression around here, because the middle is where the money is."

Several other computer vendors are making similar attempts to go "where the money is." Indeed, one of them could legitimize the entire expert-system market. Late last year, no less a player than IBM announced that it, too, was entering the game. The IBM product, Expert System Environment/VM, allows users to build expert systems on VM-based machines.

The long-term effects of IBM's entry into the expert-system market could be significant for the entire AI market. In an interview last August, The Carnegie Group's Geisel put it bluntly, "Face it, three years from now, AI companies are going to be software houses, or they're going to be IBM." □

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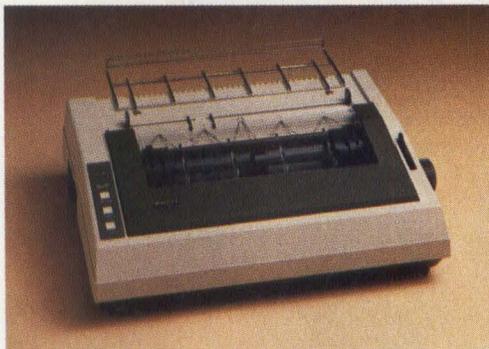


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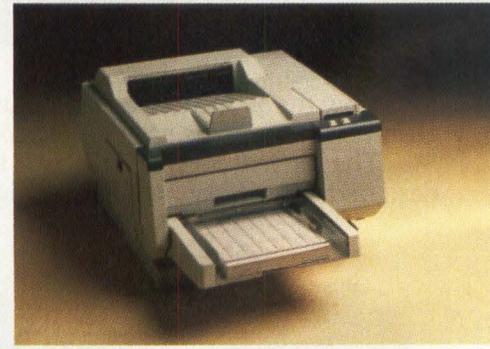
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PC COMPATIBLES BECOME FASTER, MORE ADAPTABLE

While maintaining claims of compatibility with IBM PCs, microcomputer manufacturers stress speed and flexibility to meet new needs of system integrators and end users

Carl Warren, Western Editor

Today's system integrators want machines that allow them to create new applications and address yet-untapped markets. As a result, manufacturers are producing innovative designs that provide greater flexibility in operation and connectivity.

Compatibility with the IBM Corp. PC's basic input/output system is still important, particularly for PCs being used in desktop business applications. But some of the rigidity is gone. Whether a system can properly run Microsoft Corp.'s Flight Simulator—long the industry-accepted standard of PC compatibility—is no longer as important a criterion as it once was.

One example of the trend toward adaptability is the approach taken by Tandon Corp. Although primarily known as a disk-drive manufacturer, Tandon also designs and manufactures PC-compatible systems for such companies as Tandy Corp. Don't, however, expect to see a published list of specifications and prices—they don't exist. Tandon sells only to OEMs and on the basis of, 'what you want is what you get.' Therefore, a company like Tandy can specify virtually any design it desires.

Tandy products maintain some compatibility with the IBM PC especially, again, for existing business programs. But, plug-to-plug compatibility on a bus basis doesn't always exist. In fact, not even all PC-compatible plug-in cards will work in the Tandon-designed Tandy machines.

Of course, clone vendors can't ever exactly emulate IBM, nor can they guess what IBM will put into the box on the next go-around. For example, IBM elected to change the rules with the reintroduction of the AT last October. The "new" PC/AT solved some serious drawbacks of the previous version, such as problems with the



Offering IBM PC software compatibility, Hewlett-Packard's Vectra PC is also compatible with HP's minicomputer line.

Winchester disk and associated bus difficulties. In addition, IBM recast the internal operating firmware to inhibit other companies from increasing the 6-MHz operating speed of its machine.

In the meantime, other manufacturers, like Compaq Computer Corp. and Hewlett-Packard Co., were opting to make their systems speedier. Compaq's DeskPro 286, for example, runs at either 6 MHz or 8 MHz, and is already being called by some experts the "standard" machine to emulate. Similarly, although HP bills its Vectra Personal Computer as being compatible with the PC/AT—as well as with its own minicomputers—the Vectra speeds along at 8 MHz. Unfortunately, not all programs written for the PC can operate properly at 8 MHz. Like the



Covering all the bases, Epson's Equity I (left) is compatible with the IBM PC, the Equity II (right) with the PC/XT, and the Equity III (center) with the PC/AT.

DeskPro, the Vectra can be throttled back to 6 MHz.

IBM has demonstrated that the PC/AT can act as a mini-mainframe to enhance the System/36 computer via networks. Currently, more than 500 beta test sites are using IBM PC/ATs with the virtual machine (VM) operating system and memory arrays of 8M bytes. And the company plans to introduce, not a new AT, but several enhancements to the existing model throughout 1986. In addition, IBM will offer a 32-bit, Intel Corp. 80386-based add-in board for the AT, but not in 1986. The 80386 isn't available in quantity and most likely will not be producible until mid-1987 due to chip-design complexity. In the meantime, possibly as early as this month, expect an enhanced Intel 80286, add-in co-processor board operating at 12 MHz with 4M bytes of onboard memory using new 1,024K-bit dynamic RAMS.

Epson America Inc. expects to be strong in the PC business by offering a variety of systems ranging from the QX-11 to the fully PC-compatible Equity series. Unlike Tandon, Epson sells to

end users, distributors, smaller system houses and value-added resellers.

Like Compaq and HP, Epson also emphasizes speed. For example, the Equity II, a PC/XT look-alike, can operate at either the standard 4.77 MHz or 7.16 MHz using a software switch controlled either from the keyboard or within a program. Equity II's NEC Corp. V30 microprocessor permits the two speeds. The Equity III, a PC/AT clone, however, sticks more closely to the IBM configuration and uses an Intel 80286 microprocessor operating at 6 MHz. Epson's BIOS is richer than IBM's because Epson's version offers unique software controls, such as remote on and off capability via a modem.

Puts power in new shapes

Not all PC-compatibles have the same shape or size. Ampro Computers Inc.'s Little Board 186, for example, fits the same form factor as a 5¼-inch disk drive and is extensible via the small computer systems interface (SCSI) bus. As a result, the Little Board can serve as an engine for creating much smarter systems. Rancho Technology has developed a special SCSI host adapter to accommodate the Little Board to the PC bus. Called the SCSI-AT, the adapter acts as both a combined initiator and target and as a target initiator. Although the board is currently available only for the PC bus, Rancho is planning versions for Multibus and VMEbus.

Takes aim at VARs

Faraday Electronics is taking an aggressive approach to PC-like systems with products that range from the Model FE2010, which fits on top of a 3½-inch disk drive, to full-size, AT-like systems in the A-Tease series. Most recently,

'VAR machine' anticipates IBM standard

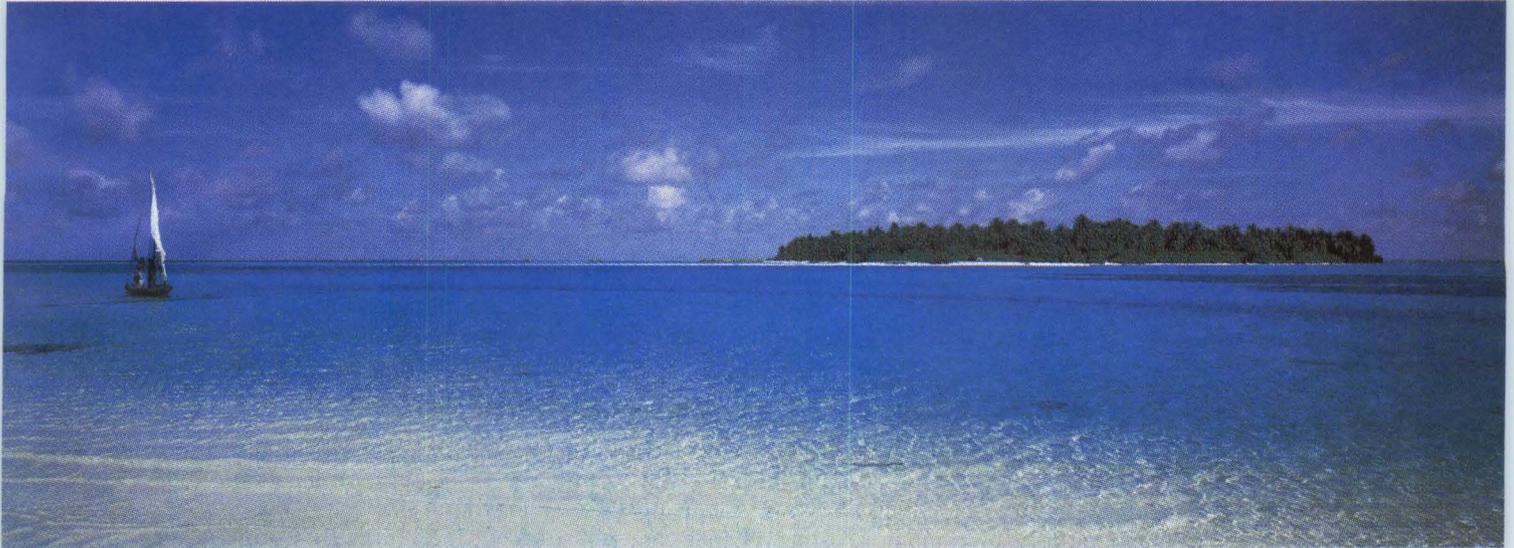
Epson America Inc.'s QX-11 doesn't look like the standard IBM Corp. PC, nor does it have a PC-like bus structure or basic input/output system. But the



QX-11 does run MS-DOS.

Epson calls the QX-11 its "VAR machine" because it can be configured with a variety of keyboards, internal modems, up to 512K bytes of memory and even PC-compatible display capability: important considerations for value-added resellers. But Epson uses 3½-inch flexible disk drives, rather than the industry-standard 5¼-inch drives. That limits software availability. However, this situation may change because IBM is preparing a lap-sized unit for the Internal Revenue Service that uses 3½-inch disk drives from Citizen America Corp. and is underwriting several programs in the small-disk format. The programs involve Ashton-Tate's dBase III and MicroPro International Corp.'s Wordstar version 4.0.

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And one of our strongest selling points: the HP 3000 Series 37.

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CIRCLE NO. 46 ON INQUIRY CARD



A 'LAN in a box,' Cordata's (formerly Corona) Mega PC permits up to eight users to share peripherals and logic and still remain independent from one another.



Offering up to 330M bytes of disk storage, Priam's ClusterTower allows as many as eight users to share data without creating I/O bottlenecks.

Faraday introduced a card-cage system with which system integrators can plug in PC-processor and special-function boards. Consequently, integrators can combine existing PC-bus-compatible boards with new devices—such as Rancho's SCSI-AT host adapter—to operate more powerful peripherals or, possibly, link a PC-bus system to a Multibus system. Faraday also offers

the FE2000 CPU controller, which provides all the necessary support functions for 8088 and 8086 microprocessors.

Cordata Inc., formerly Corona Data Systems Inc., aims at VARs with an approach similar to that of Faraday. Cordata offers systems ranging from Compaq-like portables to full multiuser systems called Mega-PCs. A Mega-PC lets up to eight independent users, each with his own dedicated processor, share peripherals and logic. This "LAN-in-a-box" concept presents some incompatibility problems in the handling of peripherals and data sharing.

Sharing data is often more important to VARs, system integrators and end users than having full PC compatibility. Because of this demand, Priam Corp. developed the ClusterTower, a shared-storage system.

The ClusterTower isn't a personal computer, but it does possess enough intelligence to serve up to eight users with its 160M-byte or 330M-byte, 8-inch Winchester disk drive. The system employs PC-compatible plug-in boards that give users access to the disk drive. Users have their own storage and can share data with other users, via special utilities.

Unlike multiuser implementations of the PC, where all the processing burden is on one bus regardless of the number of microprocessors, the ClusterTower shares the burden with each individual PC. Therefore, no single I/O channel is bogged down with data traffic. The Priam approach may represent the next level of PC-like peripherals: a smart box that shares the processing burden with a single-purpose host. □

Companies mentioned in this article

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Circle 441

Compaq Computer Corp.
20555 FM 149
Houston, Texas 77070
(713) 370-0670
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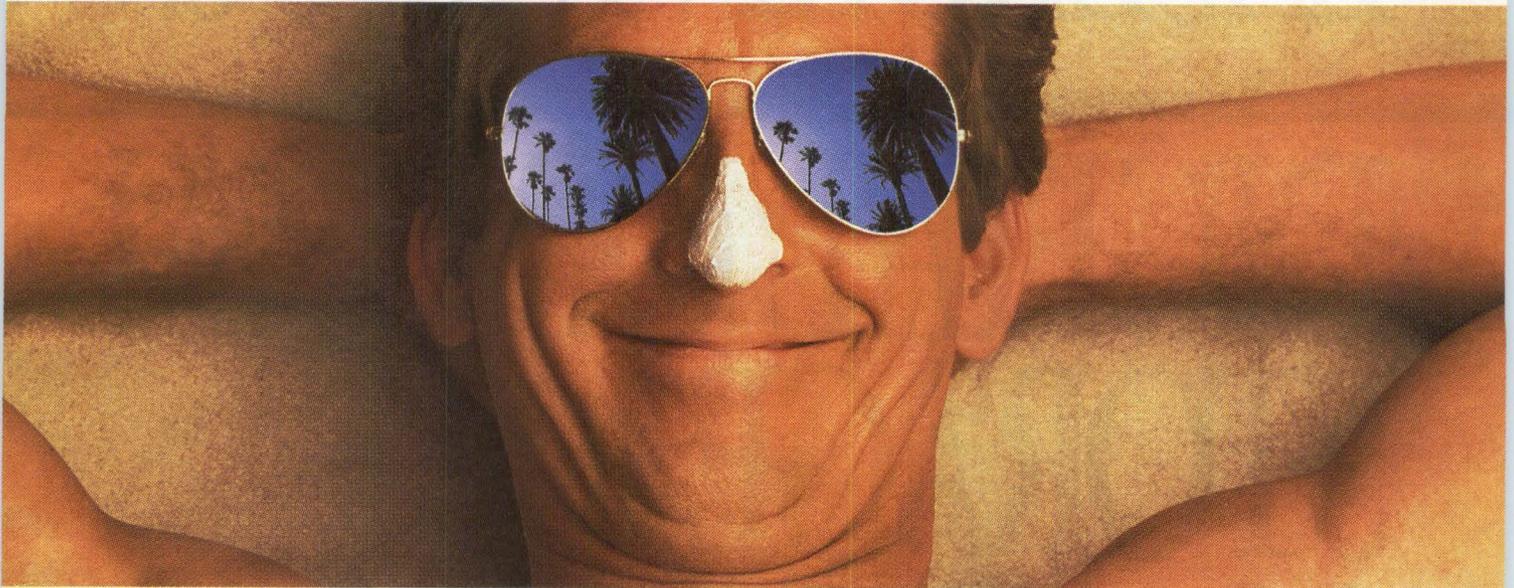
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THE DIGITAL LOGO MEANS LONG TERM PRODUCTIVITY.

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These are the things that become most apparent after hours of prolonged use. And often spell the difference between a terminal that's a genuine productivity tool and one that's - quite literally - a pain in the neck.

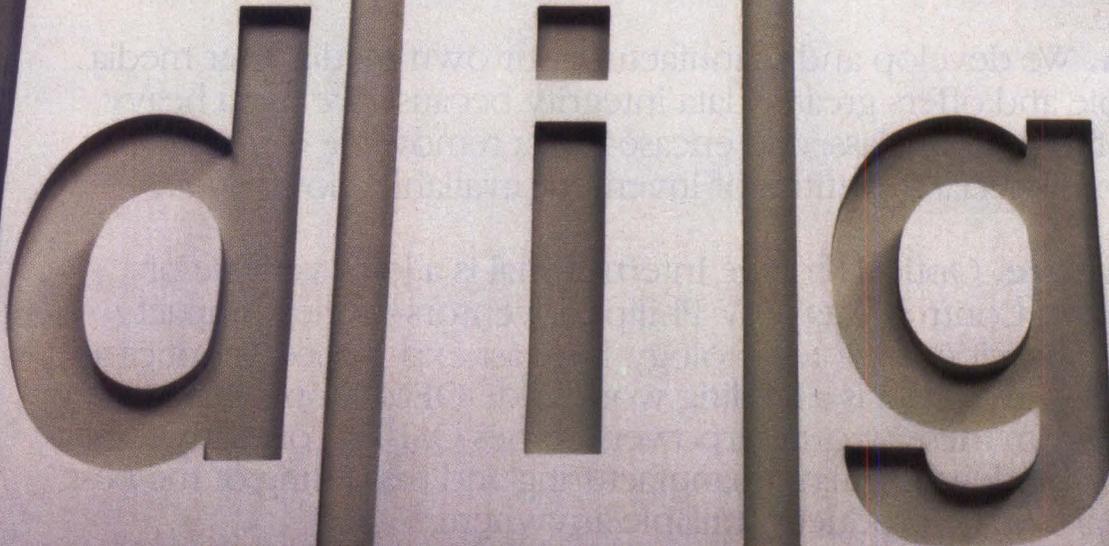
The fact is, the VT200's ergo-

nomie design and the resulting ease of use were two of the reasons it won the International Design Award, in both 1983 and 1984.

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*Independent study conducted by International Data Corporation among users of the top 10 computer brands.

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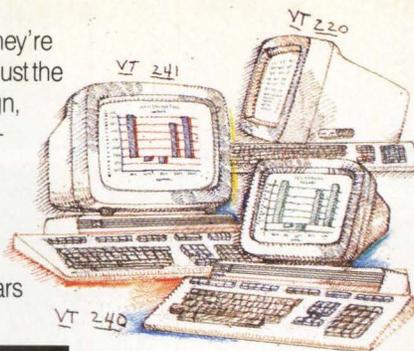
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LAN STANDARDS EFFORTS BEGIN TO PAY OFF

Major network users trigger
increased international LAN standards activity

Rick Dalrymple, Senior Editor

Prior to 1984, system integrators complained that the worldwide local area network market lacked three things: standards, standards and standards. Now, only two years later, the same individuals face a storm of standards activity. So far, the blizzard of paper contains over 70 different documents ranging from published, book-length specs to long proposals for the formation of yet another standards committee.

Add to these books and proposals the specifications of de facto LAN standards and the volume of paper for system integrators to review becomes awesome. It is not surprising then, that today's "networking experts" are confused and that those encountering the LAN market for the first time are bewildered.

This unprecedented volume of standards activity is due in large part to the efforts of General Motors Corp., whose participation in LAN standards committees shifted the search for standards into high gear. However, GM is now but one of over 100 large multinational corporations actively pushing for international LAN standards. And it is important to note that this group is not limited to the U.S. companies; its members include corporations based in the Far East and Europe as well.

And the current flurry surrounding international LAN standards is not exclusively aimed at factory automation, as GM's participation might indicate. A vast majority of the published and proposed standards can, and eventually will, be used in non-manufacturing networking applications such as finance, administration, engineering and research.

The reason many system integrators identify the international LAN standards effort with fac-

tory automation is that much of the publicity regarding activities of the LAN standards committees has been linked to GM's Manufacturing Automation Protocol (MAP).

In fact, GM blended its factory-automation efforts with the development of international LAN standards. Although GM's MAP program currently focuses on the factory floor, GM is committed to migrating all of its networking applications toward diverse implementations based on international standards.

It is useful to differentiate GM's MAP specifications from the MAP program. The current collection of specifications, known as GM MAP 2.1, references a collection of published and proposed international LAN standards that GM will use first in factory applications. In addition to these, certain items that are optional in the international standard are requirements in GM MAP 2.1. The MAP program, on the other hand, refers to GM's broader plan to build a "factory of the future," a project that goes well beyond the coordination of computer activities on the factory floor.

Why standardize?

To put the international LAN standards effort into perspective, two goals need to be reviewed. The first goal centers on the urgent requirements for international standards, well illustrated by the activities of GM. The other goal concerns the International Standards Organization's open systems interconnection (OSI) reference model, which has evolved from an architectural concept into a voluminous set of standards documents.

GM's experience with computer networks has been typical of most major U.S. corporations. About six years ago, GM's manufacturing executives noticed that they were building what they

called a "communications monster" instead of a unified production system. The company had purchased a collection of "islands of automation" controlled by as many as 12 separate networks. What's more, each "island"—a cluster of computerized machines—operated independently.

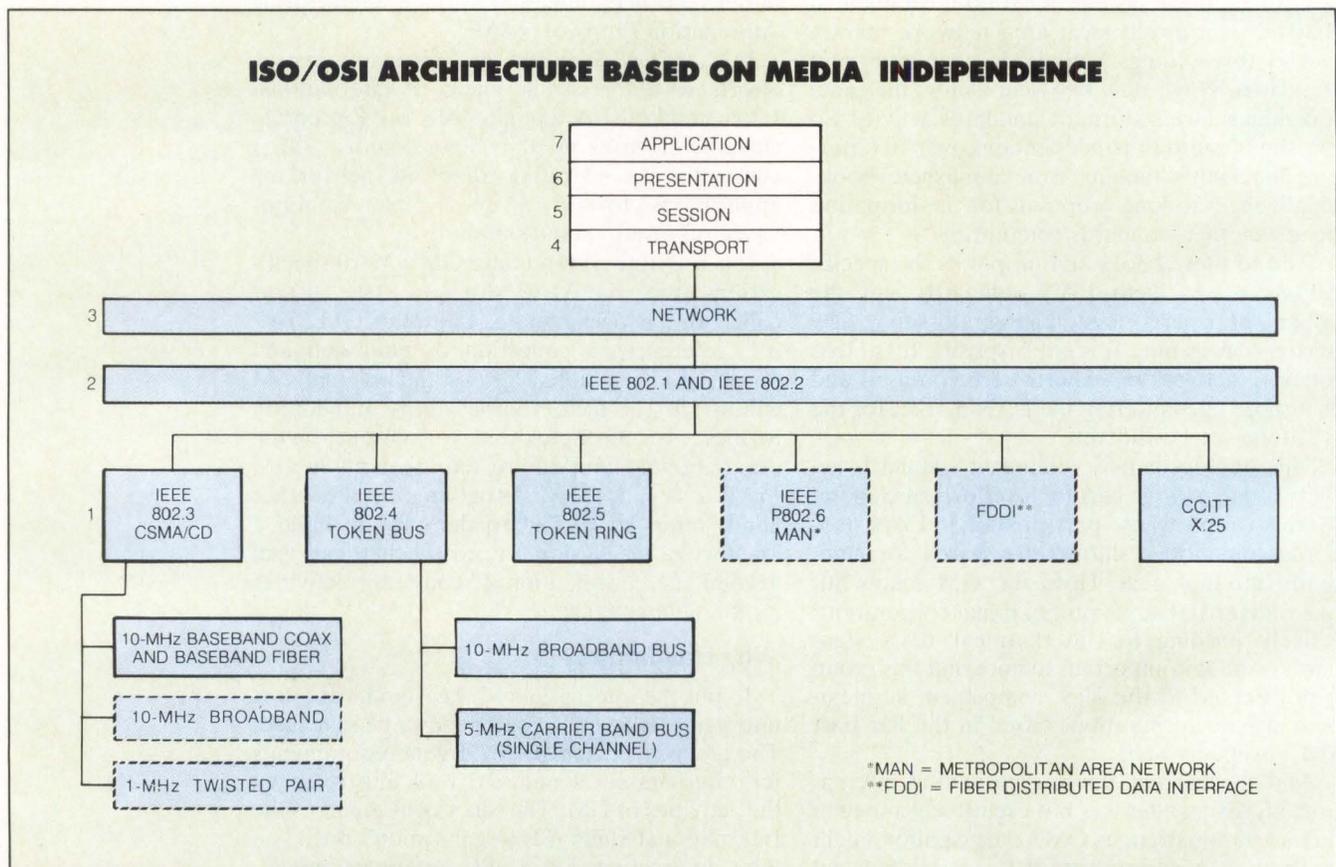
To get these "islands of automation" to work together required staff programmers to convert the data collected from one "island" into a form understood by another. The converted data was then hand-carried from one group of machines to another, creating a plodding arrangement scornfully dubbed "sneaker net."

This phenomenon is not unique to the factory. The same problems plague offices, engineering groups and research laboratories. It was in the factory, however, that the support costs inherent to these uncoordinated "islands of automation" threatened to frustrate GM's factory-of-the-future dream.

The answer was networking standards which each vendor of computer and networking products would support. A LAN standards process was already well underway, but it lacked support of networking users with lots of money.

In 1980, GM began to develop the MAP specification. GM implemented the physical layers of the network with an IEEE 802.4 Broadband Token-Passing Bus (currently draft international standard ISO/DIS/8802/4). Then it announced in 1983 that it would work with the international standards community to develop a full, seven-layer suite of specifications based on the ISO/OSI reference model.

Building a LAN based on the ISO/OSI reference model was not new. What was new was a commitment by a major user organization to spend the time and money necessary to work with a large number of standards committees to develop, fully specify and then standardize detailed implementations for all seven of the net-



Media and access-method independence are two of several concepts now implemented in the emerging suite of LAN standards based on the OSI reference model. Others include a Data Link Layer, layer 2, that presents a common interface to all types of physical networks; a Network Layer, layer 3, that allows net-

work traffic to move from one physical network to another; and a set of protocols in the upper layers, 4 through 7, so that the same application utilities (such as file-transfer commands) can be used in all types of physical networks.



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To get 'islands of automation' to work together required staff programmers to convert the data collected from one 'island' into a form understood by another.

working layers outlined in the OSI model. At first, GM tried to get computer and networking vendors to support the MAP program by persuasion. When talks failed, it suggested to vendors that, if their products were not compatible with the emerging MAP specifications, they would find it difficult to sell to GM in the future. Later, compatibility with MAP specifications became a GM purchasing policy. However, when GM realized that some suppliers were

responding in a halfhearted fashion—planning to accommodate GM while continuing to sell their proprietary products elsewhere—it decided that only concerted, coordinated action from customers would bring suppliers into line.

With some help from McDonnell Douglas Corp., GM formed a MAP users organization, recruiting Ford Motor Co., Chrysler Corp. and many manufacturing companies outside the auto industry. Representatives from over 45 compa-

ISO/OSI STANDARDS

Layer	Document number	Status	Description
Physical 1	ISO/DIS/8802/3	DIS	carrier sense multiple access with collision detection (CSMA/CD) - IEEE 802.4
	ISO/DIS/8802/4	DIS	broadband token bus - IEEE 802.4
	ISO/DP/8802/5	DP	baseband token ring - IEEE 802.5
DataLink 2	ISO/DIS/8802/2	DIS	logical link control - IEEE 802.2 (see also: IEEE 802.1, section 5, draft D)
Network 3	ISO/DIS/8473 (SC6/N3154)	DIS, 2nd ballot	connectionless-mode network protocol specification
	ISO/DIS/8473 (SC6/N3154)	DIS, 2nd ballot	connectionless-mode network service definition
	ISO/DP/8473/DAD1 (SC6/N3601)	DP	addendum to ISO 8473 covering provision of the connectionless-mode, subnetwork service
	ISO/DIS/8348	DIS	network service definition
	ISO/DIS/8348/DAD1 (SC6/N3152)	DIS	addendum to the network service definition covering connectionless-mode transmission
	ISO/DIS/8348/DAD2 (SC6/N3599)	DIS	addendum to the network service definition covering network layer addressing
	ISO/DP/8208	DP	X.25 packet-level protocol for data terminal equipment
	ISO/DP/8648 (SC6/N3457)	DP, 2nd ballot	internal organization of the network layer
Transport 4	ISO/DIS/8072 Rev.	DIS	transport service definition
	ISO/DIS/8072/DAD1 (SC6/N3709)	DIS	addendum to the transport service definition covering connectionless-mode transmission
	ISO/DIS/8073 Rev.	DIS	connection-oriented transport protocol specification
	ISO/DIS/8073/DAD1 (SC6/N20)	DIS	addendum to ISO 8073 to include a network connection management subprotocol
	ISO/DIS/8073 (SC6/N29)	DIS	amendment to ISO 8073 to enable Class 4 operation over connectionless-mode network service
	ISO/DIS/8602 (SC6/N3223)	DIS	protocol for providing the connectionless-mode transport service using the connectionless-mode network service or the connection-oriented network service
Session 5	ISO/IS/8326, 1985	IS	connection-mode session service definition
	ISO/DP/8326/DAD1 (SC21/N135 Rev.)	DP	addendum to ISO 8326 covering session symmetric synchronization for the session service
	ISO/IS/8327, 1985	IS	connection-mode session protocol specification
	ISO/DP/8327/DAD1 (SC21/N136 Rev.)	DP	addendum to ISO 8327 covering session synchronization for the session protocol
Presentation 6	ISO/DP/8822 (SC21/N522)	DP, 2nd ballot	connection-oriented presentation service definition
	ISO/DP/8823 (SC21/N523)	DP, 2nd ballot	connection-oriented presentation protocol specification

KEY:
 DP= draft proposal, content still open for change
 DIS= draft international standard, content considered stable, no major technical changes

nies showed up at the first meeting, held in 1984. Since then the MAP users' organization has swelled to well over 250 companies.

With widespread customer support, over 100 suppliers of computers and networking equipment have now endorsed the MAP program. Although these vendors are not rushing to drop established product lines, there is clearly a new focus on migrating future products toward the implementation of international LAN standards.

Another effect of the MAP users group's success was the formation of another user group, spearheaded by Boeing Computer Services Co., Bellevue, Wash., that advocates a Technical and Office Protocol (TOP). Supporters of the TOP program plan to focus and coordinate network standards activities for the office in much the same manner as MAP has for the factory.

The architectural plan that guides the international, networking-standards effort is the OSI

The answer is networking standards, which each vendor of computer and networking products would support.

STATUS REPORT

Layer	Document number	Status	Description
Application 7	ISO/DP/8571	DP, 2nd ballot	file transfer, access and management (FTAM)
	ISO/TC97/SC21/N516	DP, 2nd ballot	Part I: general description
	ISO/TC97/SC21/N517	DP, 2nd ballot	Part II: virtual file store
	ISO/TC97/SC21/N518	DP, 2nd ballot	Part III: file service definition
	ISO/TC97/SC21/N519	DP, 2nd ballot	Part IV: file protocol specification
	ISO/DP/8831 (SC21/N520)	DP, 2nd ballot	job transfer and manipulation (JTAM) concepts and services
	ISO/DP8832 (SC21/N521)	DP, 2nd ballot	specification of the basic class protocol for job transfer and manipulation
	ISO/TC97/SC21/N514	DP, 1st ballot	virtual terminal service—basic class, Part I: initial facility set
	ISO/TC97/SC21/N515	DP, 1st ballot	virtual terminal protocol—basic class, Part I: initial facility set
	ISO/DP/8649/1 (SC21/N52)	DP, 1st ballot	definition of common application service elements (CASE)—Part I: introduction
	ISO/DP/8649/2 (SC21/N524)	DP, 1st ballot	definition of CASE—Part II: basic kernel subset
	ISO/DIS/8649/3	DIS, 1st ballot	definition of CASE—Part III: commitment, concurrency and recovery (CCR)
	ISO/DP/8650/1 (SC21/N54)	DP, 1st ballot	specification of protocols for CASE—Part I: introduction
	ISO/DP/8650/2 (SC21/N525)	DP, 1st ballot	specification of protocols for CASE—Part II: basic kernel subset
	ISO/DIS/8650/3	DIS, 1st ballot	specification of protocols for CASE—Part III: commitment, concurrency and recovery
	Related standards	ISO/DIS/8211	DIS
ISO/IS/7498, 1984		IS	OSI reference model
ISO/TC97/SC21/N391		DIS	OSI basic management framework
ISO/DIS/7498/DAD1 (SC21/N142)		DIS	addendum to the reference model covering connectionless data transmission
ISO/DIS/8824		DIS, 1st ballot	specification for abstract syntax notation 1 (ANS.1)
ISO/DIS/8825		DIS, 1st ballot	basic encoding rules for abstract syntax notation 1

IS= international standard, content very stable, little or no changes made

NOTE: This list of ISO LAN standards was compiled by the editors of *Gateway—The Map Reporter*, a newsletter produced by the Industrial Technology Institute (ITI). This

listing does not include documents at the working draft stage or documents now under development by contributing standards organizations. To purchase copies of the above documents, contact the Information Systems Center of ITI, P.O. Box 1485, Ann Arbor, Mich. 48106. Telephone: (313) 769-4000.

The confusion that surrounds the OSI reference model is due to the fact that this standard only addresses the architecture of a network and does not specify any portion of its implementation.

reference model. First published in 1978, the revised version is now an international standard—ISO/IS/7498, 1984.

Over the last seven years, the reference model has been both used and abused. According to John Day, chairman of the ANSI X3T5.1 committee, one of several committees contributing to the further specification of the OSI reference model, "a few years ago, if a vendor claimed that his product conformed to the OSI reference model, he was probably trying to mislead you."

The confusion that surrounds the OSI reference model is due to the fact that this standard only addresses the architecture of a network and does not specify any portion of its specific implementation. Computer and networking vendors saluted the architectural principles of the OSI reference model but implemented a non-standard and proprietary network. Thus, two networks, if built only in accordance with the OSI reference model, are likely to be incompatible.

Building compatible computer networks requires a voluminous set of specifications. Predictably, it has taken several years to develop a comprehensive set of networking specifications suitable for the review of standards organizations. But now, in 1986, a full, seven-layer set of international networking standards is finally coming into view. Although some specifications are already international standards, many are draft international standards and draft proposals still a year or two away from achieving international-standards status. Still, for the first time, system integrators can now obtain detailed descriptions of just how a fully specified, internationally standardized, seven-layer LAN would work.

ANSI chairman Day emphasizes that the documents available today provide only a profile of the more complete collection of standards necessary for the wide variety of networking services required by large multinational corporations. But the translation of the architectural principles first outlined in the OSI reference model have now begun to settle into a concrete and practical form.

It's become clear, for example, that implementations in the upper four layers (Transport, Session, Presentation and Application) are indeed independent of the Physical layer. Thus, the upper layer services can be used in LANs based on IEEE 802.3 carrier sense multiple access with collision detection, IEEE 802.4 Broadband Token-Passing Bus or IEEE 802.5 Token-Passing Ring, plus any other international, LAN, physical-layer standard that might emerge in the future such as Metropolitan Area

Networks (the IEEE working group P802.6) and the Fiber Distributed Data Interface, under review by ANSI.

It is also easier now to see just how multiple LANs, based on different physical media, can connect, and to see that the same basic connection methods also apply to interfaces to packet-switched wide area networks such as X.25.

Considerable work lies ahead for both the standards committees and the those keeping the pressure on computer and networking vendors to incorporate these standards into future products. But don't look for a flood of products implementing a full, seven-layer suite of standards this year. Only a few products aimed at GM MAP 2.1 factory-floor applications will be shipped during 1986. Look, instead, for efforts that will outline the migration path from a Babel of incompatible networks toward implementations based on international standards.

Also pay close attention to established de facto LAN standards that already meet the criteria of being both computer- and network-vendor independent. One suite of de facto standards implemented in products on the market today, and the layers to which they relate, are: IEEE 802.3 at the Physical Layer, IEEE 802.2 at the Data Link Layer, with the upper layers supported by Transport Control Protocol and Internet Protocol (TCP/IP), at the Transport and Network layers, followed by a virtual-terminal protocol called Telnet and a TCP/IP-based, file-transfer protocol that together provide service at the Session, Presentation and Application layers.

TCP/IP LANs have a significant installed base in the engineering and research communities. And strong arguments are now being made to continue building networks based on these de facto standards until it becomes clear that the cost of converting to implementations based entirely on international standards can be justified.

Proprietary LANs are not going to disappear in the near future, however, and system integrators working with proprietary LANs must continue to support these products. Nevertheless, the lesson to learn from the activities of GM and other network users is that the number of new installations of proprietary networking solutions will begin to dramatically decline over the next few years. □

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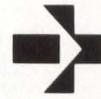
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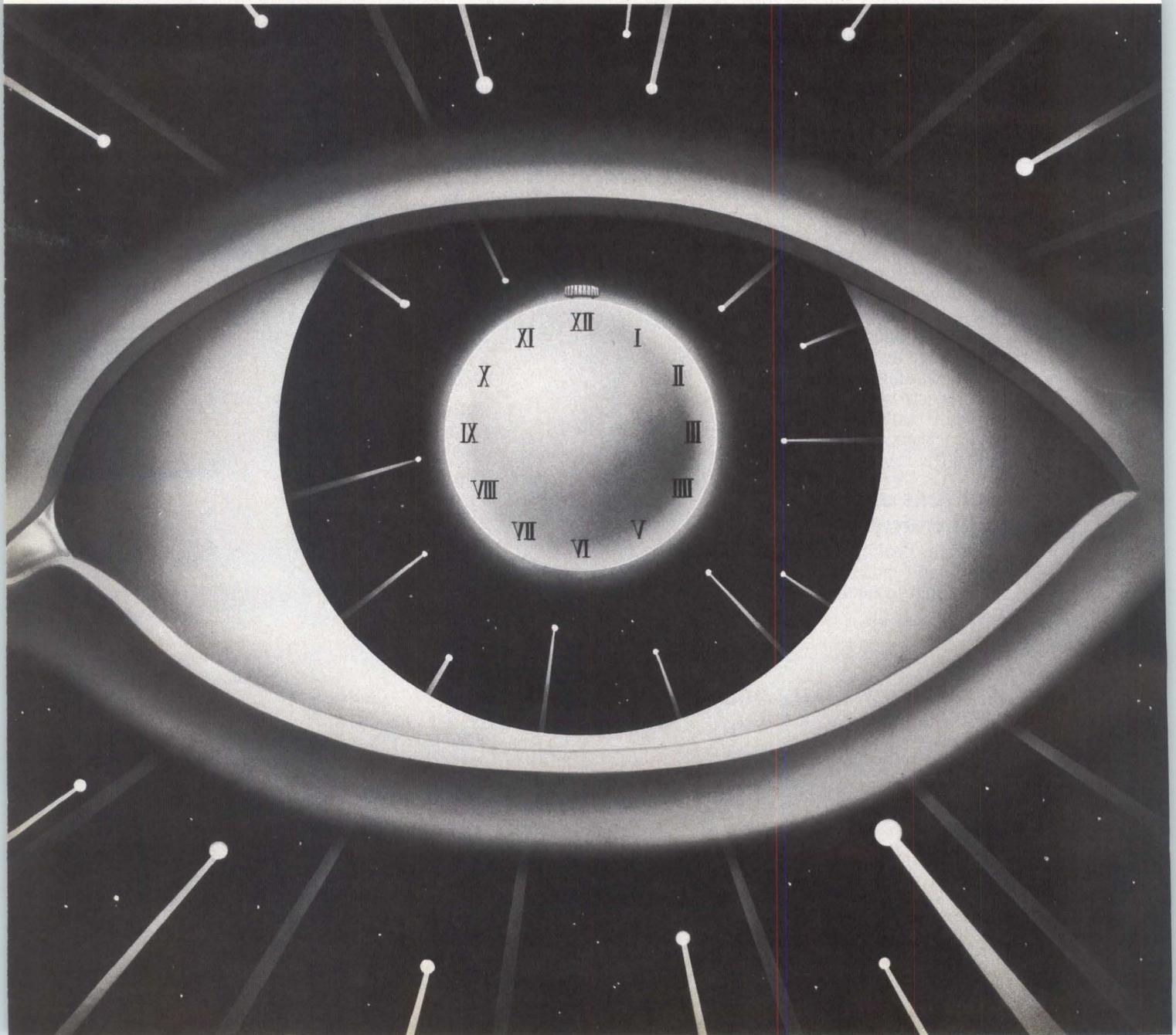
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PORTABLE MARKET REMAINS ELUSIVE

Despite new technology, the portable-computer market continues to resist exploitation, due to marketing miscues and misunderstood user requirements

Gene Talsky

Professional Marketing Management Inc.

Despite continuing slow sales, portable-computer manufacturers are introducing smaller, lighter and more technologically advanced systems in an effort to open the untapped potential of their market. They are facing added competition from other U.S. manufacturers entering the market for the first time, and the Japanese are becoming more aggressive within the U.S. portable-computer market.

Manufacturers and resellers alike continue to search for portable-computer applications. Yet, most companies still do not fully comprehend the complexity of portable markets. They have not sufficiently differentiated the particular requirements of general and specialized markets, nor have they structured their products to meet the divergent needs of those users whose portable will be their sole computer and those for whom it will be a second system—their travelling companion.

Improved displays and better packaging are, to some extent, overcoming the major technological gaps that limit buyers' acceptance of portables. Still, no evidence exists that improved products will attract the large numbers of buyers continually predicted by market-research companies.

Few innovative products arrive

One of the more interesting new products is Quadram's Keystyle 80, a battery-operated laptop that can serve as the keyboard of any IBM Corp. PC or PC compatible, including Quadram's Datavue 25. Furthermore, it also has a life



Incorporating all of the performance and PC-compatibility of the Compaq Portable 286 is the Portable II, smaller and 17 to 20 percent lighter than the earlier machine, depending on the configuration.

of its own. It contains a CMOS Z80 processor with ROM-based software that includes a word processor, calendar, world clock and onboard communications software for connection with a PC. Users can create files in up to 32K bytes of RAM, which can then be fed to a PC using the communications software or sent through the unit's own ports to a serial or parallel printer. With its unique interconnectability, the Keystyle 80 is really the first "intelligent keyboard" device that, in itself, offers almost as much functionality as the Tandy Corp. 100 or 200 and is also compatible with the MS-DOS environment. Quadram's approach effectively addresses the requirements of single-system users who need full PC compatibility in the office and full capa-



The MS-DOS-compatible T1100 from Toshiba weighs nine pounds and comes with a 3½-inch flexible disk drive.

bility on the road.

The leader in portable-computer sales, Compaq Computer Corp., decided against entering the laptop arena after reviewing proposed laptop models with key dealers. Last month, however, the company introduced a new portable—the Compaq Portable II—that incorporates all of the performance and compatibility of its Portable 286 while being smaller and, at 23 to 26 pounds, 17 percent to 20 percent lighter, depending upon configuration. The new unit incorporates two PC-compatible expansion slots and is available with a single flexible disk drive, two flexible drives or a flexible drive plus a 10M-byte rigid disk drive.

AT&T Information Systems' response to the laptop market is the Safari 7 Laptop with a backlit liquid crystal display. IBM has placed at

least two new models on the laps of beta-test-site users and might release the machines for general sale as early as this month.

Japanese push portables

The Japanese, trying to wedge further into U.S. computer-systems markets, are committed heavily to portable products. In January, Panasonic Consumer Products, a New Jersey subsidiary of Matsushita Electric Co., introduced the innovative Executive Partner. This is a compact transportable with a gas plasma display and an internal 10M-byte rigid disk drive. As does the earlier Senior Partner, the Executive Partner includes a built-in, dot-matrix or thermal-transfer printer. In addition, an Intel Corp. 8086-2 microprocessor offers improved performance over standard IBM PCs and PC/XTs.

The airfoil design of Ampere Inc.'s WS-1, marketed in the United States by Workspace Computer Inc., is one of the more interesting new portables in terms of appearance. And, here, there's more than meets the eye. Programmers can use the Motorola Inc. MC68000-based system as an APL programming environment, but other users are completely shielded from that language's technology by Octagon, a comprehensive ROM-software environment that incorporates eight major personal computer applications, from word-processing and spreadsheet through database, graphics and communications. As an aside, the company should also be lauded for producing a brochure that tells users what they actually can do with the WS-1, rather than merely describing its technological marvels. However, even though it offers external disk



An "intelligent keyboard," Quadram's Keystyle 80 (left) can plug into any IBM-compatible personal computer, including the company's Datavue line of



portables (right). The battery-operated laptop contains a Z80 processor and ROM-based software that provides a variety of applications.

How to get so much power (up to 1.3 meg), in such a small computer (12 lbs.), for so little (\$1695).

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Built-in 5-1/4" drive and RAM drive software lets you swap 5-1/4" floppy disks between your Datavue and other PC's.

You can expand Datavue's 2-drive system even further with an additional add-on floppy disk drive.



The small computer that's big on features.

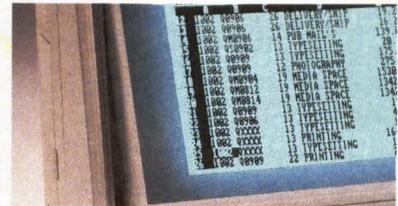
Datavue features a detachable low-profile sculptured keyboard with that IBM-type touch and 10 function keys for special software. Its cordless infrared operation doesn't tie you down.

A full-sized 80 x 25 line display lets you run text or graphics. And six different screen palettes allow you to fine tune the greys and blacks according to the software you're using. If it's color graphics you're looking for, just plug an RGB monitor into the standard port.

And that's just the beginning of Datavue's expandability. Turn Datavue into a telecommunications device with a modem. Add 1.3 meg of power to run memory-intensive programs or an expansion chassis for a 10 megabyte hard disk and 3 standard IBM cards. The choices are yours.

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The future is looking bright.

Quadram is always working to make a great computer like Datavue even better. Options include a long-lasting fluorescent screen that helps you make the most of low-light situations.

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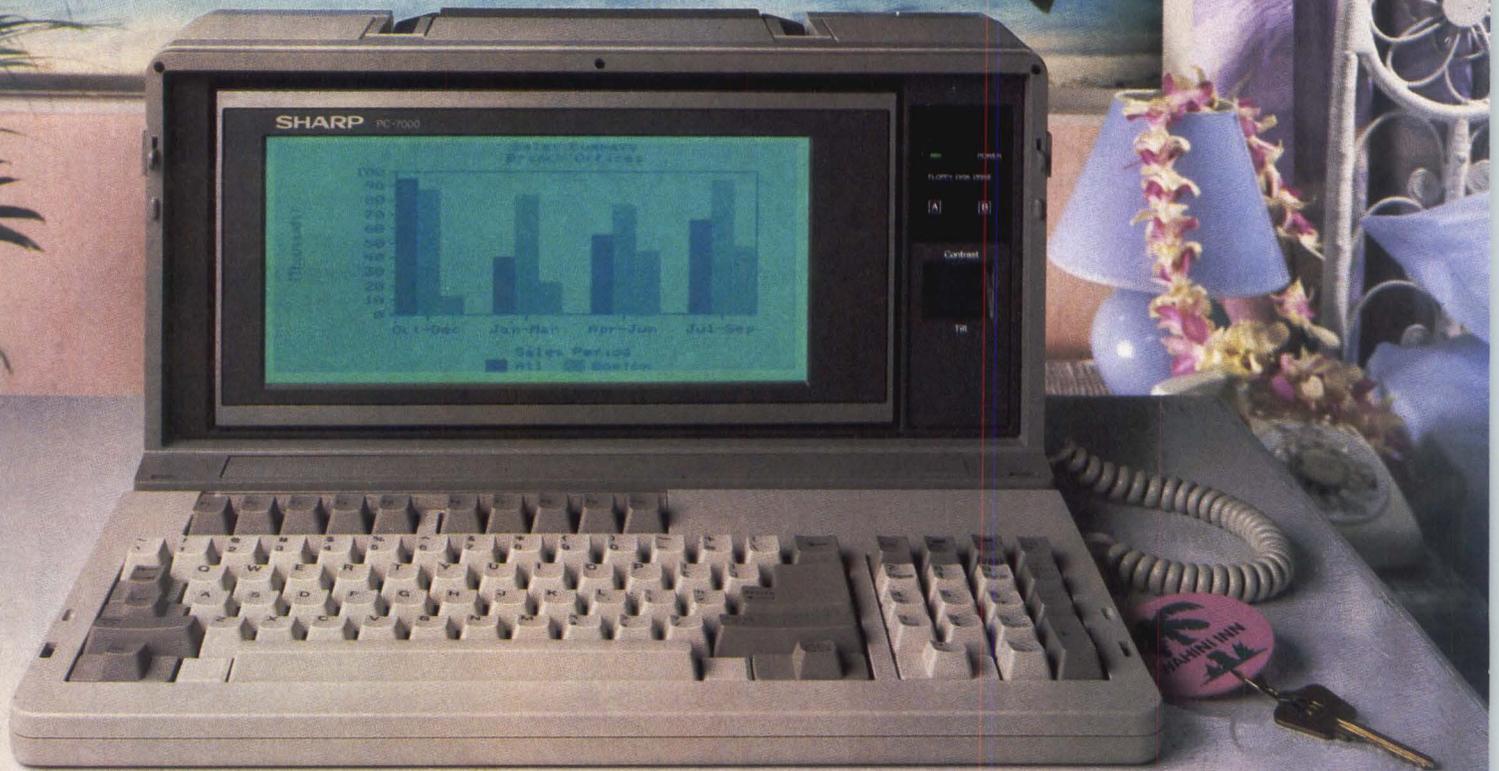


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Or carry it because it's easy to use. In addition to a high-speed 16 bit microprocessor, the PC-7000 has an easy-to-read bit-mapped screen with backlighting from an innovative electro-luminescent panel. And the keyboard is detachable, ergonomically designed for comfortable use.

It only takes memory chips to

upgrade RAM, and a modem card enables it to communicate with other computers. And our Near-Letter-Quality (32 x 48 dots) silent transfer printer attaches directly to the main unit.

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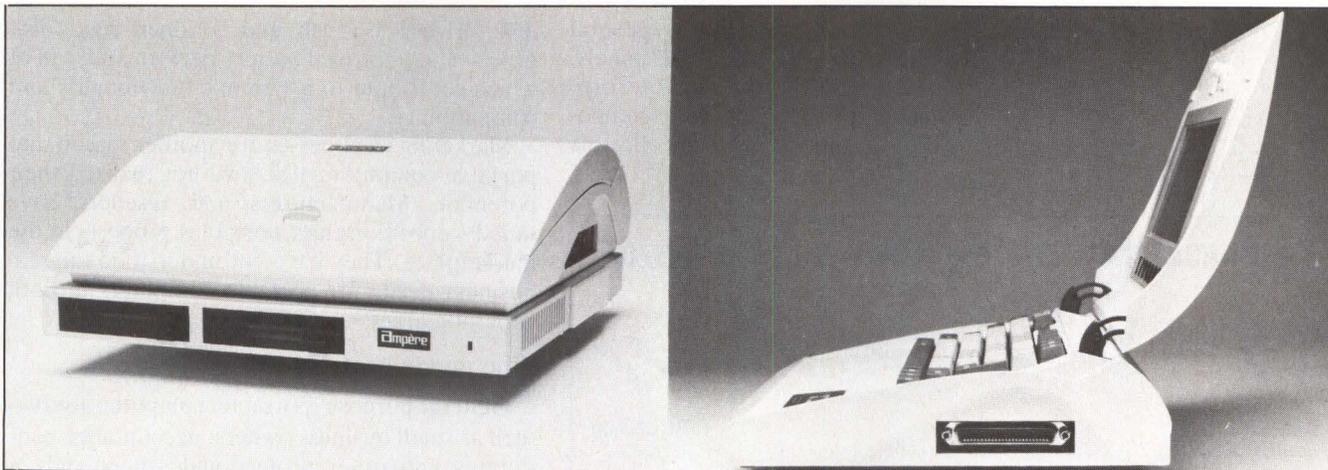
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drives, its PC incompatibility and lack of internal drives limit the appeal of this otherwise advanced system.

Toshiba America Inc. and Hitachi America Ltd. offer MS-DOS-based laptop systems that include one or two internal 3½-inch flexible disk drives, as well as improved LCD screens. Toshiba's T1100 weighs nine pounds. Sharp Electronics Corp., maker of one of the first laptops—the model 5000—now offers the 7000, a compact transportable with an advanced, backlit LCD screen that provides wide-angled viewing. Its dual 5¼-inch flexible disk drives provide operational compatibility with current MS-DOS applications software in a package that is significantly easier to travel with than many other transportables. Its travel case will also accommodate an optional, attachable printer.

Sanyo Business Systems Corp. includes a 9-inch color CRT and dual 5¼-inch flexible disk drives on its MS-DOS-based MBC 775 transportable. The monochrome model 675 offers compactness and compatibility in a 23-pound package. The Canon U.S.A. Inc. A-200 Transportable has an optional expansion unit that provides three PC-compatible slots.

Why portables have failed

Even with such advances in portable technology, most portable computers don't meet anticipated sales levels for several reasons. First, technology has not provided users sufficient operational and application-software compatibility. In many cases, lack of PC-compatible removable storage has limited the flexibility required by business users. In addition, weak displays render most portables difficult to use for more than an hour at a time.

For example, Data General Corp.'s model One offered several LCD displays, all of which provide relatively poor readability. And, until

3½-inch disk drives become more widely used, DG's One will not be adequately compatible. Hewlett-Packard Co. also failed the readability and compatibility tests in its initial portable model. Unfortunately, its updated Portable Plus solves neither problem. However, most analysts anticipate that HP will rectify these weaknesses in 1986.

Recent advances in electroluminescent (EL), LCD and plasma technologies overcome display weaknesses at the cost of reducing or eliminating battery operating time. This isn't necessarily a drawback because, if users require battery operation at all, it often is not for more than one hour

Sporting a unique airfoil design, Ampere's WS-1 features an MC68000-based APL system for programmers. For general users, a ROM-based software environment provides all major personal-computer applications.



The Intel 8086-2-based Executive Partner, from Panasonic, incorporates a gas plasma display and an internal 10M-byte rigid disk drive.

at a time. For improved readability, several systems now feature LCDs backlit by EL panels, first offered in 1984 by STM Electronics Corp. Other improvements include electronic-component miniaturization, one-third-height flexible

disk drives, 3½-inch and 5¼-inch rigid disk drives, and improved battery performance, all of which contribute to a system's functionality and compatibility.

Marketing weaknesses are another reason that portable-computer sales have not realized their potential. Manufacturers and resellers have failed to position their portables properly in the marketplace. They have not understood the real business needs for portable computers in both general markets and in specialized niches.

Who needs portables?

General-purpose portable computer users—such as small business owners, accountants, consultants and other professionals—need only a single computer. And most would be better served by one that could easily be taken between home and office and from client to client. Compaq's Portable and Portable 286, although relatively bulky and heavy, have met these needs due to their high degree of compatibility with the full line of IBM PC products. Because most users use commercially available software and may want to share files with their clients, they don't want to sacrifice compatibility.

Corporate users comprise another general-user group. They have access to one or more desktop PCs and have developed numerous files on 5¼-inch flexible disks that they use for word-processing, spreadsheet, database and other applications. When they need to transport data and programs, they also require operational and PC-software compatibility. However, because they cannot remove their large base systems from their offices, they need a secondary system in which portability, expressed in size and weight, becomes paramount.

Specialized markets for portables range from remote data collection—such as meter reading and branch inventory recording—to insurance sales, real estate sales, on-site maintenance and service and remote communications, as well as more general business applications for multiple-location operations. Also, government agencies, including the Internal Revenue Service and the military, have specialized needs for portables. Some of these needs are best met by hand-held units; others require full general-purpose portable systems.

Of these markets, the general-user market offers the greatest potential, but portable-computer manufacturers must overcome the marketing challenges faced by all computer system manufacturers in developing effective distribution channels. With the notable exception of Compaq, most companies have invested much of their marketing resources in identifying (and, in

REPRESENTATIVE NEW PORTABLES, 1985/86

Manufacturer Model	Type	Operating system	Display	Storage	Weight (pounds)
AMPERE INC. CIRCLE 400 Asahi Building, 5-20, 7-chome, Nishi-Shinjuku, Shinjuku-Ku, Tokyo, Japan					
WS-1	L	68000 (APL)	LCD	cassette	
AMQUTE CIRCLE 401 66-05 Woodhaven Blvd., Rego Park, N.Y. 11374, (718) 896-5415					
Ile, IIIe, IVe	T	MS-DOS	CRT	two 5¼	24, 28
BONDWELL INDUSTRIAL CO. INC. CIRCLE 402 3300 Seldon Court, #10, Fremont, Calif. 94539, (415) 490-4300					
2	L	CP/M	LCD	one 3½	11
18	T	MS-DOS	9-inch CRT	two 5¼	28
CANON U.S.A. INC. CIRCLE 403 One Canon Plaza, Lake Success, N.Y. 11042, (516) 488-6700					
A-200	T	MS-DOS	LCD	two 5¼	19
COLBY COMPUTER CIRCLE 404 849 Independence Ave., Mountain View, Calif. 94043, (415) 968-1410					
Mac Colby	T	Mac OS compatible	CRT	two 3½	24
PC-5	T	MS-DOS	EL	two 3½, opt. 5¼ or 20M-byte disk	18
COMPAQ COMPUTER CORP. CIRCLE 405 20333 FM 149, Houston, Texas 77070, (713) 370-7040, ext. 618					
Compaq Portable II	T	MS-DOS	9-inch CRT	two 5¼, opt. disk	20 to 25
CORDATA INC. CIRCLE 406 275 East Hillcrest Drive, Thousand Oaks, Calif. 91360, (805) 495-5800					
ATP-8-Q, 20-Q	T	MS-DOS	CRT	two 3½	24
GRID SYSTEMS CORP. CIRCLE 407 2535 Garcia Ave., Mountain View, Calif. 94043, (415) 961-4800					
GRIDCase 1, 2, 3	L	MS-DOS	LCD/plasma	3½	12
HEWLETT-PACKARD CO. CIRCLE 408 3000 Hanover St., Palo Alto, Calif. 94304, (800) 547-3400					
Portable Plus	L	MS-DOS	LCD	Ramdisk	9
HITACHI AMERICA LTD. CIRCLE 409 Computer Sales and Service Division, Suite 100, 950 Elm Ave., San Bruno, Calif. 94066, (415) 872-1902					
LCX	L	MS-DOS	12-inch LCD	two 3½	11½
KAYPRO CORP. CIRCLE 410 533 Stevens Ave., Solano Beach, Calif. 92075, (619) 481-3900					
2000	L	MS-DOS	25 by 80 LCD	3½	11½
MELARD TECHNOLOGIES INC. CIRCLE 411 5 Westchester Plaza, Elmsford, N.Y. 10523, (914) 592-3044					
Access	H	proprietary 8-bit	8 by 40 LCD	ROM/RAM	1½

•KEY: L = Laptop H = Handheld
T = Transportable U = Upright

some cases, inventing) specialized niche markets.

Some smaller companies, GRiD Systems Corp. foremost among them, have survived by effectively identifying and addressing specific niches, especially governmental agencies and the field-sales and support operations of major corporations. For all that, it failed in trying to promote its highly engineered, expensive systems to top corporate executives as the Porsche of portables. On the other hand, Compaq succeeds in the general market because it offers 100 percent compatibility in a package that provides some mobility, and it markets its systems as both the main computer system and as a second system for limited travel.

Market research lacks substance

Most market-research reports on the portable-computer market, all of which have greatly overstated market potential, concentrate on quantitative aspects, which are often based on desktop PC sales. One interesting study of the European market, "Portable Computer, The Market Potential in Europe 1985-1990," by Systems Concepts Ltd., London, provides new insights by identifying four distinct categories of portable-system usage, each of which is addressed by different types and levels of portable systems:

- Carrying information
- Collecting information
- Processing information while mobile
- Communications (with the office and elsewhere).

Although the findings are not always applicable to U.S. markets, the methodology, information and analysis offer a thorough understanding of the way in which portable computers are actually used, and ways in which people plan to use them. The report profiles the amount, type and duration of portable usage to provide a realistic view of the operating, travelling and applications environment of each type of user.

Short-term opportunities abound

A variety of short-term opportunities exist for specialized applications. A number of portable-computer manufacturers are following the IRS' acquisition of as many as 15,000 portables for their field auditors. It is rumored that this opportunity has been the impetus for IBM to enter the laptop arena.

Ford Motor Co. recently purchased 500 Zenith Data Systems Z-171 portables (produced under license from Morrow Designs Inc.) to increase the productivity of its travelling employees. And GRiD has a major contract to incorporate its portable in a tactical field-communication systems for the U.S. Army.

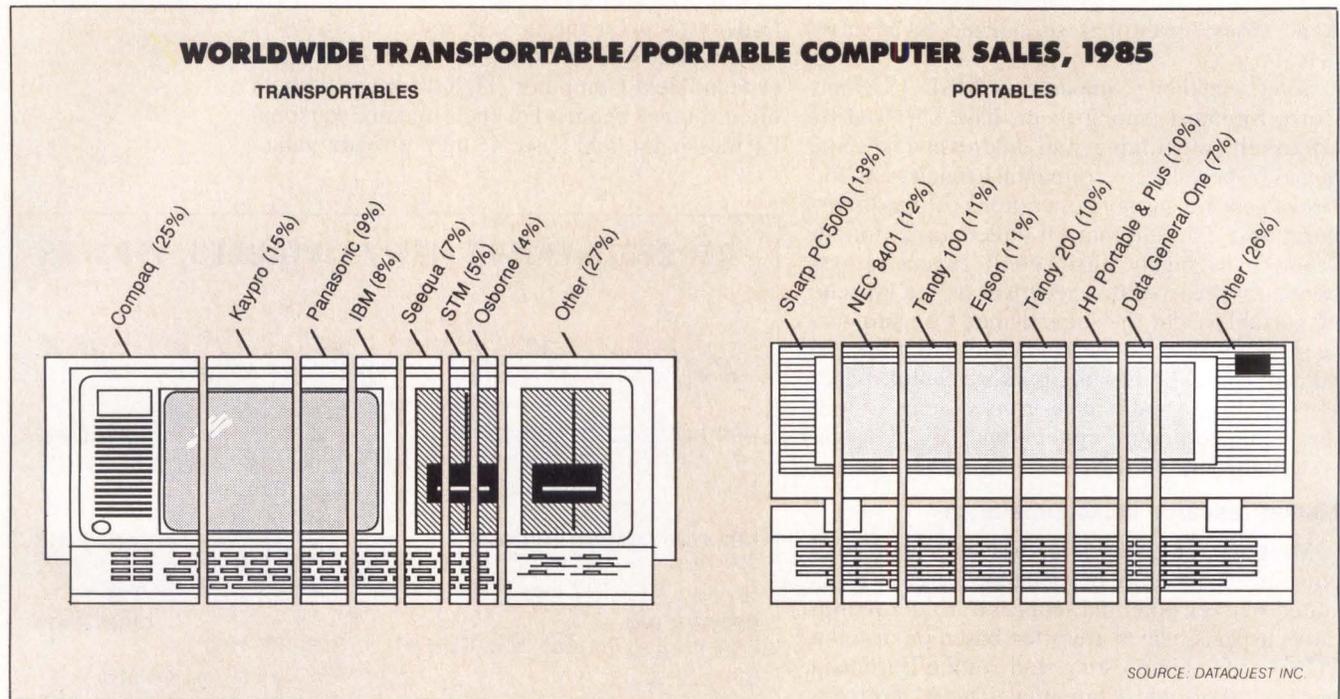
tions systems for the U.S. Army.

Panasonic sold an estimated 70,000 of its earlier HandHeld Computer (HHC) for use by field life insurance agents. For their updated Personal Partner hand-held system, they provide value-

REPRESENTATIVE NEW PORTABLES, 1985/86

Manufacturer Model	Type	Operating system	Display	Storage (inches)	Weight (pounds)
NEC HOME ELECTRONICS INC. CIRCLE 412					
1401 Ettes Ave., Elk Grove Village, Ill. 60007, (800) 323-1728					
Starlet	L	CP/M	16 by 80 LCD	Ramdisk	5
NIXDORF COMPUTER CORP. CIRCLE 413					
300 Third Ave., Waltham, Mass. 02154, (617) 890-3600					
8810/25	T	MS-DOS	CRT	two 5 1/4	33 to 35
OEMTEK INC. CIRCLE 414					
3707 Williams Rd., San Jose, Calif. 95117, (408) 247-1100					
82000, 92000	T		CRT	two 5 1/4, opt. disk	33
PANASONIC CONSUMER PRODUCTS CIRCLE 415					
1 Panasonic Way, Secaucus, N.J. 07094, (201) 348-7000					
Executive Partner	T	MS-DOS	plasma	5 1/4, 10M-byte disk	28
Personal Partner	H	80c88 ROM	5 by 80 LCD ROM		2
QUADRAM CIRCLE 416					
4355 International Blvd., Norcross, Ga. 30093, (404) 923-6666					
Keystyle 80	L	Z80 proprietary	8 by 80 LCD RAM, ROM		3
SANYO BUSINESS SYSTEMS CORP. CIRCLE 417					
51 Joseph St., Moonachie, N.J. 07074, (201) 440-9300, ext. 307					
MBC 775	T	MS-DOS	color CRT	two 5 1/4	32
SHARP ELECTRONICS CORP. CIRCLE 418					
Systems Division, 10 Sharp Plaza, P.O. Box C, Paramus, N.J. 07652, (201) 265-5600					
PC-2500	L	proprietary	4 by 24 LCD RAM		2.9
PC-7000	T	MS-DOS	backlit LCD	two 5 1/4	18 3/4
STM ELECTRONICS CORP. CIRCLE 419					
Suite 250, 535 Middlefield Rd., Menlo Park, Calif. 94025, (405) 320-6226					
STM Laptop	L	MS-DOS	EL or LCD	3 1/2	15
TANDY CORP. CIRCLE 420					
1800 One Tandy Ct., Fort Worth, Texas, 76102, (817) 390-3921, ext. 3273					
Model 600	L	proprietary	16 by 80 LCD	3 1/2	11
TOSHIBA AMERICA INC. CIRCLE 421					
Information Systems Division, 2441 Michelle Rd., Tustin, Calif. 92680, (714) 730-5000					
T1100-9	L	MS-DOS	LCD	3 1/2	9
ZENITH DATA SYSTEMS CIRCLE 422					
1000 Milwaukee Ave., Glenview, Ill. 60025, (312) 391-8800					
Z-136	T	MS-DOS	7-inch CRT	two 5 1/4	24
Z-171	U	MS-DOS	backlit LCD	two 5 1/4	15

• KEY: L = Laptop H = Handheld
T = Transportable U = Upright



added resellers and value-added dealers with a complete development capability, hoping to find success in similar niche markets.

Various specialty companies support portable systems. Traveling Software Inc., for example, supports the Tandy 100 and 200 and the NEC Home Electronics Inc. 8201 with ROM-based software that provides comprehensive productivity tools, including word-processing, spreadsheet and database applications, as well as specialized sales-management software, an appointment scheduler, expense reporting and remote project management, including time reporting. Recently, the company migrated its Laptop software series to a new Desktop series to broaden its market base to include portable and desktop MS-DOS systems.

Independents shift strategies

Many portable-computer manufacturers are shifting their business and marketing strategies. STM is one of the more innovative. Although rated sixth in total units sold, STM isn't big enough to compete for the shelf space of U.S. dealers. So it has successfully shifted its marketing emphasis to technology transfers with Third-World nations. Cordata Inc., whose OEM contracts with several major vendors for both its portable and desktop systems proved disappointing, has shifted emphasis to new markets and products, including its In-House Print Shop. Meanwhile, pioneer Osborne Computer Corp., a survivor of Chapter 11 reorganization, is mar-

keting outside the United States and forming joint ventures with other independents, including Colby Computer, in order to offer a full range of products, from IBM-compatible portables and desktops to Apple Computer Inc.- and CP/M-compatible systems.

In 1985, most of the technological problems were solved. So, the challenge for 1986 is more in fulfilling market expectations and needs. Providing independent VARs and VADs with developmental capabilities is a step in the right direction, but, in most cases, addresses limited niche markets.

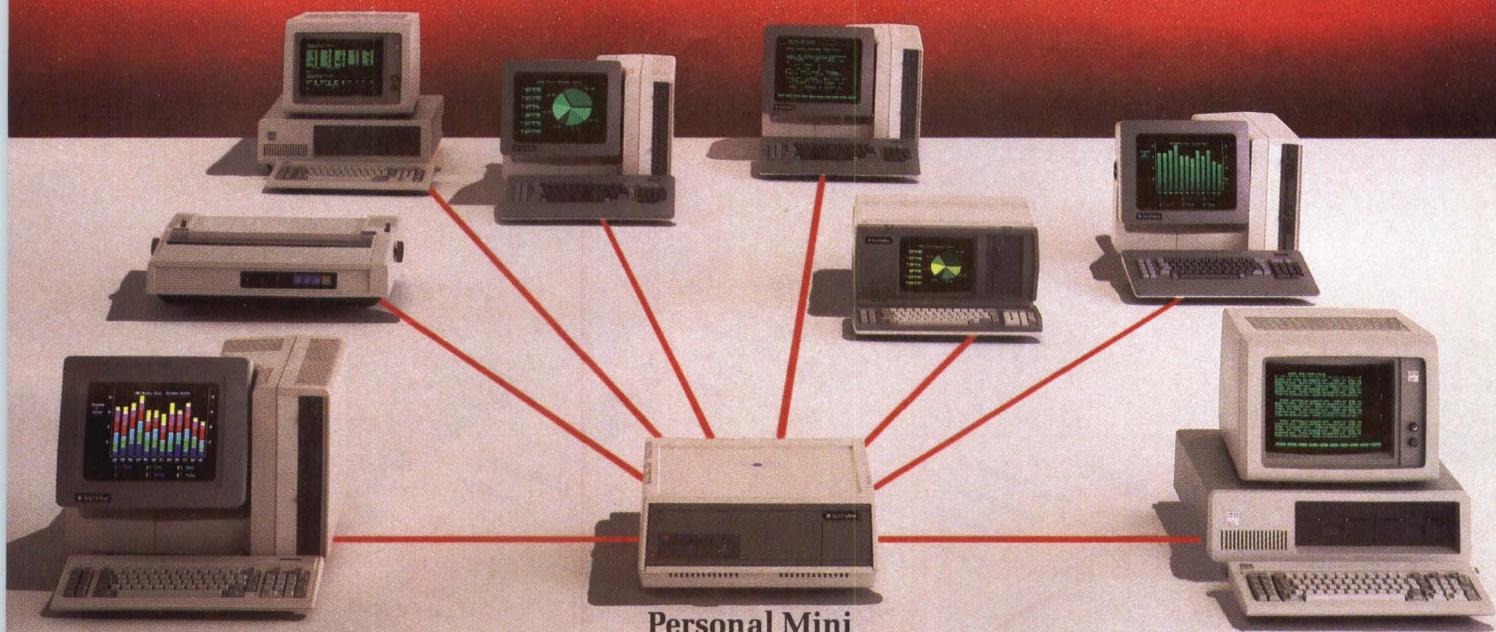
At this point, no manufacturer of laptops has been able to overcome buyers' perception that a 10-to-15-pound box cannot deliver as much PC-compatible functionality as does a desktop system, especially when the screen is difficult to read. The few advertising campaigns that implied that portables are interchangeable with desktops—notably HP's for The Portable and DG's for the One—promoted systems that do not actually offer full compatibility. This reinforced buyers fears rather than relieving them.

The first vendors to realistically confront the remaining challenges should be able to unlock the potential of this untapped market. □

Gene Talsky is president of Professional Marketing Management Inc. (PROMARK), Old Lyme, Conn., which provides strategic planning, business development and marketing planning services to computer-industry vendors and resellers.

Interest Quotient (Circle One)
High 487 Medium 488 Low 489

TeleVideo is the multiuser system for companies who expect to grow.



Personal Mini

After all, growth is why you need a proven and low-cost network for your PCs in the first place.

Over 5000 TeleVideo Personal Mini systems have been installed. You're assured of a reliable and stable system the first time out. And you can easily connect TeleVideo, IBM, AT&T or other PC, XT, or AT computers. Add more PCs only as you need them.

The Personal Mini is focused around the high-performance dual-processor architecture. You can pick the right configura-

tion to match your needs from two to sixteen users, 20 MB up to 142 MB hard-disk storage, and fast tape backup. If you need more, the Personal Minis can be linked together.

For software, you retain your original PC-DOS application investments because they run on the Personal Mini. In addition, hundreds of industry-proven multi-user applications are available because we provide NetWare™, NETBIOS™ and MS-DOS 3.1 compatibility. Concur-

rent user access and data security are built into the network operating system.

Our PC interface costs are the lowest in the industry—less than \$200 per PC. So your original investment in hardware, software and training is never lost. From a one-user PC, to a two-user or a 16-user TeleVideo network system, your growth opportunity never ceases.



NetWare, NETBIOS, MS-DOS, are trademarks.
IBM, AT&T, TeleVideo and Personal Mini
are registered trademarks.

Regional Sales Offices: Northwest (408) 745-7760, Southcentral (214) 258-6776, Southeast (404) 447-1231, Southwest (714) 476-0244, Midwest (312) 397-5400, Eastern (516) 496-4777, Northeastern (617) 890-3282.

CIRCLE NO. 65 ON INQUIRY CARD

27mW and you're ready to roll.

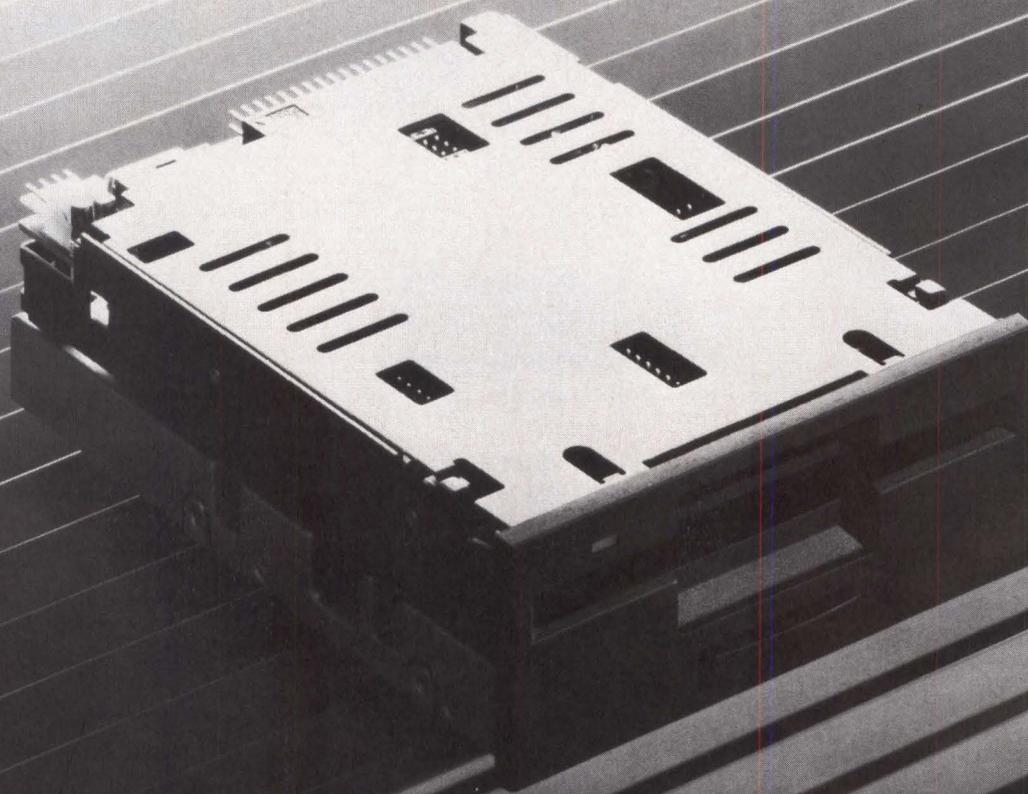
27 milliwatts. That's all it takes for standby mode on our FD-35 Series 3.5 inch floppy disk drives with the Power Saver option. And, in operation, they consume a mere 1.72 watts average at read/write, and 2.90 watts average at seek. These just happen to be the lowest numbers for any 3.5 inch drive.

This remarkable feat is made possible by the use of new custom LSI chips with CMOS technology for more efficient control over all the drive functions.

For added reliability and accuracy we shortened the gap between the band actuator and the head and included a more precise head position mechanism. This means stable reading and writing, even at high track densities.

And, as if all that weren't enough, we've thrown in special aluminum RF shielding to keep out noise pollution.

With the growing need for more portable systems, 27 milliwatts is a load anybody can carry.



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CIRCLE NO. 66 ON INQUIRY CARD

INTERFACE '86 EXPANDS COMMUNICATIONS FOCUS

This year's show will cover more product categories, from local area networks to voice/data-integrated systems

Frances T. Granville, Associate Editor

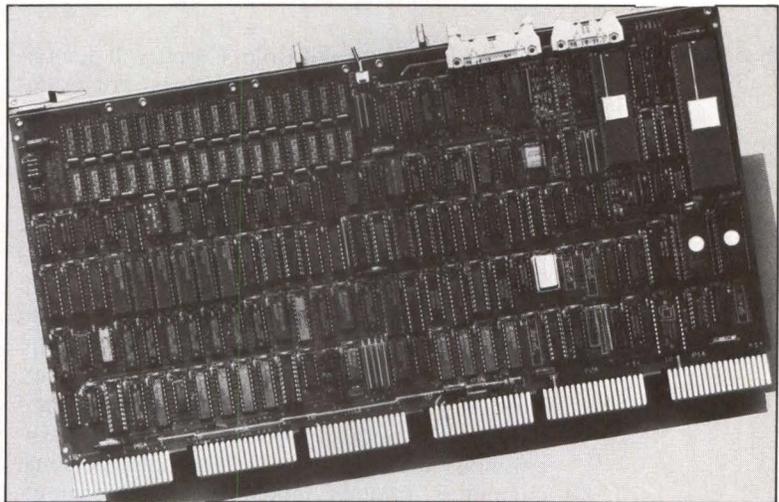
The Interface conference—traditionally covering data communications and information processing—will expand this year, according to The Interface Group, producer of the exhibition. The 14th annual show, to take place March 24 to 27 at the Georgia World Congress Center in Atlanta, will cover a wider range of communications equipment, software and services than in previous years.

Last year, Interface attracted approximately 300 exhibitors and 15,761 attendees. Among those attending, nearly 39 percent represented companies with more than 5,000 employees. Most of the remaining 61 percent came from companies with 1,000 to 5,000 employees. This year, The Interface Group again expects more than 15,000 large-scale corporate end users and approximately 350 exhibitors.

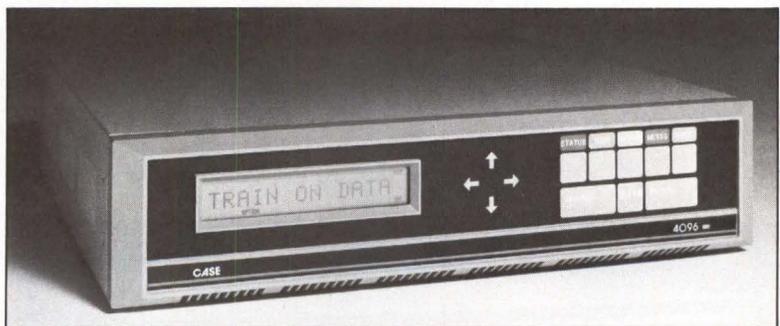
A program committee of 17 industry experts has developed a schedule of more than 60 technical sessions, covering such topics as networking operations and strategies, communications products and trends, voice/data integration, telephone/switching systems, private packet networks and communication satellites. The keynote speaker for Interface '86 will be James E. Olson, AT&T Co. president and chief executive officer.

Companies will exhibit telecommunications, data communications, information networks, local area networks, fiber optics, facsimile equipment, private branch exchanges, satellite and microwave equipment and voice/data-integration systems. In addition, many companies plan multivendor on-line demonstrations of internetworking products.

Among companies announcing products at the show will be Canoga Data Systems, Canoga Park, Calif. Canoga will introduce a midrange fiber-optic modem, the 2260—the third in the



Bridge's integrated VAX Ethernet communications server (IVECS) fits into a single VAX Unibus slot.

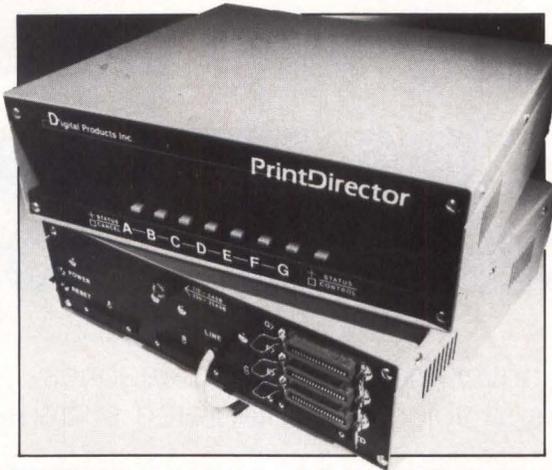


company's Gray Hound series. The 2260 offers T1 and RS422 interfaces and data-throughput speeds as high as 1.522M bits per second (bps). Telebyte Corp., Natick, Mass., plans to introduce a data-compression modem.

Other companies, including Bridge Communications Inc., Case Communications Inc., CXI Inc., Digital Products Inc., Equinox Systems

Case Communications' 4096 is the first 9,600-bps modem with trellis-coded modulation, according to the company.

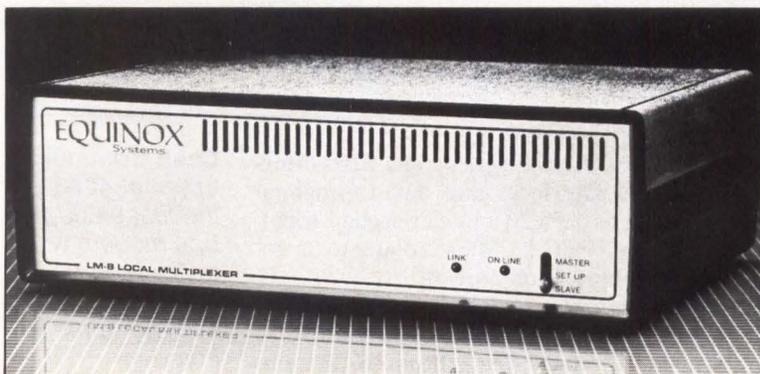
Digital Products' PrintDirector allows one or more laser printers to accept tasks from as many as 21 microcomputers, minicomputers or mainframes.



Inc., Proteon Inc. and Rolm Corp., will demonstrate recently announced products. For example, Bridge, Mountain View, Calif., will demonstrate its single-board integrated VAX Ethernet communications server (IVECS), which was announced in January at the Communications Networks '86 exhibition in Washington. The IVECS plugs into a hex-sized VAX Unibus slot and emulates as many as eight DMF 32 I/O controller cards while establishing a direct attachment to an Ethernet LAN. Bridge will also demonstrate its CS/200, also introduced at Comnet. The CS/200 is a briefcase-sized Ethernet communications server that connects four or 10 asynchronous devices, such as terminals, personal computers, printers, modems and host computers, to a Bridge Ethernet LAN running the Xerox Network System (XNS) high-level protocols. IVECS sells for \$6,900 plus an annual software fee of \$250; the 10-port CS/200 sells for \$3,250.

Equinox's LM-8 local multiplexer allows eight channels of data to be sent over a single cable to distances as far as one mile away

Case, Silver Spring, Md., will demonstrate its recently introduced 4000 Series diagnostic modems. The 4000 Series includes the point-to-point or multipoint model 4096, the first 9,600-bps modem with trellis-coded modulation (TCM), according to the company. TCM allows



for line error corrections without retransmission of data blocks. The company will also display the 5000 Series network-management processors and the DCX switching-exchange processor. The 5000 Series includes the model 5200 multidevice controller, which the company will demonstrate controlling networks, modems and multiplexers. The price depends on configuration.

CXI, Palo Alto, Calif., plans to demonstrate its 3270-emulation and gateway product lines. The gateway products include the PCOX/Gateway Coax connection, a gateway between a LAN and an IBM Corp. 3274 cluster controller; the PCOX/Gateway-16 and PCOX/Gateway-64 remote connections, which emulate 3274 cluster controllers; and the PCOX/Gateway WS workstation software, which emulates IBM 3278/79 terminals, 3287 printers and 3270 PCs. Prices are \$275 for PCOX/Gateway WS, \$2,595 for PCOX/Gateway-16, \$2,995 for PCOX/Gateway Coax and \$4,595 for PCOX/Gateway-64.

Digital Products, Watertown, Mass., will exhibit its NetCommander, an intelligent data-exchange system for sharing printers and peripherals and for file-transfer applications in local personal computer work clusters. The NetCommander is available in four-, seven-, eight- and 16-port versions. The eight-port version, NC 8/250, sells for \$1,895 with RS232 cables and \$1,695 with RJ-45 cables. The company will also display its PrintDirector, a buffered printer-sharing system introduced late last year. It allows one or more laser printers to accept tasks from as many as 21 microcomputers, minicomputers or mainframes. The PrintDirector sells for \$695 to \$1,295, depending on the configuration.

Equinox Systems, Miami, will display its LM-8 local multiplexer, introduced last December. The LM-8 provides a vehicle for sending eight channels of data and associated control signals over a single cable to sites as far as one mile away. The company will demonstrate the LM-8 with Equinox's low-end DS-5 Data PBX and the high-end DS-15 Data PBX. The LM-8, including an interface to the Data PBX, sells for \$700.

Proteon, Natick, Mass., will demonstrate its high-speed Pronet token-ring LANs and fiber-optic connections. The LANs come in 4M-, 10M- and 80M-bps versions that connect Unibus, Q-bus, Multibus, VMEbus and IBM PC bus computers.

Rolm, Santa Clara, Calif., plans to exhibit its recently introduced PhoneMail voice-messaging system and its CBX-II computerized business-exchange system. □

Interest Quotient (Circle One)
High 490 Medium 491 Low 492

SCO XENIX SYSTEM V
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—Kaare Christian, PC Magazine



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CIRCLE NO. 67 ON INQUIRY CARD



PRESENTS

SCSI FORUM / SUNNYVALE '86

After a successful East Coast Conference in October of 1985, the SCSI Forum plans to move West in May of 1986 with a 3 day Technical Program devoted to discussing SCSI issues, hearing about the latest SCSI developments, learning about SCSI, and promoting industry standardization.

WHERE The Sunnyvale Hilton

WHEN May 5 - 8, 1986

- TOPICS/ISSUES**
- What is the structure and size of the SCSI market?
 - Who is committed to SCSI?
 - What is the Common Command Set?
 - How can higher performance for SCSI be achieved?
 - Is SCSI a viable alternative for personal computers?
 - How are intelligent SCSI storage peripherals tested?
 - How is the copy command effectively used for backup?
 - Is SCSI just for storage devices?
 - What other steps in addition to the Common Command Set should be taken to ensure software portability?
 - How do the many interface alternatives compare with one another?
 - Is SCSI a viable alternative for IPI?
 - What SCSI products are available today?
 - Is SCSI compatible with the ISO's open systems interconnect concept?

WORKSHOP In addition to covering "Leading Edge" SCSI topics, Delegates may attend an optional SCSI Workshop on Monday evening, May 5th, in order that they may derive more benefit from the technical sessions to come.

RECEPTION Delegates will also have an opportunity to see the latest in SCSI Products during the Exhibitors Reception scheduled for Tuesday evening, May 6th.

SPONSORS The SCSI Forum is sponsored by Technology Forums, and the SCSI Forum Advisory Board consisting of:

- Adaptec
- ENDL
- Pertec Peripherals
- Adaptive Data Systems
- Fujitsu America
- SMS/OMTI
- Control Data
- Mini-Micro Systems
- Siemens Communications Systems
- Emulex
- NCR
- Xebec Systems

FEE The registration fee of \$995.00 for the 3 day SCSI Forum covers attendance at all scheduled sessions, a Delegate Information Binder containing the Speakers' presentations, the SCSI Specification, the Common Command Set Specification, and other material, a Welcome Reception, 3 Luncheons, the Exhibitors Reception which includes Cocktails and a Buffet Dinner, 3 Continental Breakfasts, a Wine Tasting Social Event, refreshments during breaks, gratuities and taxes.

ATTENDANCE Attendance is limited to preserve an appropriate atmosphere within which to learn and interact with other Delegates. It is therefore recommended that your registration form and payment be mailed early.

CANCELLATIONS Registration fees are refundable, subject to a 10% service charge, if cancellation occurs before April 14. Substitutions may be made at any time at no charge. Cancellations and substitutions must be in writing.

HOTEL ACCOMMODATIONS A block of rooms has been set aside for SCSI Forum Delegates at the Sunnyvale Hilton (408) 738-4888.

CONFIRMATION Shortly after registration, Delegates will receive a confirmation kit by mail containing conference registration confirmation, a map, receipt and general information.

Please register me for the SCSI Forum to be held at the Sunnyvale Hilton on May 5 - 8, 1986. Enclosed is my \$995 registration fee. Please print the following information as you want it to appear on your name tag and the list of delegates.

NAME _____

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SCSI Forum registrations cannot be accepted unless accompanied by full payment. Please make checks payable to SCSI Forum and mail to:

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CIRCLE NO. 68 ON INQUIRY CARD

NEW PRODUCTS

SYSTEMS

Megan Nields, Assistant Editor



System offers IBM compatibility

- DEC VT220 protocol
- 16 asynchronous hosts
- 19.2K to 64K bps

The 6500 Multifunction Communications System allows information stored in different computers to be accessed simultaneously from a single IBM 3270-compatible terminal. Comprised of modular controllers, terminals, personal computers and printers, the unit can cluster up to 32 devices connecting directly to multiple host computers with synchronous or asynchronous protocols. The system's 6544 cluster controller provides support for three 3270-compatible remote host computers, eight or 16 asynchronous hosts and/or display terminals and X.25/SNA packet network interfaces. Display terminals and printers are attached to the controller via twisted-pair wiring or coaxial cable. It supports transmission rates to 19.2K bps synchronously and up to 64K bps asynchronously. \$41,020 to \$58,620. **AT&T Information Systems**, 100 S. Parkway, Morristown, N.J. 07960. (201) 898-8000.

Circle 300

System incorporates voice/data workstation

- 3½-inch disk drive
- Built-in modem
- TTY, DEC emulation

An office-automation system with three models integrates information and data processing with voice/data commu-

nication. Geared toward OEMs, the system includes electronic mail that handles voice messages and files with voice annotation. The basic workstation contains a microcomputer with word-processing, spreadsheet, database, graphics and communications software; a video display and keyboard; a 3½-inch, 720K-byte flexible disk drive and a modem. It provides interfaces for a Winchester drive, a printer and a telephone headset.



Terminal emulations for TTY, DEC VT100 and IBM-3270 are included in the software. The unit can be hooked to a mainframe computer and is available in three models, and in OEM-quantity prices. \$4,000, The Executive; \$5,000, The Professional and The Secretary. **In-system Inc.**, 450 N. Lakemont, Winter Park, Fla. 32792, (305) 671-2057.

Circle 301

System employs UNIX engine

- 16M-byte memory
- 32-bit system
- DEC compatible

A 32-bit computer system operating under UNIX System V, the Python/32B combines CPU, memory, a multiplexer and mass-storage/backup device controllers. The unit is plug-compatible with the DEC LSI-11 Q-bus and supports a variety of Q-bus peripherals. It provides support for 64 users with up to 16M bytes of memory and 100M bytes of streaming-tape backup. Block mode facility handles high-speed data transfers between system components. The computer uses a National Semiconductor NS32032 microprocessor. Features include dual-address space capabilities and a slave floating-point processor that performs 32- and 64-bit operations in less than 12 µseconds. \$9,050 OEM quantities. **General Robotics Corp.**, 57 N. Main St., Hartford, Wis. 53027, (414) 673-6800.

Circle 302



Multuser computer supports eight users

- 500K-byte disk drive
- 8-MHz 68000 CPU
- 512K-byte memory

The 680/30-25 multuser business system supports up to eight users. The unit is equipped with an 8-MHz MC68000 CPU and 512K bytes of internal memory, expandable to 768K bytes. UNIX, RM/COS and Pick operating systems are provided, as well as a 500K-byte, IBM-compatible, 5¼-inch, flexible disk drive. A nine-slot Multibus chassis allows system expansion with controllers and interface cards. Two parallel printers with speeds of 600 lpm can be supported. \$5,995. **CIE Systems Inc.**, 2515 McCabe Way, Irvine, Calif. 92713-6579, (714) 660-1800.

Circle 303

DISK/TAPE

Tape drives offer multiple backup modes

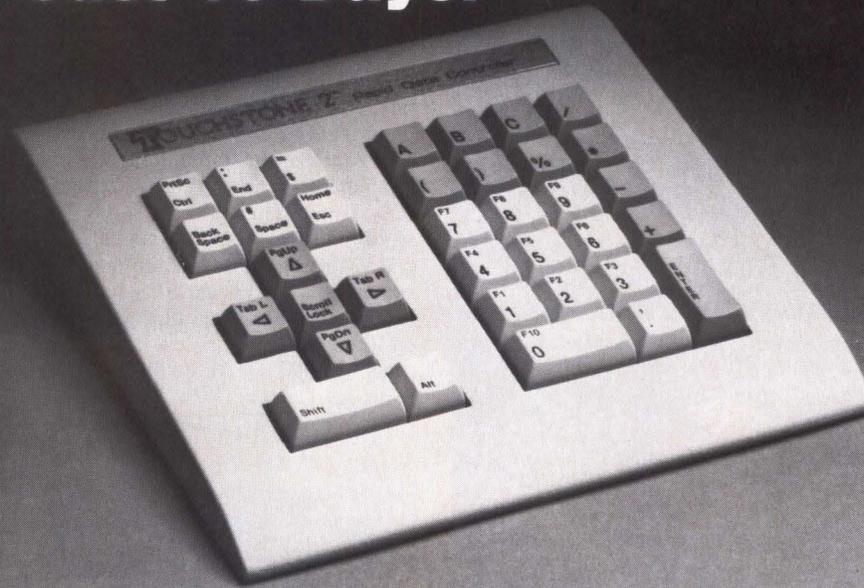
- 20M-byte storage
- QIC-02 interface
- IBM PC-compatible

Offering 20M bytes of half-height, streaming digital cassette tape backup and restore capability, the models 3120

internal and 3220 external tape drives run under IBM DOS 2.0, 2.1, 3.0 and 3.1 operating systems. Proprietary multiwindow software, operating with the drives, provides user function selection, a mouse-like input, menu-driven commands and an intelligent command line editor. Backup and restore options are implemented via menu-driven or batch modes. Image backup

features full restoration in the full image or file by file. A record of the last 10 tape/restore operations is displayed on the screen. The file-by-file backup or restoration is executed by directory or subdirectory, time, date and last modified files, or by file appending and exclusion. This includes readback verification and consecutive read/write without rewinding. Features include parameter edits, which allow entries to be edited without retyping and a DOS toggle, which permits DOS commands, or lets other applications run without terminating the proprietary program. The drives transfer data at 86.3K bytes per second at 90 ips, streaming mode. In 4.3 minutes, 60M bytes of data can be transferred. The standard interface is QIC-02. \$995, model 3120; \$1,145, model 3220. **Genoa Systems Corp.**, 73 E. Trimble Road, San Jose, Calif. 95131, (408) 945-9720.

Circle 304

Custom Keypads in Just 10 Days!**Touchstone Keypads**

The choice of thousands of serious PC users, the TOUCHSTONE 2 keypad is the premier auxiliary keypad for the IBM PC, XT, AT and many compatibles. Its solid construction, careful design and software transparency make it well worth its \$200.00 retail price.

8-inch Square Footprint

The compact design of the Touchstone keypad makes it ideal for applications where workspace is limited. However, this size makes it impossible to include every key, so we did the next best thing. We designed it for quick and economical reconfiguration.

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Specialized applications of the Touchstone keypad are unlimited: Public access systems, control systems, point-of-sale; wherever you need controlled access, simplified entry, space savings, or other custom features.

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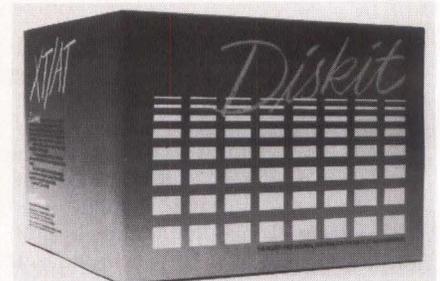
TOUCHSTONE
TECHNOLOGY INC.
955 Buffalo Road
Rochester, NY 14624

Disk drives offer IBM compatibility

- 10M to 20M bytes
- 28-msec to 85-msec access
- Upgrade policy

For use in PC systems, Diskit is a line of IBM-compatible internal disk drives, ranging from 10M to 20M bytes of formatted capacity for IBM PC/XT, PC/AT and compatibles. The XT models include a controller-interface card; the AT models connect to PC/AT controller cards. The disks have an average access time of 28 msec to 85 msec and from two to 15 read/write heads. An upgrade policy allows users to trade to a higher capacity as storage requirements increase. \$1,595 to \$8,995, PC/AT Diskit; \$1,495 to \$9,595, PC/XT Diskit. **IDEAssociates Inc.**, 35 Dunham Road, Billerica, Mass. 01821, (617) 663-6878.

Circle 305

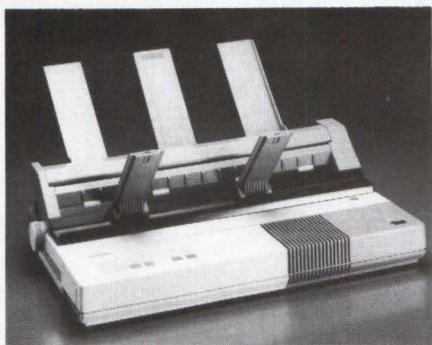


Laser printer runs in three modes

- 12 ppm
- 300 by 300 dpi
- Forms memory

Serving word-processing, correspondence-printing and other high-speed applications, the Opus 1 laser printer runs at 12 ppm. Workload capacity is 20,000 pages per month. Generating 300-by-300-dpi resolution, the unit operates in three modes. In set-up mode, software creates custom fonts by changing the height, width or grade slant on one of four stored, basic fonts. By switching to type mode, any one of four stored forms can be recalled and merged with printed text. In type mode, the unit emulates Qume or Diablo daisywheel printers, interfacing with both serial and parallel interfaces. In draw mode, business line drawings are completed in eight directions with five different line widths and bar graphics. The printer's stack capacity is 250 sheets. \$9,500. **Facit Inc.**, 9 Executive Drive, Merrimack, N.H. 03054, (603) 424-8000.

Circle 306



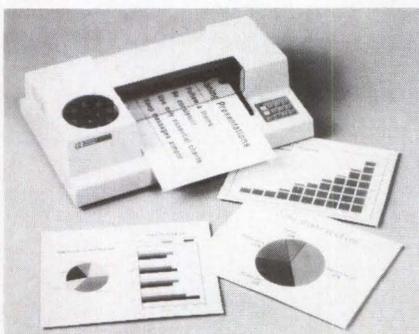
Dot-matrix printer operates in two speeds

- 180 cps, draft
- 45 cps, NLQ
- 3K bytes

Suiting office-automation and engineering-workstation systems, the M-1509 dot-matrix printer runs at 180 cps in draft mode and 45 cps in near-letter-quality (NLQ) mode. Software compatibility includes switch-

selectability between IBM PC and Epson FX-100+ protocols and character sets. Both Centronics and RS232C interfaces are standard. Character sets accommodate multilanguage, scientific and mathematical printing. Graphics can be produced from seven bit-image modes. The unit provides a 3K-byte input data buffer. Accommodating 5- to 16-inch, fanfold paper and 4- to 16½-inch cut sheets, the printer produces an original and two copies. \$499. **Brother International Corp.**, 8 Corporate Place, Piscataway, N.J. 08854, (201) 981-0300.

Circle 307



Color plotter supports 100 software packages

- Eight pens
- 0.001-inch resolution
- 15.7 ips

Combined with a personal computer and graphics software, the ColorPro eight-pen plotter serves business applications. For reports and presentations, the plotter produces multicolor pie, bar and line graphs and text charts on 8½-by-11-inch overhead-transparency film and paper. Achieving a resolution of 0.001 inch, the unit plots solid areas of color and continuous lines at 15.7 ips. It supports over 100 software packages, ranging from integrated packages to dedicated graphics programs. Its fiber-tip pens are available in two widths and 10 colors for paper. Either the RS232C or the IEEE-488 bus comes with the system. \$1,295. **Hewlett-Packard Co.**, 1820 Embarcadero Road, Palo Alto, Calif. 94303. Telephone locally.

Circle 308



Laser printer produces 8 ppm

- 300 dpi
- 55-dB(a) noise level
- Four typefaces

The NCR 6416 desktop laser printer combines laser-beam scanning with electrophotography to produce 8 letter-quality ppm at 300 dpi. The unit interfaces with a personal computer or small business machine through a serial or parallel interface and operates in daisywheel-compatible or ISO mode. It prints vertically and horizontally, running under PC-DOS, MS-DOS or CP/M operating systems. Features include a 55-dB(a) noise level, one paper cassette, four typefaces and an EP cartridge containing toner, drum and cleanser. \$3,220. **NCR Corp.**, Personal Computer Division, PCD-1, Main and Caldwell streets, Dayton, Ohio 45479, (513) 445-5324.

Circle 309

Daisywheel printer runs 25 cps

- 57 dB(a)
- 96 characters
- Serial, parallel interfaces

Printing 25 cps from a 96-character printwheel, the Fortis DX-25 daisywheel printer has a 57-dB(a) noise level and serial and parallel interfaces. The unit prints bidirectionally and emulates the Diablo 630. It has a printing pitch of 10, 12 or 15 cpi with proportional spacing. A front control panel allows character and line pitch access and top of form, line feed and select functions. The multistrike ribbon has a life expectancy of 1 million characters. Features include a 7K-byte buffer and a copy capacity of five, including the original. \$650. **Dynax Inc.**, 6070 Rickenbacker Road, Commerce, Calif. 90040, (213) 727-1227.

Circle 310

The Hewlett-Packard A-Series Automators:
a rugged family of real-time computers with
total software compatibility.

Available as boards, boxes,
systems or microsystems.

256K RAM error-correcting memory.
Up to 24 MB. So flexible, it can manage
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memory-based controller.

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(DMA per channel).

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program support.

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architecture, with cache,
optimized for real-time
performance.

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A profitable Sales Support Program. Direct selling, if you need us. Sales aids, if you don't.

HP's program for system designers, software suppliers and resellers includes discounts from 5 to 39%.

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Display terminal suits ASCII

- ANSI X3.64-compatible
- 80 or 132 columns
- 400 scan lines

Geared toward the ASCII marketplace, the Falco 500 video display terminal provides ANSI X3.64-compatibility and emulates DEC, TeleVideo, Wyse,

Hazeltine and ADDS products. The unit comes equipped with a 14-inch screen; white, green or amber display; 400 scan lines with 25-kHz horizontal output and a 10-inch-by-16-inch dot-matrix character cell. Windowing software provides immediate access of up to six terminals, allowing up to four pages of text to be stored or viewed concurrently in optional screen displays of 24, 25 or 38 lines by 80 or 132 columns. Selectable RS232C and

RS422 interfaces configure automatically to identify the chosen protocol. \$795. **Falco Data Products Inc.**, 1294 Hammerwood Ave., Sunnyvale, Calif. 94089, (408) 745-7123.

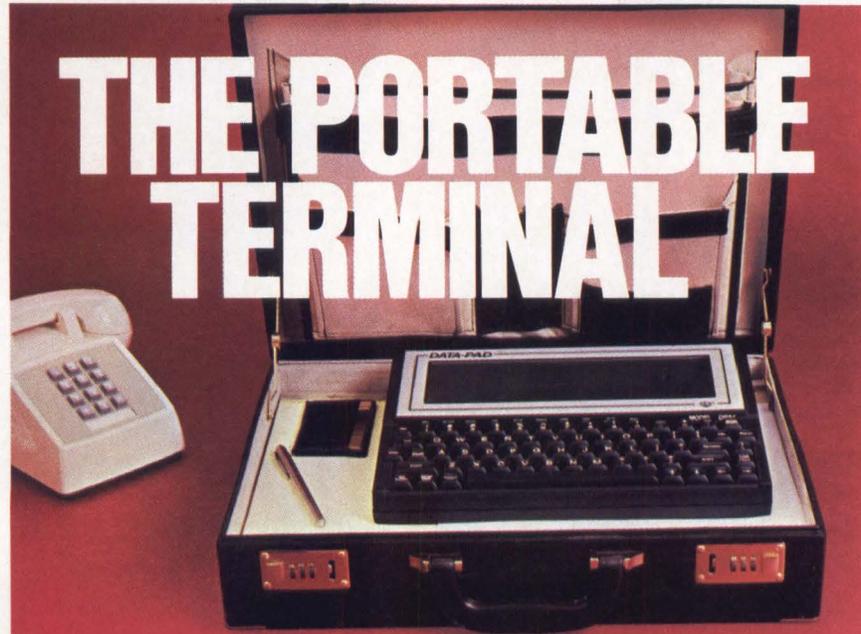
Circle 311

Monitor serves CAD/CAM

- IBM-compatible
- 640 by 480 pixels
- 13-inch screen

An RGB analog color monitor for CAD/CAM applications, the CM-1376 is used with the IBM Professional Graphics Adaptor Card or compatibles and is IBM Model 5175-compatible. The unit is targeted for OEMs and value-added resellers and has a horizontal scan frequency of 30.48 kHz and a vertical scan frequency of 50/60 Hz. Features include a 13-inch screen, 4,096-color palette and a resolution of 640 by 480 pixels. \$999. **Tatung Co. of America**, 2850 El Presidio St., Long Beach, Calif. 90810. (213) 637-2105.

Circle 312

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WEIGHT: 3.25 lbs.

COMMUNICATIONS: RS-232-C, 50 to 19.2 k.Baud, 300 Baud acoustic built-in modem (optional), compatible with most external modems.

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EMULATIONS: (keyboard selectable) DEC VT100/VT52*, Televideo* TV910, Lear Siegler ADM 34/5, Hazeltine 1400/10, ADDS 20/25.

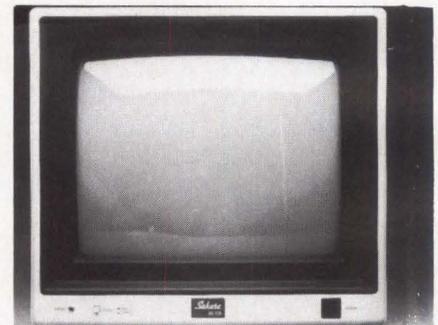
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- 0.42- mm dot pitch
- 80 columns by 25 lines
- 13-inch screen

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Circle 313

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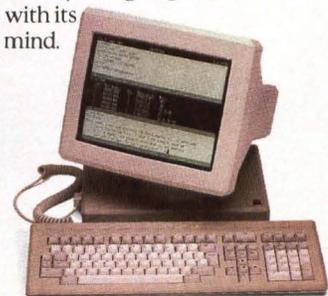
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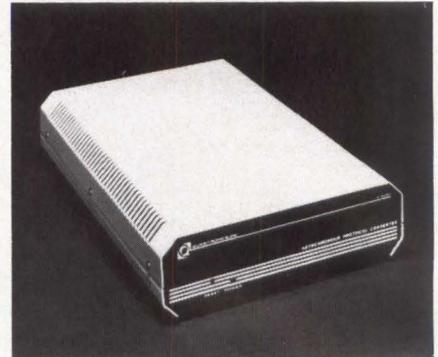
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Converter provides application firmware

- 50- to 19.2K-baud rate
- 8K-byte buffer
- Full-, half-duplex ports

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Circle 314

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- 300, 1,200 bps
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- 8- to 11-bit words

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Circle 315

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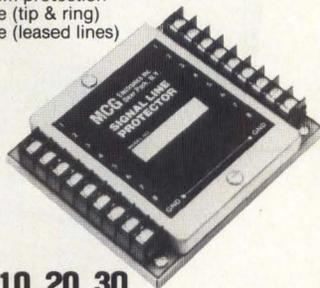
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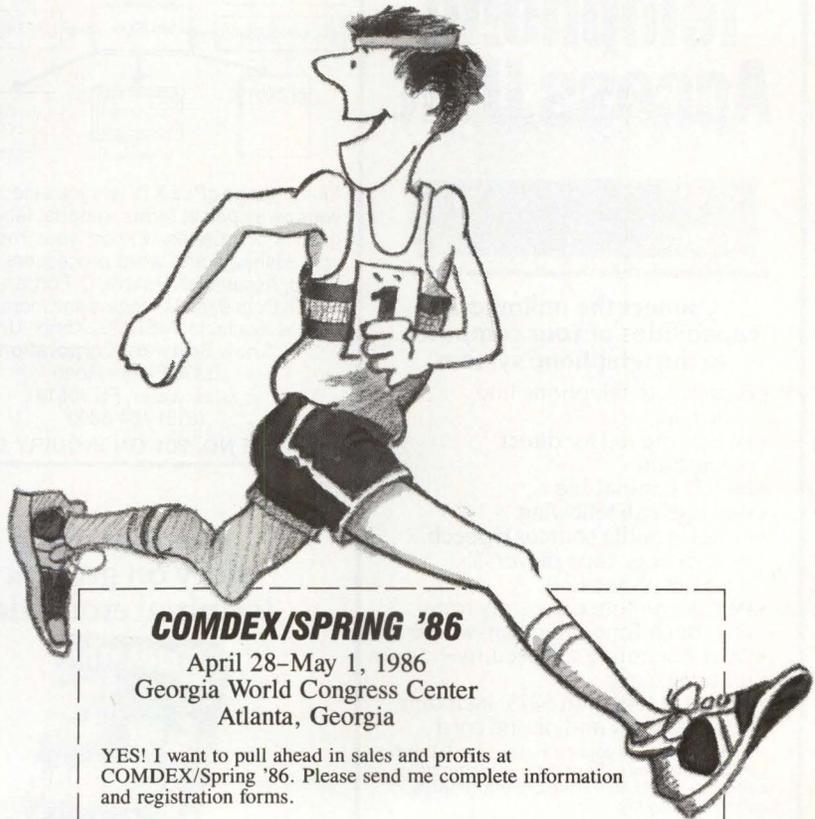


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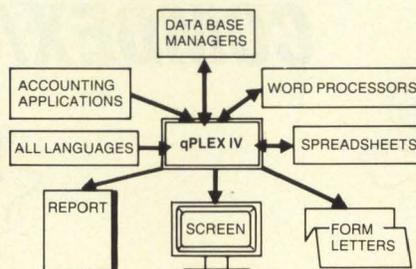
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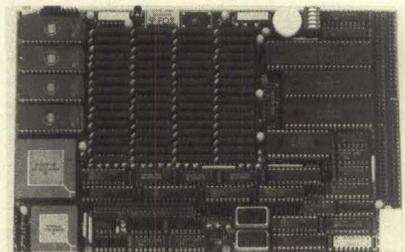


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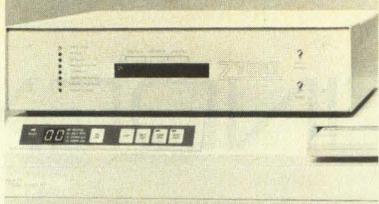
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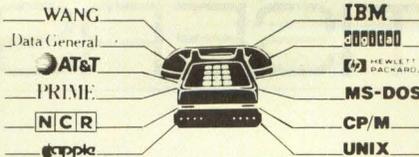
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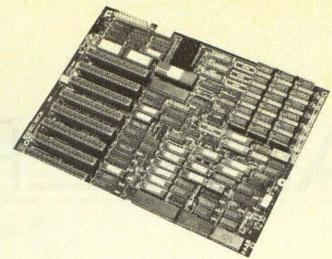
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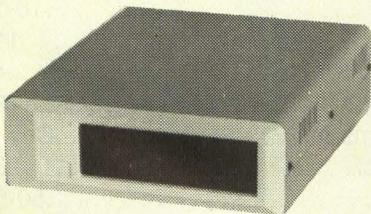


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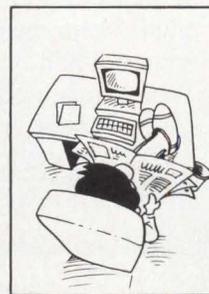
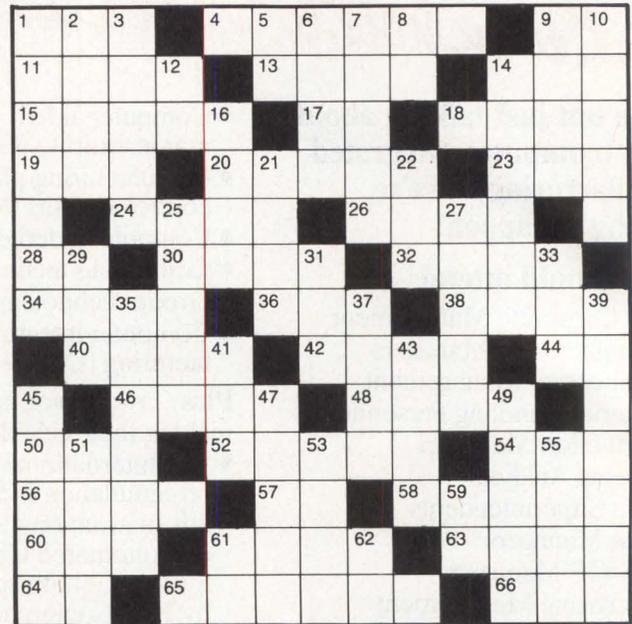
A C R O S S

- 1 Calculator-style key layout
- 4 Fault-tolerant computer vendor
- 9 When it is
- 11 European deer (Pl.)
- 13 Poker program for Apple II
- 14 Compass direction of Los Angeles from San Francisco
- 15 U.S semiconductor manufacturer
- 17 Sodium symbol
- 18 Industry-standard operating system
- 19 Born
- 20 String turns off highlighting
- 23 Monitor
- 24 Level (building, e.g.) to ground
- 26 Educational robot
- 28 Popular sci-fi movie
- 30 Companion
- 32 Not completely cooked
- 34 Speed up drive
- 36 Unit of data handled by computer
- 38 X's
- 40 French computer maker
- 44 New Atari machine
- 46 money

- 48 Process that starts computer
- 50 The night before
- 52 This software language ties PCs to mainframes
- 54 Yale
- 56 Speed of data transfer
- 57 Sure of success
- 58 Printer vender
- 60 West German city on the Danube
- 61 Former Russian emperor
- 63 For men only
- 64 Germanium (Chem.)
- 65 "Luggable" computer vendor
- 66 Students for a Democratic Society (Abb.)

D O W N

- 1 Hard-copy peripheral
- 2 Desirable computer condition (2 words)
- 3 Discourage
- 5 Electrical current
- 6 One-billionth of a second
- 7 Printer-quality type
- 8 Prefix meaning "early"
- 9 Province of Saudi Arabia on Red Sea
- 10 Original words
- 12 Compass direction
- 14 Computer vendor
- 16 Outdated Apple computer
- 21 Part of speech
- 22 Statement
- 25 Computer vendor
- 27 Combining form meaning "suffering"
- 29 Function
- 31 Statement
- 33 Abstract being
- 35 Institution exhibiting computer history
- 37 CRT
- 39 Series of bytes
- 41 The sheltered side
- 43 Singular
- 45 Remove mistakes from computer program
- 47 Letter-quality print wheel
- 49 Dry runs
- 51 Latin "farewell"
- 53 Easy task
- 55 Implement software
- 59 Afterthought
- 61 British child's "thank you"
- 62 Railroad (Abb.)

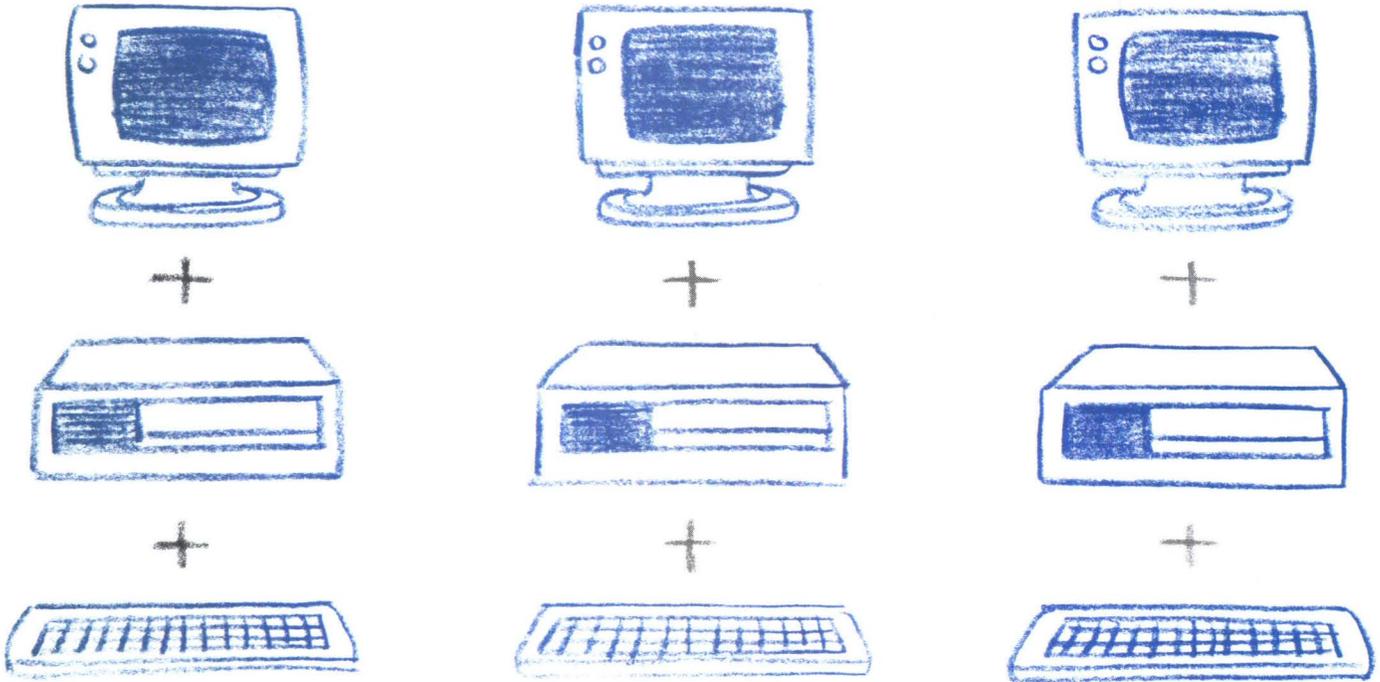


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