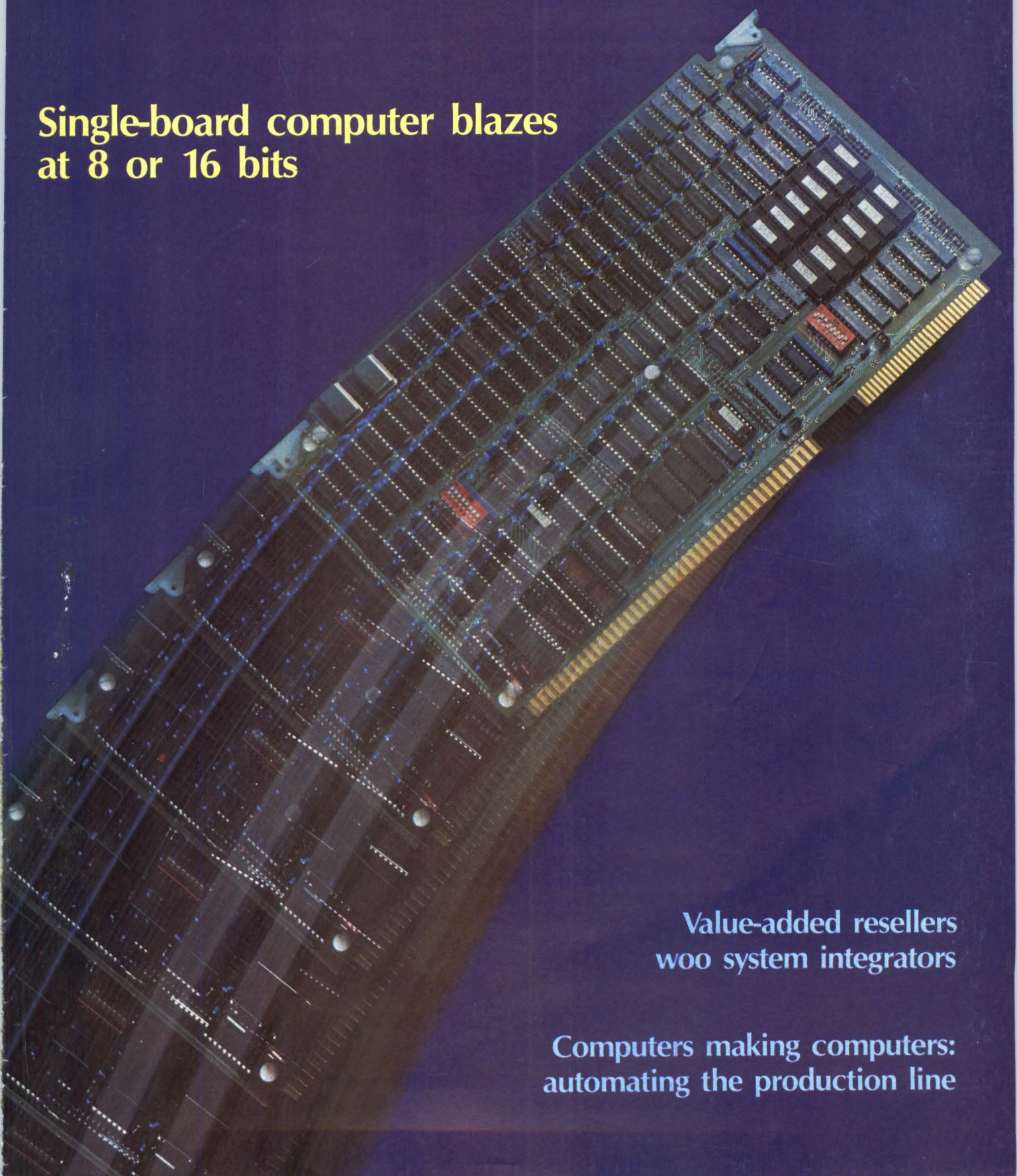


# Mini-Micro Systems

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AUGUST 1984

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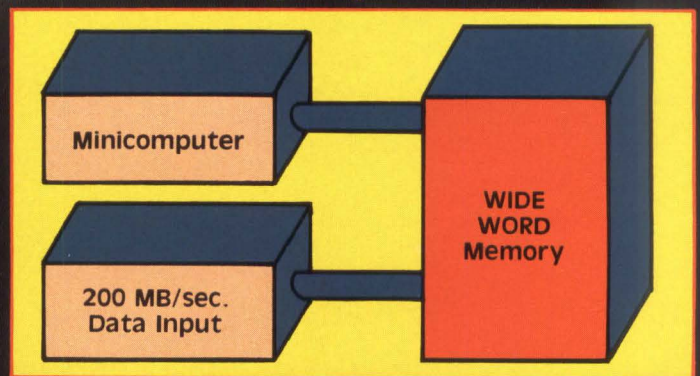
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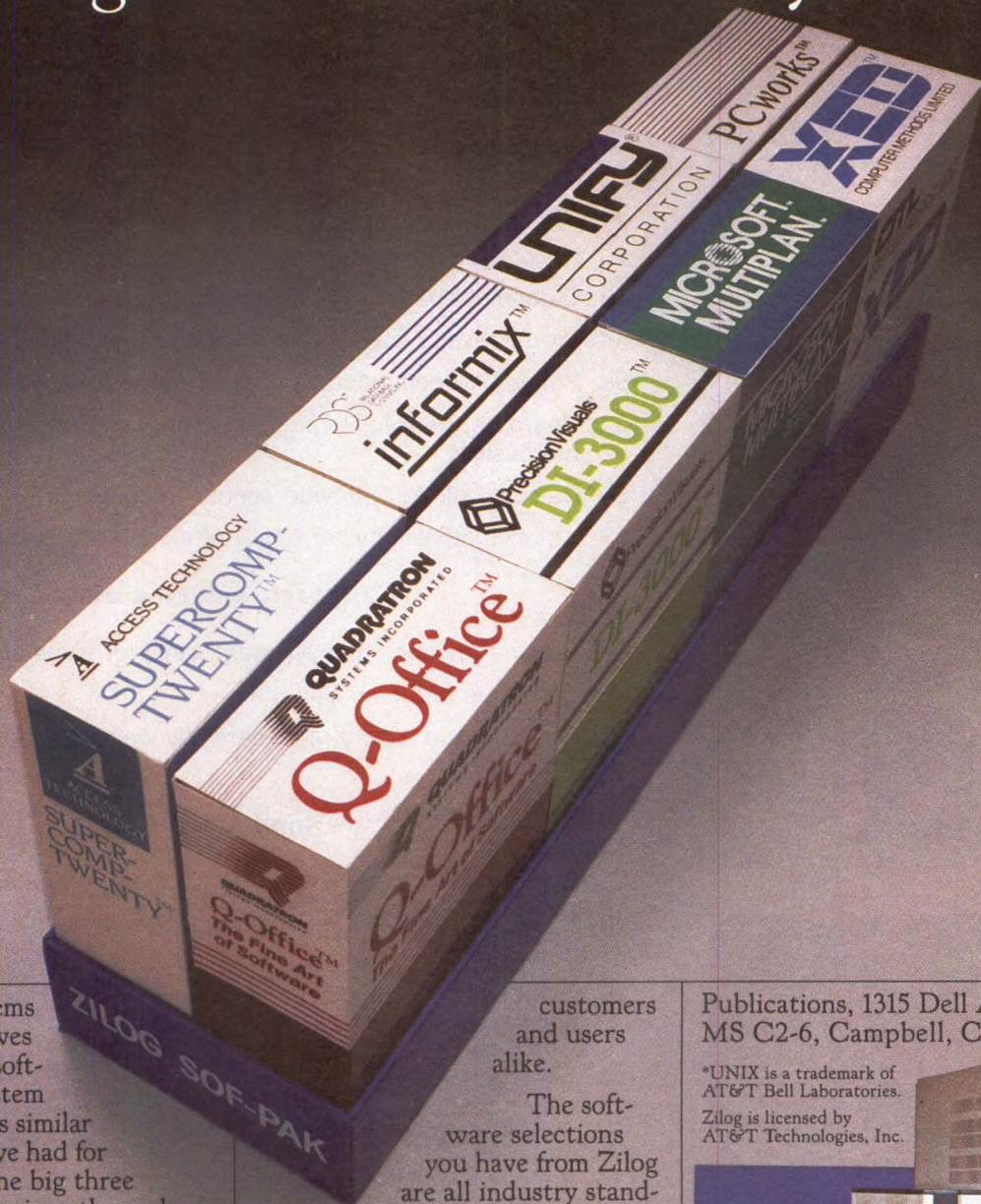


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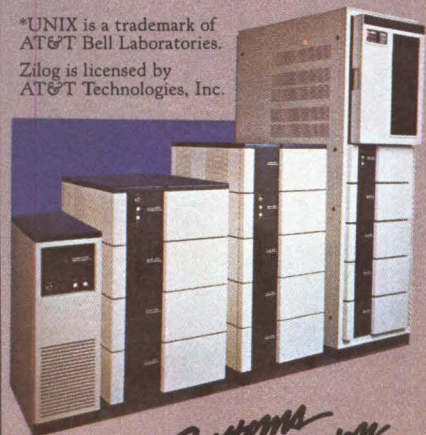
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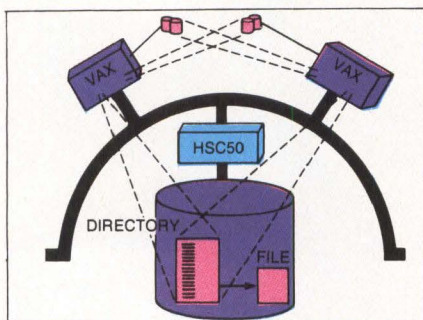
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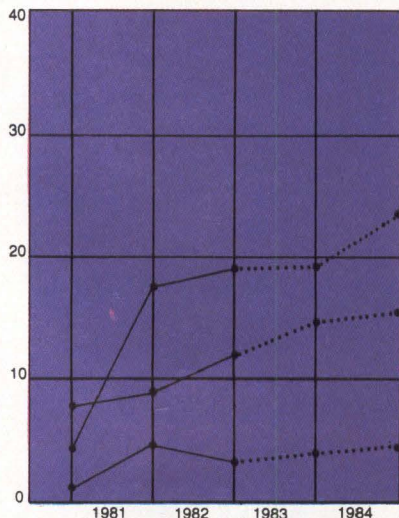
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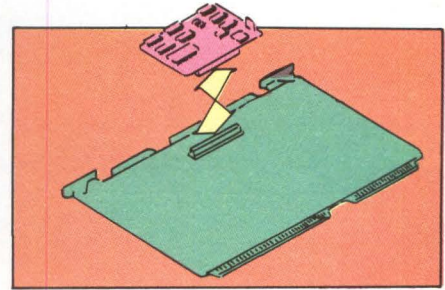
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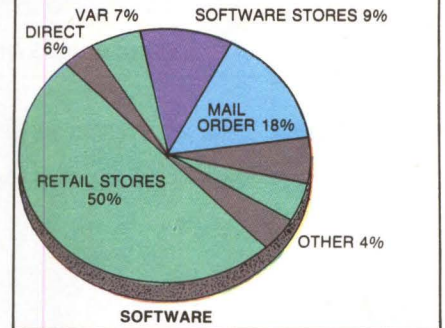
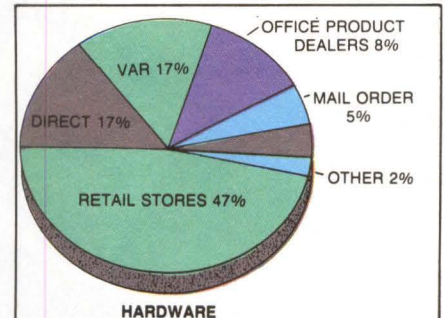


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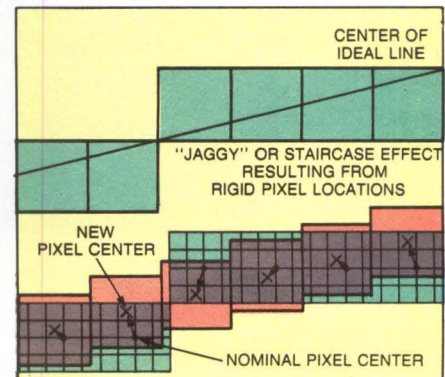
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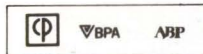
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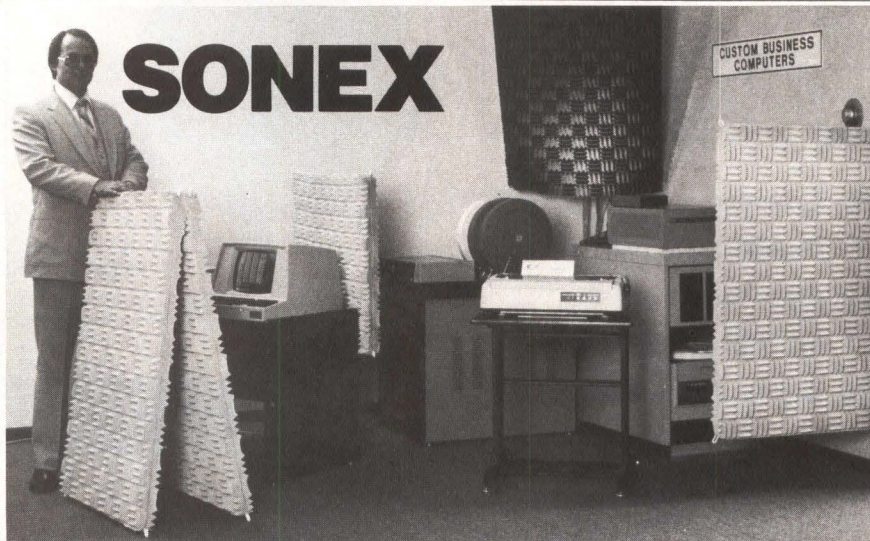
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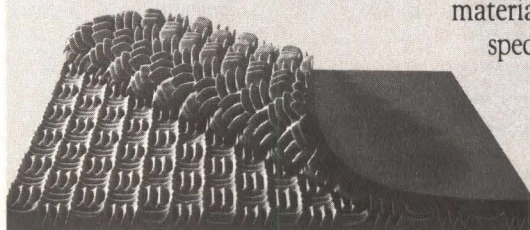
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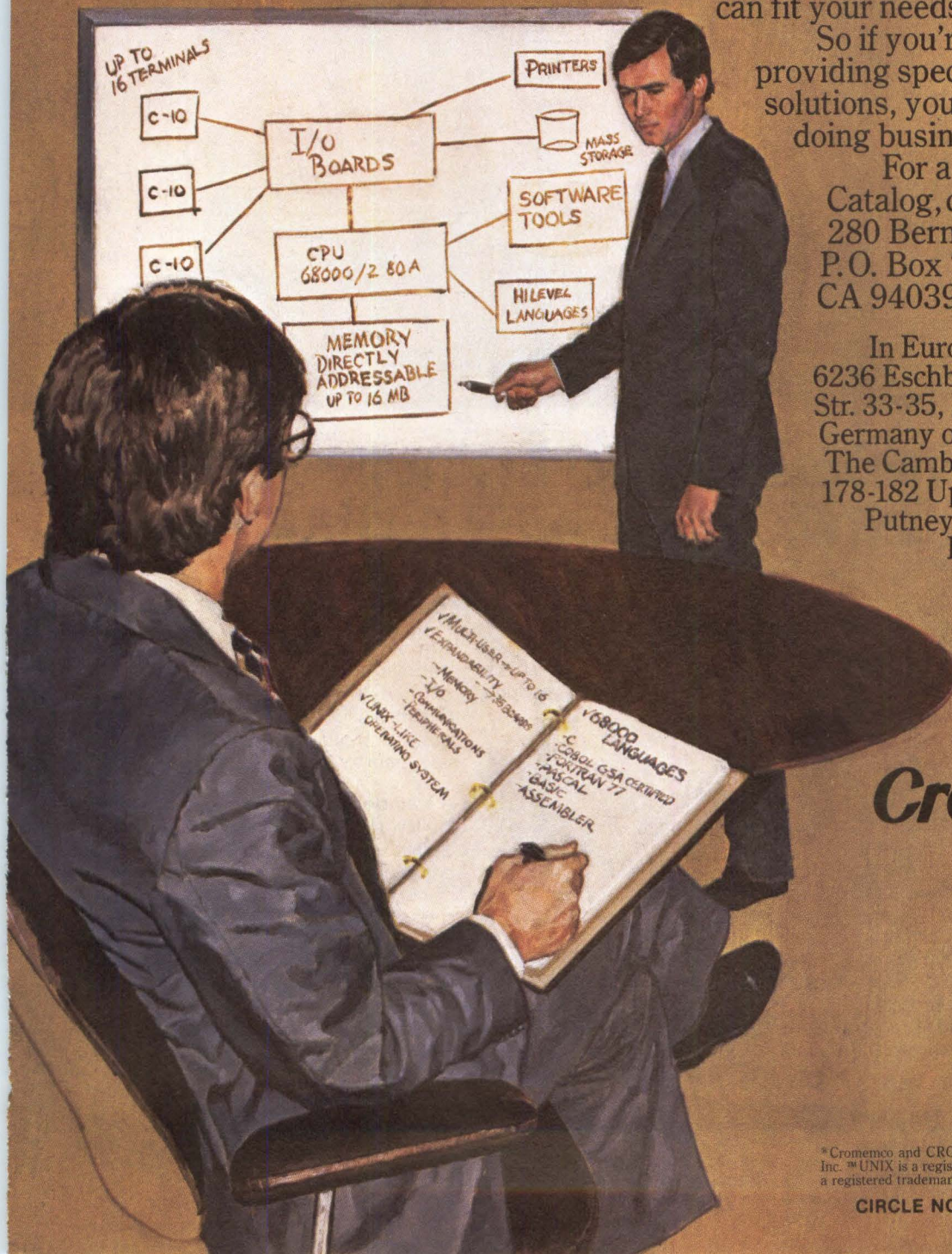
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## Personal computers: boom and bane

The recently published report, "Trends in Computing Systems and Services for the 80's," produced by International Data Corp. (IDC), a Framingham, Mass.-based market research company, for *Fortune* magazine, discussed the expected changes and challenges of personal computers, as well as minicomputers and mainframes. The report essentially states that during 1984 and 1985 the movement of innovative computer technologies into commercially available products will greatly accelerate.

In fact, the sale and shipment numbers boggle one's mind. For example, IDC claims that worldwide computer shipments for 1983 exceeded \$42 billion, and that the installed base is now worth more than \$200 billion. But this decade, says IDC, belongs particularly to the personal computer. By 1985, the dollar value of personal computer shipments in the United States, projected at \$12 to \$13 billion, will exceed those of mainframes. By 1987, personal computers will be king of the hill, with U.S. shipments achieving a predicted value of \$19 to \$20 billion.

Even more optimistic is Dr. Egil Juliussen of Future Computing Inc., a market research company located in Richardson, Texas. In his state-of-the-market, personal report (MMS, June 1984, Page 167), Dr. Juliussen prophesied that U.S. revenues for office personal computers will reach \$13.1 billion in 1985 and \$20.7 billion in 1987. Moreover, he states that the U.S. software market for office personal computers will expand from \$3.2 billion in 1985 to \$5.6 billion in 1987.

But what do all these numbers mean to system integrators? On the positive side, a flood of low-cost, high-performance personal computers should inundate the marketplace. On the negative side, though, system integrators will be paddling furiously against the tide to gain adequate product knowledge, to achieve full product utilization and to determine proper product application.

In fact, the IDC report predicts that the decade's outstanding trend is that all computer systems will eventually be integrated. First, the systems will be joined in-house and, second, to the outside world. Therefore, the trend implications point to integrating personal computers with mainframe operations and with existing microcomputer and minicomputer systems.

Consequently, the need for new computer product and system information becomes paramount. And most system integrators will rely on computer trade magazines, trade shows and seminars to meet their immediate information needs. For our part, *Mini-Micro Systems* serves you with the latest computer, peripheral and software product, industry and technology news, issues and events—in depth and in perspective. Let us know how we're doing.

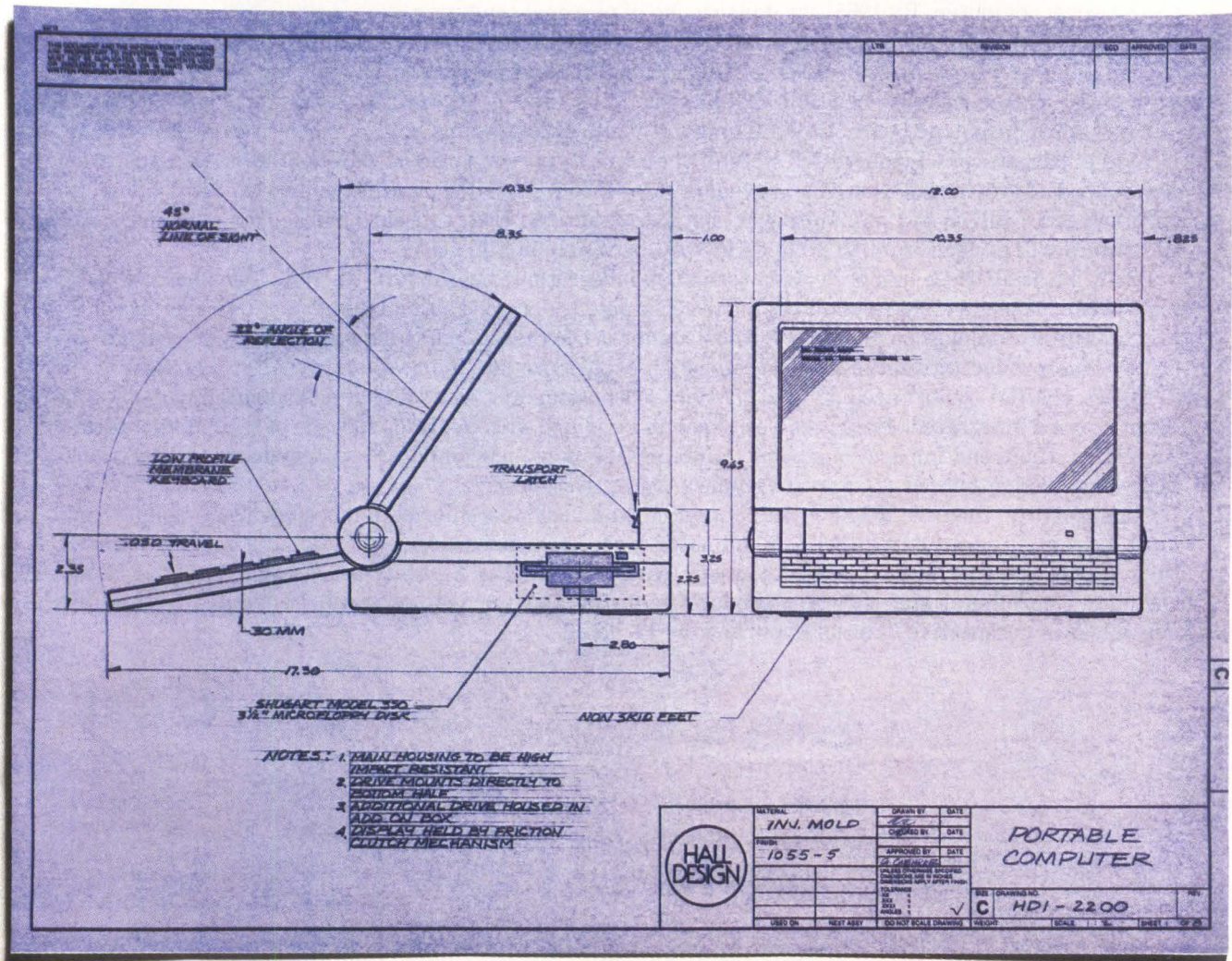


*George V. Kotelly*

George Kotelly  
Editor-in-Chief



# IF YOUR BUSINESS IS SHRINKING, SHUGART CAN HELP.





These days, computer designers everywhere face a problem of massive proportions: How do you cram a desktop computer into a briefcase?

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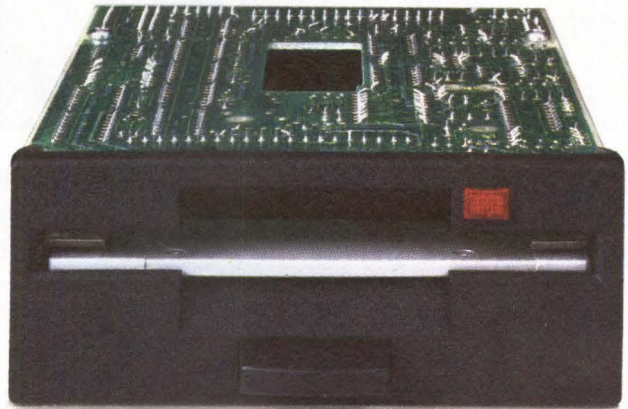
Shugart drives are so reliable, you can count on an MTBF of 10,000 power on hours. One reason we're projecting delivery of over 100,000 microfloppy drives this year.

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What more could a shrinking

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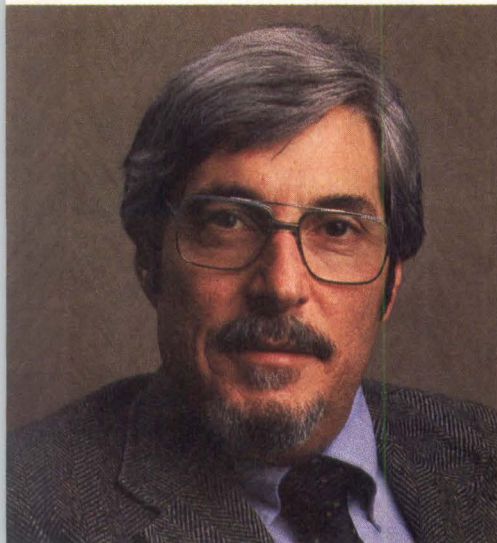
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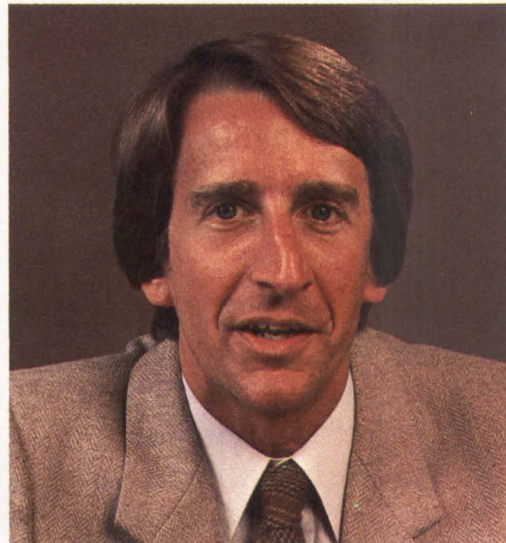


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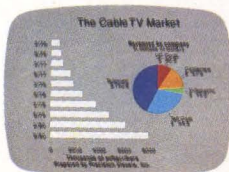
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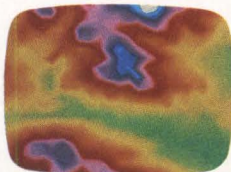
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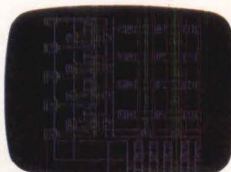
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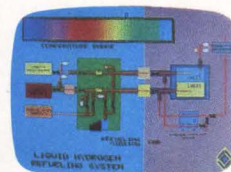
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# Letters

## CORPORATION LOSS

### To the editor:

I take exception to some of the information in the article "Bypassing Local Telephone Lines—a Growing Option for Data Communications" (MMS, February, Page 115). The information, ostensibly provided by Pacific Northwest Bell (PNB), claims that corporation stands to lose \$800,000 annually because of Tektronix's microwave system. However, Tektronix's calculations show that PNB's unrealized revenue would come to only a small fraction of the stated amount.

The report provided by PNB to the Federal Communications Commission (FCC) describes Tektronix's microwave system as having the potential to avert annual charges of \$800,000. Your article, stating that PNB "stands to lose \$800,000," is almost unequivocal in its implication that such a loss is a reality.

The extent to which the article suffered from misleading source data is unclear. What is clear, however, is that, in these days when regulatory matters are being decided in the political arena and common carriers submit carelessly researched information to public agencies, it is more important than ever that the media research more assiduously and probe a bit deeper to provide accurate and informative assessments.

**C.J. Thomas**  
Telecommunications Manager  
Tektronix Inc.  
Beaverton, Ore.

### Author's response:

The \$800,000 figure as related to revenue losses experienced by Pacific Northwest Bell due to Tektronix's private microwave system was obtained directly from the FCC's Third Report and Order in the Matter of MTS and WATS Market Structure, released Feb. 28, 1983, FCC 82-579 32607, Attachment 1, Page 5. The report was cited accurately in my article. This report is a public document and can be obtained through the FCC's Office of Public Affairs.

**Stephen J. Shaw**  
Washington Editor

## BROADBAND NETWORKS

### To the editor:

In reference to "Broadband Networks Prove Expensive for Interconnecting

Terminals" (MMS, March, Page 139): I have been reading *Mini-Micro Systems* for several years. This is the first time I have found myself upset at what would appear to be a report that uses a specific, narrow instance to extract a general truth.

First, uninformed readers would probably not realize that, if the only requirement of an application is to interconnect terminals to host processors, purchasers of a network would be wasting money if they even study a broadband solution. That being the case, twisted-pair wiring is certainly the answer unless the application requires thousands of terminals.

Second, I'm not sure why you indicated maximum system terminal capacity for WangNet before major renovation was only 192 additional terminals. Pre-planning cable plant installation would allow that many terminals on one 6-MHz channel. If the bandwidth is approximately 360 MHz, you could get approximately 60 times that number. Therefore, the number of terminals to be supported is limited only by customers' ingenuity in defining future requirements while engineering their cable plants.

By the way, I'm not a big fan of WangNet, but I do believe your reporting lacks some fact or you are biased.

**Peter E. Donohue**  
Montgomery, Ala

### Author's response:

Mr. Donohue's letter reflects a widespread problem in the field of area networks: the tendency to confuse technology with products. I will respond to certain points in his letter.

Wang Laboratories Inc.'s workstations are directly connected to the VS-100 host via a twin coaxial cable over which signals travel at approximately 2M bits per second. The only alternative to direct connection is to use the WangNet's peripheral attach band. Even then, the terminals and the host must still connect to the WangNet system via the twin coaxial cable. Twisted-pair wiring simply cannot be used.

Whether or not a broadband system is economical is precisely what the study was trying to determine. Wang had aggressively promoted the benefits of WangNet to the client in the study and had provided encouragingly low, although informal, estimates of the cost of installation. The parallel cost studies were run to put the question on an

objective basis. In an industry in which people often make broad, sweeping generalizations, reporting on practical experience is the only way to clear the air.

Mr. Donohue's statement concerning maximum system capacity does not quote the article correctly, much less correct an error. The basic facts are these:

- The peripheral attach band of WangNet has a capacity of 192 workstations, serviced through six sub-channels, each having a capacity of 32 workstations. If users need to support more than 192 devices (which typically means a second VS-100 computer in the system), they can do so only through a complex procedure that involves splitting the population of the terminals into two groups, each associated with one of the two computers, using RF diplexors. The two groups of terminals and their associated computers must be on physically separate sections of the coaxial cable. Overlapping and intercommunications are not possible between terminals in one group and the computer in the other group. In a diplexed configuration, both segregated terminal-computer populations use the same RF band.

- This restriction would not exist if Wang permitted users to configure the network with several independent peripheral attach bands, each assignable to a different sector of the RF spectrum. But, since Wang did not do this, the restriction must be abided.

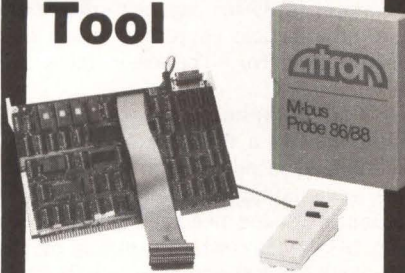
Wang could possibly release new features for WangNet that might remove some of these limitations, and users considering the system would most likely want the most current product information available. The study in the article was done in early 1983. Interested readers can consult the Wang brochure "WangNet Overview," dated August 1982, to verify our baseline.

Technologies and methodologies, like cabling methods, control schemes (CSMA/CS vs. token ring), topologies (rings, stars, buses) and transmission schemes (broadband, baseband, Manchester coding), do not provide service to users. They must be incorporated into workable products. Perhaps we should declare a moratorium on seminars and magazine articles about local-area-network technology and talk only about real products.

**Walter A. Levy**  
Edgewood Computer Associates Inc.



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CIRCLE NO. 12 ON INQUIRY CARD

## Letters

### ARETE SYSTEMS

To the editor:

I am writing to correct an article about Arete Systems Corp. (MMS, February 1984, Page 44).

Arete has chosen to occupy a high-performance (not low-end as mentioned in your article) niche with OEM systems ranging from \$52,600 (not \$15,000) to \$104,300 (not \$80,000).

Your article said: "As many as three 12.5-MHz 32-bit processors and a controller are contained in a memory-management unit with a capacity of 16M bytes." This sentence is confusing. The Arete 1000 supports up to four CPUs. The CPUs are 12.5-MHz 68000 microprocessors.

The Arete 1000 supports as many as 12 intelligent I/O controllers and a high-speed memory controller. The entire Arete 1000 supports 16M bytes of tightly coupled physical main memory. There is not a separate memory associated with each CPU.

The author missed the point of the Arete system architecture. Arete provides the computing and I/O capabilities of a superminicomputer using the advantages of inexpensive and reliable microprocessor components. Arete represents a major breakthrough in computer architecture. It is the first multithread, data-flow system that has been commercially produced. Until now, multithread machines have been found only in laboratories.

**John R. "Beau" Vrolyk  
President  
Arete Systems Corp.  
San Jose, Calif.**

### UNIQUELY UNIX

To the editor:

I thoroughly enjoyed the May 1984 issue of *Mini-Micro Systems*. As a UNIX operating system professional, I am gratified to see the expanding interest in this system. (UNIX was central in at least 30 ads and seven articles.)

I submit the following comments as a reader and not as a representative of Motorola Inc.

From the title of the article "Micro-soft makes XENIX compatible with UNIX System V" (MMS, May 1984, Page 93), the casual reader would conclude that this compatibility was a fait accompli. However, the first paragraph indicates that Logica UK Ltd. is merely investigating the technical issues in-

involved. Hence, compatibility with UNIX System V is not a current realization. I am sure Microsoft Corp. does not want potential customers to be confused about this.

In the same article, John Ulett of Microsoft notes that "porting the [System V] shared-memory feature to [non-VAX] processors poses problems" and that XENIX already provides another System V facility—record locking.

As part of the Motorola Microsystems team that ported the UNIX System V operating system to the MC68000 microprocessor under contract to AT&T Technologies Inc. (and without any subcontracting, despite rumors to the contrary), I believe I can speak with some authority on these statements. The port of the UNIX System V shared-memory feature to the MC68000, along with semaphores and message passing, was trivial. System V does not have record locking. I anticipate that AT&T will offer this in a future release. It is true that, in view of the current lack, many OEMs have added this enhancement.

On a separate topic, it appears de rigueur for computer industry writers to complain about IBM Corp.'s apparent inconsistencies in the UNIX market. "Version 7 on the Series/1, XENIX on the System 9000, System III on the PC. What is IBM's choice?" they cry. It seems to me the answer is, "the latest." The Version 7 release was the latest for the Series/1 port, called CPIX, and for Microsoft's XENIX port to the System 9000. The System III release was the latest when Interactive Systems Corp. began its port to the PC.

**Fred Christiansen  
Staff Software Engineer  
Motorola Microsystems  
Tempe, Ariz.**

### NEXT MONTH IN MMS

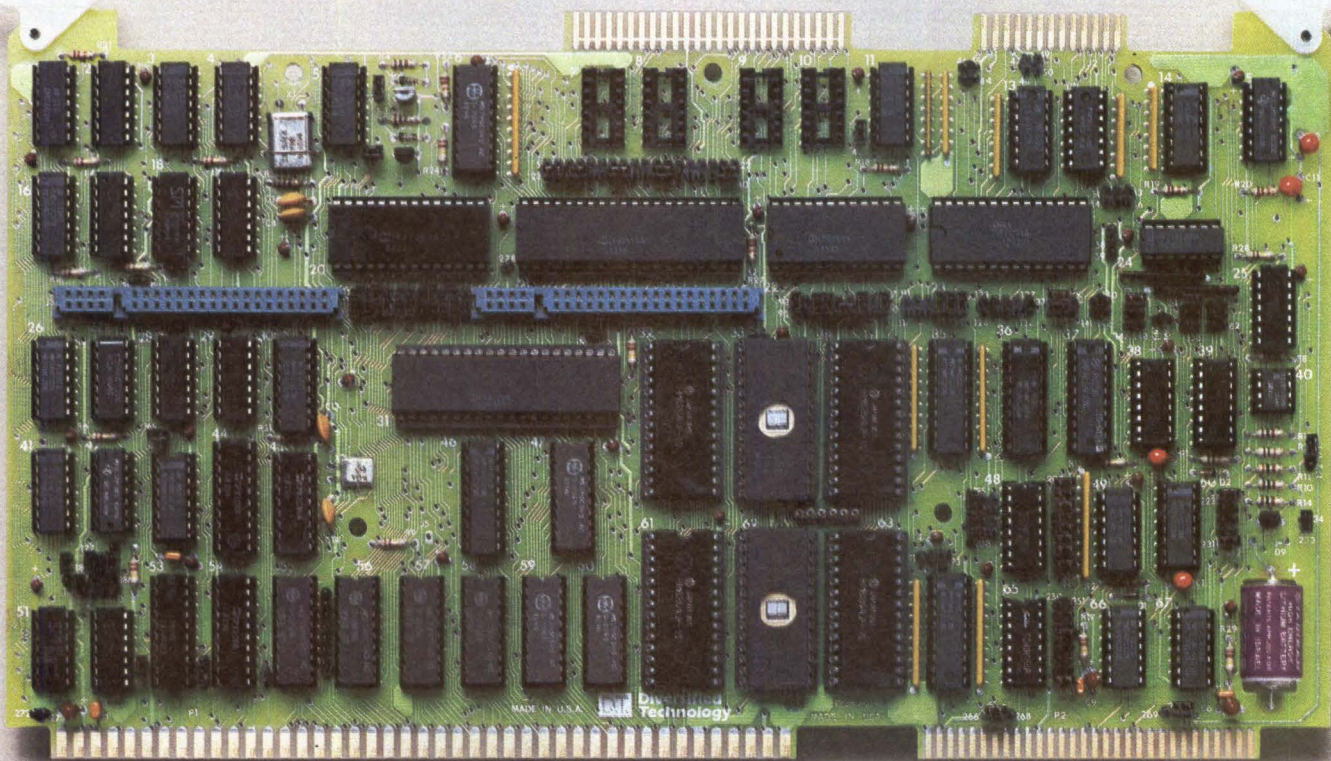
Line printers get the feature spotlight in the September issue of *Mini-Micro Systems*. Manufacturers of traditional impact line printers are foregoing technological innovations and, instead, are focusing on lower prices and higher reliability.

A comprehensive survey chart of over 130 products and 25 companies is included with the article.



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# Breakpoints

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## **DATA GENERAL TO BROADEN PRODUCT SCOPE WITH LAP-TOP COMPUTER**

Taking the road less traveled by other minicomputer makers, Data General Corp., Westboro, Mass. plans to introduce a lap-top portable computer in about five months, sources say. The 7-pound model, which was shown privately at the recent National Computer Conference, will be built by the company's Nippon Data General subsidiary in Japan. It is said to be fully IBM PC-compatible and will run the MS-DOS operating system. The unit includes dual 3½-inch microfloppy drives, a 24 line by 80 character display with graphics capability, 256K bytes minimum memory, and an Intel Corp. 8088 processor. A hard disk may also be offered. DG is expected to sell the product through retail stores such as Businessland.—L. Valigra

## **U.S. CONGRESS TO ACT ON COMPUTER CRIME LEGISLATION**

The U.S. Congress is finally about to act on federal computer crime legislation. Stirred from years of inactivity by the disclosure of a recent TRW Inc. credit-database break-in, the House Judiciary Committee has approved the Counterfeit Access Device and Computer Fraud and Abuse Act. Similar to H.R. 1092 (MMS, July, Page 264) but containing stronger penalties, H.R. 5616 would permit fines of up to \$100,000 and up to 20 years' imprisonment for anyone who knowingly accesses without authorization a computer used in interstate or foreign commerce and gains \$5,000 or more from the break-in over a one-year period. Although it's expected to pass in the House, the bill would have to be reconciled in conference committee with a similar credit card abuse bill already passed by the Senate. That bill doesn't contain computer crime provisions.—J. Victor

## **SERVO WRITER REPLACES UNITS THREE TIMES ITS PRICE**

A low-priced servo writer from Pioneer Research Inc., Santa Monica, Calif., may solve both the availability and price problems of support tools for disk drive manufacturers. The model PR1000 Servowriter, at less than \$60,000, is designed to replace units three times its price and six times its size. It manages hard disks from 3½ inches to 14 inches. The company claims the unit is a universal device capable of writing servo information on as many as four drives at a time, with no restrictions on the servo formats. The user can either design formats for downloading from a microcomputer, or have hard-wired versions built in at the factory.—C. Warren

## **GRAPHICS CARD FOR IBM PC TRANSLATES COLOR INTO 16 GRAY SHADES**

Paradise Systems Inc., of Brisbane, Calif., has introduced its Modular Graphics Card in a bid to meet the strong demand for high-resolution graphics for IBM Corp.'s Personal Computer. Due to be shown in the United States later this month, the card already is available from Accent Computers International Ltd., of London. Accent president Terry Harris claims the card runs color graphics software written for the PC's color board, without modification. The \$495 Paradise card translates color graphics into 16 gray shades on IBM's monochrome screen. It also can be used with the IBM PC color monitor.—K. Jones



# Breakpoints

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## **MICROCOMPUTER MEMORIES READIES 25M-BYTE 3½-INCH WINCHESTER**

Microcomputer Memories Inc.'s 25M-byte (unformatted) 3½-inch Winchester disk drive, available in three configurations, is scheduled for shipment in the fourth quarter. The Van Nuys, Calif. company will sell the drive for less than \$600 in OEM quantities. The 588-track-per-inch, 10,943-bits-per-inch drive has four platters, eight heads, and comes in three models: the 3½-inch model M-125, the half-high 5¼-inch model and the full-size 5¼-inch model M-325. The larger size is constructed by bolting on the appropriate 5¼-inch bezel.—C. Warren

## **DATA MANAGEMENT LABS EXTENDS DEC'S Q-BUS WITH CONTROLLER**

The model DML-660 standalone controller made by Data Management Labs, San Jose, Calif., extends the Q-bus architecture of Digital Equipment Corp.'s MicroVAX and Micro PDP-11 computers. Housed in a 19-inch rack, the controller provides Q-bus extension and offers DEC UDA-50 subsystem-type operation. The DML-660, priced at \$2,650 in 100-unit quantities, should be shipped in December. The controller can be attached to a DML D80 404.5M-byte disk system for \$8,400 or a DML D81, 640.5M-byte drive for \$10,100, both in 100-unit volumes.—C. Warren

## **XEBEC AND HEWLETT-PACKARD TO PURSUE 3½-INCH WINCHESTER MARKET**

Xebec Corp., Sunnyvale, Calif., and Hewlett-Packard Co., Greeley, Colo., are separately planning 3½-inch Winchester drives. Xebec currently has the 3½-inch, 20M-byte Micro-Owl, but company officials say they are looking to internal use before releasing it onto the market. The drive's capacity may range above 10M bytes.—C. Warren

## **BRITISH SUPERMINICOMPUTER AIMED AT ARTIFICIAL INTELLIGENCE USE**

High Level Hardware Ltd., of Oxford, England, is seeking OEM deals in the United States for its Orion 32-bit minicomputer. Because the Orion can be microprogrammed to execute as many as 16 different languages simultaneously, it facilitates implementation of artificial intelligence languages such as LISP or prolog, says Tim Robinson, High Level technical director. The Orion is based on bit-slice processors, runs Berkeley 4.1 UNIX, and operates at about the same speed as the Digital Equipment Corp. VAX-11/750, Robinson claims. Prices range from approximately \$25,000 for a four-user version with 1M byte of main memory and 80M bytes of disk storage, to \$35,000 for a 16-user system with 6M bytes of main memory and 260M bytes on disk.—K. Jones

## **ADAPSO EXAMINES SOFTWARE PROTECTION SCHEMES**

The Association of Data Processing Service Organizations (ADAPSO) plans to offer a testing service for developers of software protection schemes. ADAPSO is expected to contract with a major university this summer for a product evaluation service. The university then would make information on hardware-based and software-based protection systems available to the industry.—M. Stenzler-Centonze





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CIRCLE NO. 16 ON INQUIRY CARD



# Breakpoints

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## **STARTUP TO SELL GKS SOFTWARE RUNNING UNDER UNIX**

A yet to be named company that begins operations late this month in Los Gatos, Calif., plans to sell software supporting the Graphics Kernel System standard and running under UNIX. Dennis Griswold, a former director of European operations for Contel Codata, set up the company. The software is likely to run on the TP 10m MC68000-based board-level computer from Tadpole Technology Plc., Cambridge, England. The TP 10m is Multibus-compatible.—K. Jones

## **TECH FILES: A QUICK LOOK AT INDUSTRY DEVELOPMENTS**

**NCC HIGHLIGHTS:** Last month's National Computer Conference in Las Vegas, Nev., had promised to be the largest in history, with 100,000 attendees expected to visit 3,800 booths. However, attendance was reportedly only 50,000 to 60,000. Some exhibitors expressed disappointment with the light traffic, and local merchants complained about lack of business. Conferees, it seemed, favored working over playing in the casinos. As a result, the Las Vegas Convention Authority reportedly is considering reviewing its convention-booking policies. Though major new product introductions were minimal, some companies attracted prospects to private suites in local hotels.

**Diconix Inc.**, an Eastman Kodak Co. subsidiary, demonstrated a non-impact, ink-jet printer in its hotel suite. Diconix was formerly known as Mead Digital Systems, a company that pioneered ink-jet technology. The printer uses a multiple-array, binary-deflection, continuous ink-jet that is not electrostatically charged. Company officials claim the technology allows more accurate dot placement on plain paper. The 18-page-per-minute printer places dots in a 300-by-300 dot matrix in high-quality mode, and in a 200-by-300 dot matrix in draft-quality mode. The printer includes two MC68000 processors; one for font creation and one for image and data management. The printer houses 64 jets on a printhead the width of an index finger. Introduction of the printer is slated for October, and availability is scheduled for the first part of next year. Tentative pricing is \$12,000 to end users, and \$5,000 to \$7,500 to OEMs. Printer supplier C. Itoh & Co., Ltd. was one visitor to the suite.—L. Valigra

**CompuPro** has added its blessing to the 6MHz NS32016 processor from National Semiconductor Corp. by using it in its 816/G series of microcomputers. The eight configurations of the G series, all IEEE 696/S-100-compatible, bring to 50 the number of products offered by CompuPro. The 816 line already includes machines built around Motorola Inc.'s MC68000 and Intel Corp.'s 80286 chips. A typical price for an 816 is \$14,995, including 40M bytes of hard disk storage and 1M byte of 16-bit static memory.—J. Donohue

**NEC Information Systems Inc.** has introduced a line of superminicomputers based on custom NEC processors. The computers, called



# Breakpoints

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the Astra 300 series, begin in price at \$15,000, and use the proprietary NEC ITOS operating system, so they are compatible with earlier, Astra 200 series computers.—L. Valigra

The major knock against **Apple Computer Inc.**'s MacIntosh portable computer is a lack of applications programs. But the company is clearing up that problem. At its NCC booth, Apple demonstrated 80 packages from 65 vendors. Fifty of the packages should be available by the end of the summer, and 150 packages should be shipped by year's end.—D. Bright

**Digital Research Inc.** is preparing Concurrent PC-DOS for fourth-quarter availability on AT&T's PC6300 microcomputer. The multitasking operating system supports Concurrent CP/M and PC-DOS. AT&T also is considering Digital Research's StarLink multiuser add-in board for the PC6300, according to Digital Research sources.—D. Bright

In a move away from its traditional office environment, **NBI Inc.** introduced a workstation for scientific and technical workers. The U! Technical Workstation runs the Berkeley 4.2 version of UNIX and is said to support most applications designed to run on AT&T Co.'s UNIX System V. Based on a Motorola Inc. 8MHz MC68010 processor, the workstation has paged virtual memory and a high-resolution, 14-inch, 1024-by-768-dot, bit-mapped, monochrome display. The price in single quantity is \$15,495, including 1M byte of memory, one 640K byte, 5¼-inch, floppy disk drive and a 2M byte hard disk drive. The workstation may be attached to an IEEE 802.3 Ethernet local network with TCP/IP protocols.—J. Donohue

**Bellsoft Inc.**, a Bellevue, Wash., startup, next month plans to market its PopUp programs. Users can call the programs in windows while using application programs in a PC-DOS environment. PopUp programs with an assembly language kernel include a calculator, a notepad, a calendar, an alarm clock, a telecommunications program, and a POP-DOS utility that allows the user to perform system functions such as formatting disks. Package prices range from \$19.95 to \$79.95.—D. Bright

**Epson America Inc.**'s OEM products division introduced the model 3740 ink-dot, 40-column printer/plotter. An ink reservoir at the top of the printhead wets the head's four pins, which then place dots directly onto the paper. Print speed is 8.8 characters per second. The price has not yet been determined. Epson also unveiled a 25 line by 80 column, liquid crystal-display module for portable computers. The 640-by-200-dot display measures 9 inches by 3 inches. The price for 100 units is \$325. The accompanying LCD controller is \$17.70.—D. Bright

An 1800-by-1400-dot, color CRT was shown by **Panasonic Industrial Co.** The T101-01 CRT measures 40 inches diagonally, and is intended for computer-aided design, manufacturing, and engineering applications. Panasonic also



## LINE PRINTER COMPARISON CHART

STANDARD FEATURES	CIE TERMINALS CI-300	CIE TERMINALS CI-600	DATAPRODUCTS B-300/600	PRINTRONIX P-300/600
LOWEST PRICE	X	X		
L Q PRINTING	X	X	X	
COMPRESSED PRINT	X	X		
GRAPHICS RESOLUTION				
60 x 72	X	X		X
120 x 72	X	X		X
200 x 144	X	X		
200 x 288		X		
BOLDFACE PRINTING	X	X		
SLANTED PRINTING	X	X		
CHAR. ENLARGEMENT	X	X		
INT'L CHARACTERS	X	X		

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# Breakpoints

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introduced its 19-inch graphics terminal with a 1365-dot-by-1024-dot resolution and a drawing speed of 40,000 short vectors per second.—D. Bright

**AlphaCom Inc.** unveiled a number of products in a private hotel suite. Aimed at the lap-sized computer market, the AlphaCom Traveler is a 60-character per second (cps), battery-powered, thermal printer that weighs 5½ pounds and is priced at \$199.95. The associated interface cable for RS-232 or RS-422 connections is \$49.95. The company's AlphaPro 18-cps \$399.95 daisy wheel printer can use Diablo Systems Inc. and Qume Corp. print wheels and ribbons. It has a 93-byte buffer expandable to 4K bytes. The interface cable is priced at \$49.95. AlphaCom also showed a \$49.95 interface cable that couples its model 801 thermal printer to Apple Computer Inc.'s Macintosh. All products are slated for October delivery.—C. Warren

**NOTES FROM OVERSEAS:** West Germany's electronics giant **Siemens AG** has earmarked about \$357 million for its mega-project, an effort aimed at producing its next two generations of microchips. Siemens chief executive Dr. Harlheinze Kaske said last month that the first stage of the project, with \$143 million budgeted, will be for a 1M-bit memory chip. The second stage is for development of a 4M-bit dynamic RAM by the end of this decade. Siemens already has 64K chips in volume production and is ramping up to produce 256K RAM chips in volume by next year.—M. O'Gara

**Hitachi Ltd.** said its output of 64K dynamic RAMs is growing from the present pace of 7 million to 8 million units a month toward 9 million a month by year's end, when it will peak. Hitachi is more interested in building capacity for 256K dynamic RAMs, now being produced at a rate of about 700,000 monthly, to one million monthly starting this month. Hitachi makes an estimated 80 percent of all 256K memory devices. Sutezo Hata, a Hitachi managing director, said the change in bit emphasis will probably show up in mid-1985. Hitachi is preparing a plastic package to add to the SIL- and DIP-packaged 256K dynamic RAMs now available. Chips with those packages should be ready by fall, and available in quantity early next year.—I. Takehashi

The **Samsung Semiconductor and Communication Co.**, a division of one of Korea's four biggest electronics companies, plans to start marketing in October for 64K dynamic RAMs being produced at its new VLSI plant in the Kiheong Industrial Complex in Kyunggi-do. The facility, a \$125 million investment in a first, 28,000-square-meter phase, plans to produce 6 million devices a month. Samsung will invest another \$750 million in the second phase of the plant this fall. That investment is, first, for producing 1M bit dynamic RAMs, static RAMs, and microprocessors, then for personal computers and peripherals, and, eventually, for minicomputers and mainframes. The development by Samsung of a 64K device last year made Korea the second country after Japan to develop a 64K dynamic RAM outside the United States.—I. Takehashi



# Breakpoints

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**Toshiba Corp.** is shipping samples of two CMOS mask ROMs that have 200 nanosecond access times. One device, the TC531000P, can store 16-by-16-dot patterns for 3,418 characters at a time. The mask ROM is widely used in word processors, personal computers and printers for generating characters and patterns. The Japan-based sample prices are about \$26 for the 256K TC53527P device and less than \$110 for the 1M-byte TC531000P. Toshiba will start taking mask data for production orders in September.—I. Kakehashi

**Inmos Corp.**, the Colorado Springs, Colo., R&D unit of Britain's Inmos Group, has formed a production technology-sharing agreement with the newly-established NMB Semiconductor Company for the manufacture and sale of 256K CMOS dynamic RAMs. The five-year agreement provides for use of Inmos technology to make the devices at a plant being built in Tateyama, Japan, and representing a \$91.8 million investment. Initial production output will be about 200,000 chips a month, and will gradually grow to one million a month. Inmos will get half of the production volume. The companies plan to make the RAMs available to outside customers early in 1986.—I. Kakehashi

**AT&T** last month launched UNIX Europe Ltd., a London-based joint venture with Olivetti SpA. Heading the small 15-person startup is Digital Equipment Corp. veteran Vanni Papi. The appointment of an outsider to fill the post may signal to current and would-be European UNIX licensees that Olivetti, the exclusive European distributor of AT&T's UNIX-based 3B computers, will not receive preferential treatment from the venture. Some resellers had expressed fear about buying the operating system from a strong competitor such as Olivetti. Reports indicate AT&T is planning another UNIX marketing operation in the Far East.—M. O'Gara

U.K. distributor **Universal Computer Systems Ltd.** is charging its sole supplier, Datamedia Corp., with fraud and breach of contract in a \$5 million lawsuit filed in New Jersey. The action follows Datamedia's abrupt cancellation of the exclusive distribution pact it signed with Universal a year ago for Datamedia 932 computers running the Pick operating system. The suit demands damages, reimbursement for lost profits and investments, legal costs, and reinstatement of Universal's exclusive marketing rights in the U.K. The suit also asks to nullify the worldwide remarketing agreement for 932s Datamedia signed only months ago with Britain's ICL Plc.—M. O'Gara

**Taiwan's National Science Council** is planning to establish a liaison office in California's silicon valley for the purpose of attracting high technology and foreign investors to Taiwan's Hsinchu Science-based Industrial Park. The office, which is expected to be set up soon, will be administered in the United States by Taiwan's Coordination Council for North American Affairs, the equivalent of a consulate. Two similar offices were established in Los Angeles and Houston earlier this year. Hsinchu, established in 1980, is the offshore manufacturing site for a growing number of American computer companies, including Qume Corp. and Wang Laboratories.—C. Hintermeister



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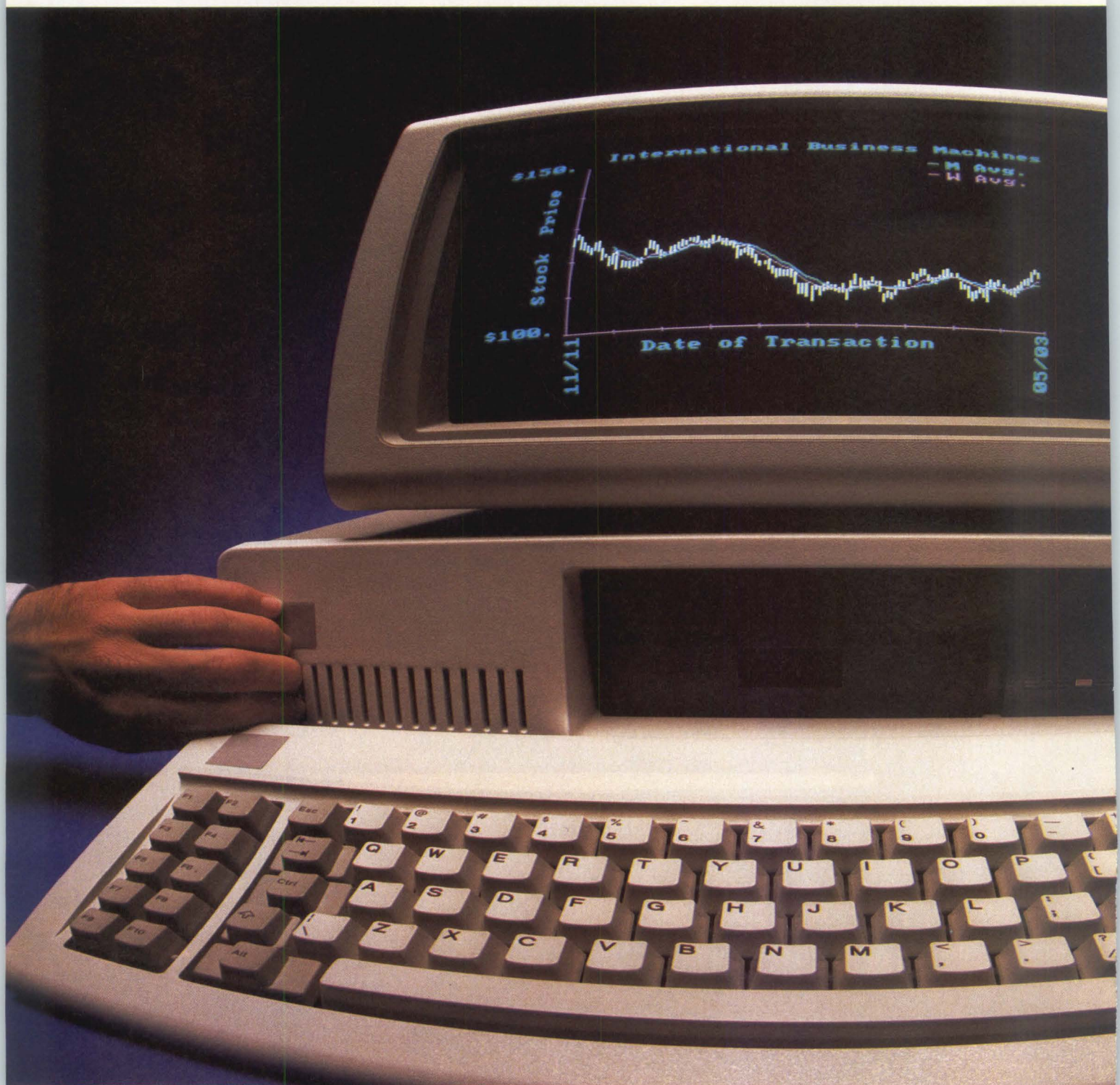
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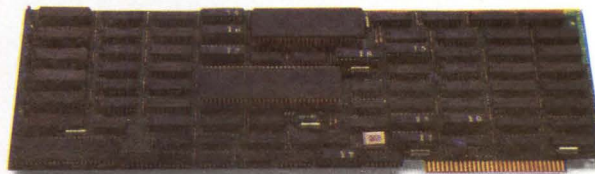
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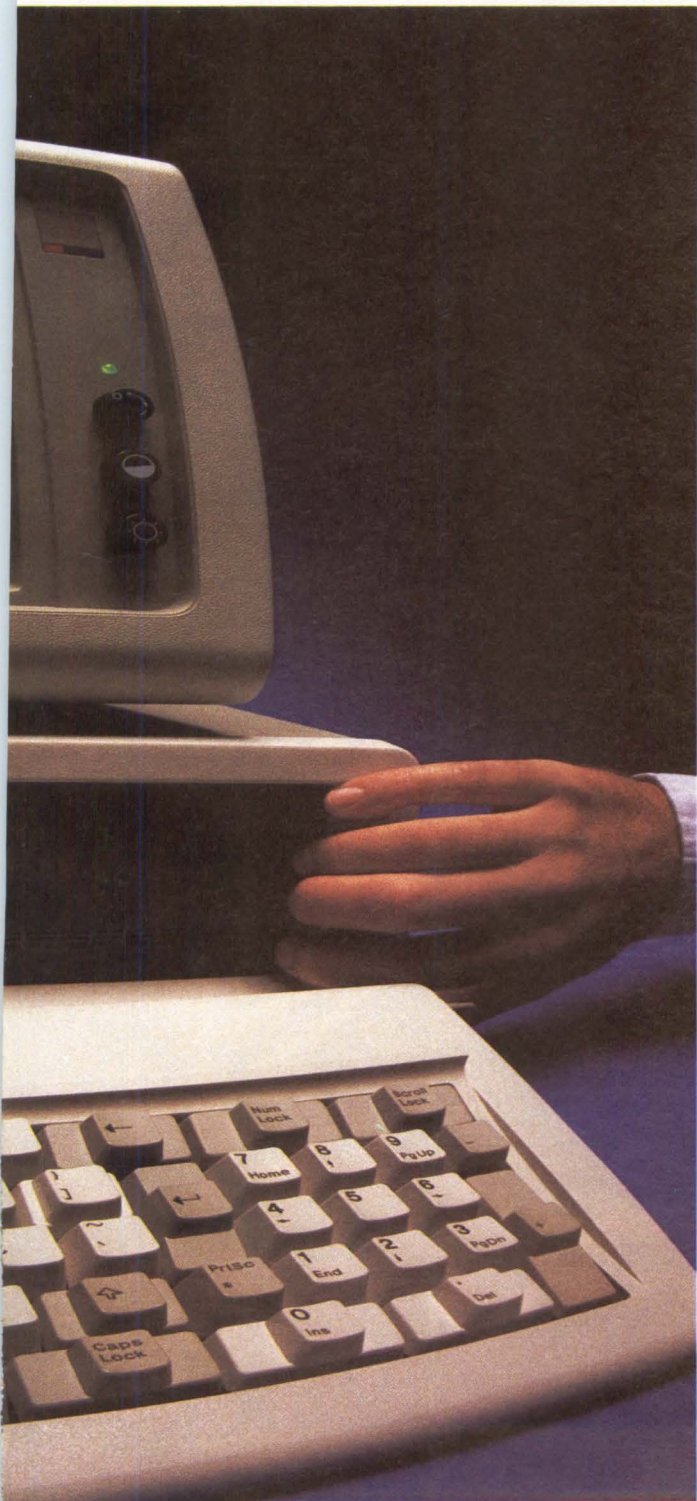
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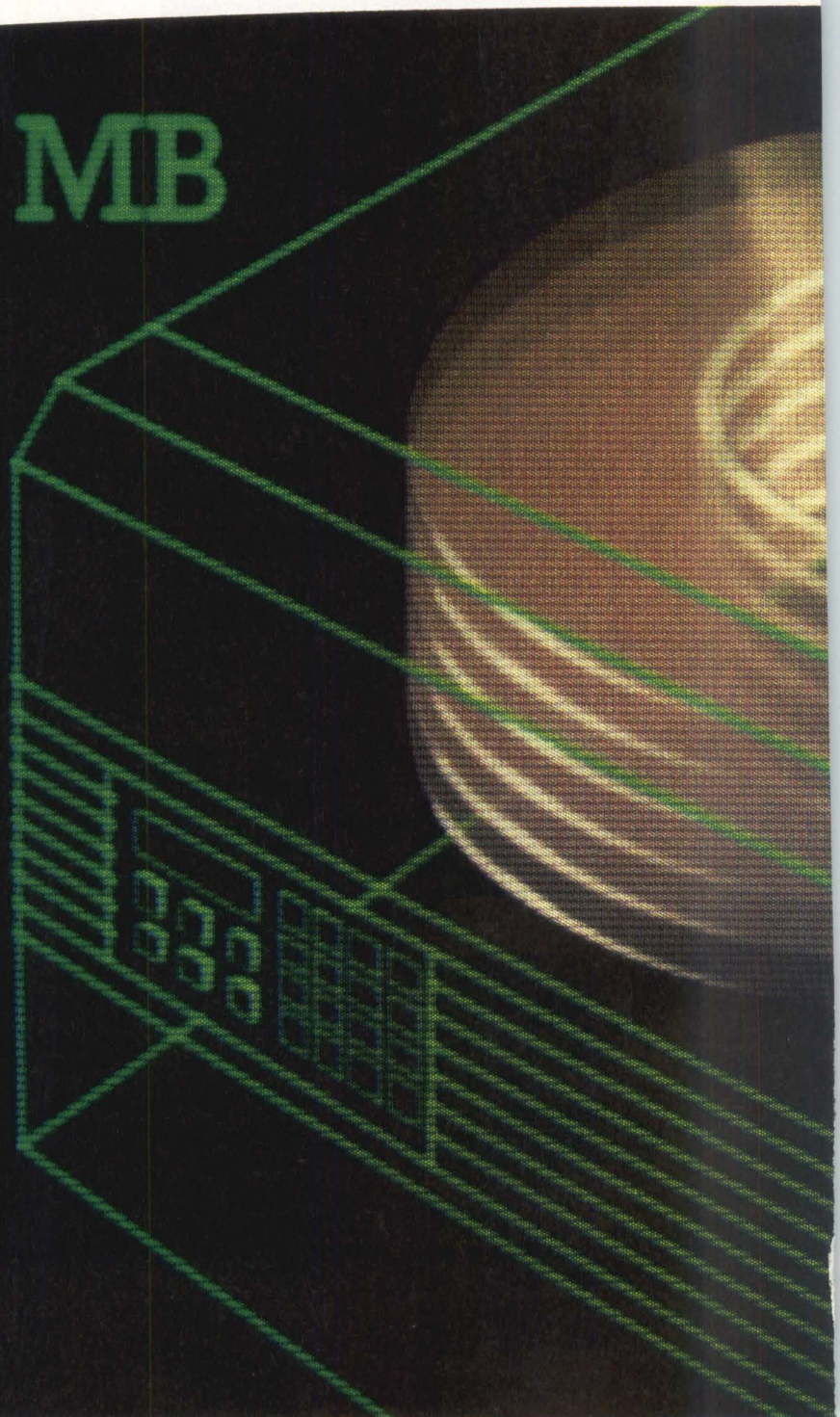
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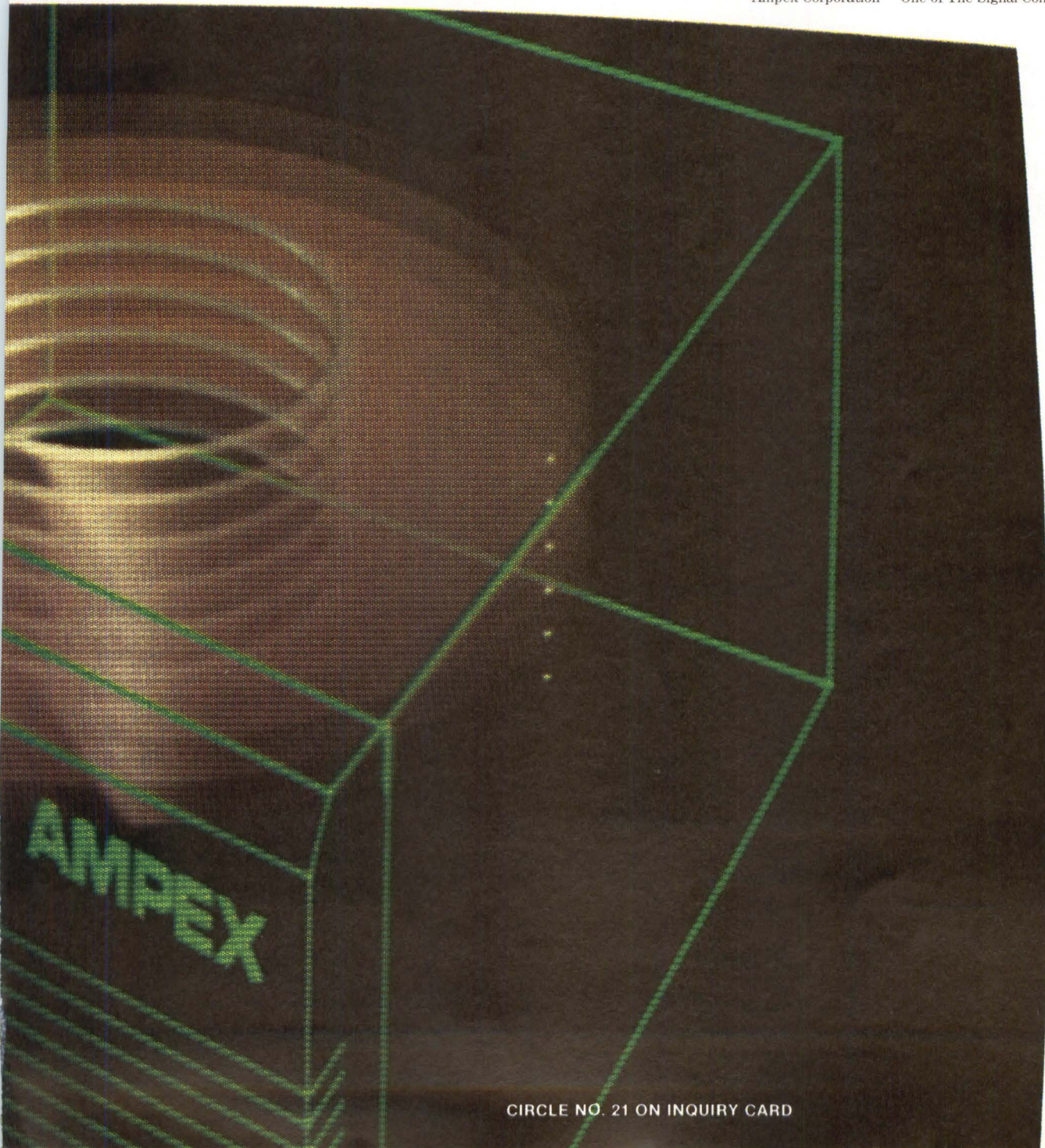
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# Mini-Micro World

NEWS

## TeleVideo enters DEC market with VT220-compatible terminal

Tom Moran, Associate Editor

TeleVideo Systems Inc., Sunnyvale, Calif., has introduced the model 922 terminal, which the company hopes will enable it to compete head-to-head against Digital Equipment Corp. in the VT200 market. Code-compatible with both the VT220 and VT100, the \$995 TeleVideo 922 will undercut the retail price of the VT220 by \$300. TeleVideo showed the monochrome, alphanumeric 922 at the National Computer Conference in July, and the company expects to begin shipments this month.

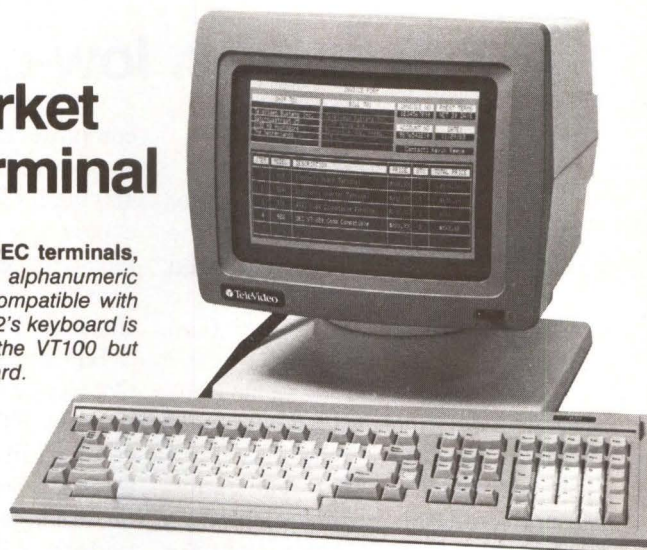
### A major departure

TeleVideo's only previous DEC-compatible product is the TeleVideo 970, which is aimed at the high-end market for American National Standards Institute (ANSI)-compatible units. The 970 contains a VT100 subset, but, according to Steve Tatum, TeleVideo's vice president for national sales, "The 970 was never targeted to go directly into the DEC market, and it was not a DEC emulator."

The 922 offers a low-profile keyboard, a tilt-and-swivel screen, a 10-key, accounting-style keypad, block mode, eight character fonts and space for an auxiliary option board. The 12-inch, non-glare screen uses a P31 green phosphor and displays 80 or 132 columns by 25 lines. An optional Tektronix-compatible monochrome graphics board should be available when the 922 is introduced. The graphics upgrade board will match the 922 against DEC's VT240 monochrome text and graphics terminal.

Tatum says the company agonized

*Intended to compete with DEC terminals, TeleVideo's 922 monochrome alphanumeric terminal is said to be code-compatible with the VT220 and VT100. The 922's keyboard is nearly identical with that of the VT100 but differs from the VT220 keyboard.*



over designing the 922's keyboard because, when DEC designed the VT220, it ignored the VT100 keyboard. Instead, DEC used the Rainbow microcomputer keyboard for the VT220 and placed the >/< key adjacent to the letter "z"—where most typists expect to find the shift key. "If you're going to enter somebody's market, the golden rule is that you must emulate the keyboard—key-for-key and stroke-for-stroke," says Tatum, but "we couldn't bring ourselves to put the key there, so we decided to break the golden rule." A number of other keys on the 922, including "break" and "escape," are also in positions different from the VT200.

TeleVideo director of marketing Craig Lynar does not believe the keyboard differences will present a problem for the company, "since [the VT220] is not out in the field yet and does not have an installed base." He adds that TeleVideo is prepared to move the keycaps on the 922 if the VT220 keyboard becomes a standard. The installed base for VT100 keyboards is estimated at 500,000 units.

### DEC market to grow

Tatum expects the DEC market to grow at a compound annual growth rate of 15 percent to 20

percent. He estimates that more than 270,000 units are being shipped into the DEC market and that about 80,000 of those units are captive customers of DEC. The major competition for the remaining 190,000 units is DEC. "We are going to try to get as large a share of that as possible," he adds.

Bob Sanekoff, vice president for display terminals for Dataquest Inc., a San Jose, Calif., research concern, predicts that the demand for DEC and DEC-compatible terminals will be strong for the next two years. "Because of the basic uses of data input, data retrieval, information updates and so on, [terminals] will continue to show good strength," he says. Dataquest says that DEC has about 60 percent to 62 percent of the DEC-compatible market and forecasts that DEC will ship about 250,000 terminals worldwide this year.

TeleVideo will distribute and service the 922 through 35 active distributors, including two-tier distributors (through dealers), wholesale distributors and full-service, value-added resellers. TeleVideo will service large OEMs directly only if the OEM's volume is greater than the amount a distributor could handle. TeleVideo does not plan a direct retail effort. □



### HP is first with low-cost laser printer

Tom Moran, Associate Editor

Hewlett Packard Co.'s Boise, Idaho, division has unveiled the \$3,495 LaserJet printer, described as the first laser-beam printer to retail for significantly less than \$10,000.

The LaserJet uses Canon USA Inc.'s LBP-CX print engine to produce 8 pages per minute of 300-by-300-dot resolution text and 75-by-75-dot resolution graphics. Billed by HP as a one-to-one replacement for daisy-wheel printers, the page printer sells for about the same price as high-end daisy-wheel units. Producing less than 55 decibels adjusted (dBA) during operation, the LaserJet is aimed at small businesses and offices. The unit offers the flexibility of a number of fonts and graphics capability, and the print quality of text is said to be difficult to distinguish from fully formed impact printing.

#### HP adds formatter and interface

HP designed its own interface and formatter for the Canon engine, which has only a video formatter. Canon USA, Lake Success, N.Y., will build the electronics for the HP design. HP also offers system integration, support and distribution. According to product marketing manager Robert Granger, "We've aggressively taken [the LaserJet] to independent software vendors for them to interface with their packages." The LaserJet supports Lotus Development Corp.'s Lotus 1-2-3, Multimate International Corp.'s Multimate, MicroPro International Corp.'s WordStar, Software Publishing Corp.'s pfs:Write, BPI Systems Inc.'s BPI Accounting and other software packages.

The printer is compatible with the HP 150 touch-screen personal

computer, the IBM PC and IBM PC compatibles. When linked to the HP 150 via its RS232 port, the LaserJet copies the 150's screen on a one-keystroke command. HP says it will provide screen-copy software for the IBM PC this year.

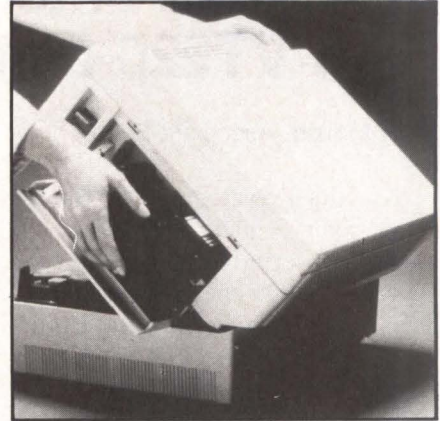
HP offers the LaserJet with a Courier 10 font, but an optional plug-in ROM cartridge provides three additional fonts. The font cartridges allow use of four typefaces on a single page. Other ROM cartridges with additional fonts are scheduled to be released this year. LaserJet also rotates images 90 degrees, which allows the printing of spreadsheets in "landscape" mode using compressed type.

The LaserJet prints on letterhead paper, labels, envelopes and transparencies. Its paper cassettes feed standard 8½-by-11-inch sheets, legal-size pages and European sizes A4 and B5. Manual feed permits printing on both sides of a sheet and the use of odd-sized paper. The LaserJet opens like a clamshell to permit easy clearing of the paper path.

#### Same engine as Imagen

The LBP-CX print engine is also the heart of the previously announced Imagen 8/300 from Imagen Corp., Mountain View, Calif. The Imagen 8/300 has a more sophisticated controller than the LaserJet and retails for less than \$10,000.

Edward Webster, president of Datek Information Services Inc., Newtonville, Mass., says one source of buyer resistance to the LaserJet may be the \$99 disposable, electrophotographic cartridge. He also believes that the 100-sheet capacity of the paper cassette is not large enough for small business environments. "There's a lot of resistance to new things in the market. For several reasons, people are not real-



The LaserJet printer from HP opens like a clamshell to permit easy clearing of the paper path. A disposable cartridge containing toner, developer and a rotating drum is the heart of the print engine supplied by Canon USA.

ly unhappy with daisy-wheels."

Webster says that the LaserJet print quality is "great for a laser printer but not as good as a daisy. There's nothing wrong with the HP machine. I think its amazing that they can sell it for \$3,500."

According to the Boise division's general manager, Raymond A. Smelek, changing the electrophotographic cartridge produces extremely consistent print quality. "All the key imaging components, including the drum, are replaced each time. This makes the LaserJet simple to maintain." The cartridge includes mono-component toner, developer, a rotating photoconductive drum, a charge corona assembly and a drum-cleaner blade.

HP will distribute the LaserJet through approximately 1,100 dealers of its personal computer and plotter products in the United States. The company will also sell the printer through its direct sales force. HP projected quantity shipments by June 1, with European availability scheduled for late 1984. □



# Data General's engineering workstations push price/performance boundaries

Lori Valigra, Senior Editor

Data General Corp., Westboro, Mass., recently introduced two 32-bit minicomputer-based engineering workstations with an entry-level price tag of \$35,500.

DG is entering the low end of a market in which machine prices reach \$100,000. In doing so, it is trying to attract the growing ranks of cost-sensitive Fortune 1,000 and OEM companies that need to increase their engineers' productivity and decrease product design time.

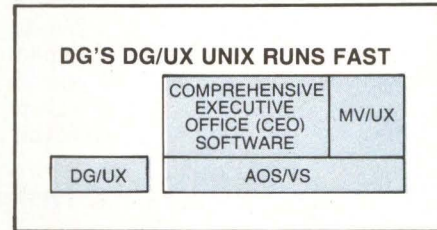
"Customers must change from system integrators and R&D groups to Fortune 1,000 and OEM operations for the market to explode," says David Rome, marketing manager for the workstation group in DG's Technical Products Division. Rome figures Fortune 1,000 companies employ more engineers than other companies, because they account for 80 percent of computer sales.

The single-user DS4000 and DS4200 superminicomputers borrow their processor technology from DG's low-cost 32-bit system, the MV/4000. The DS4000 is a monochrome model sporting 1,024-by-1,024-by-2-bit-map resolution and having 256K bytes of graphics memory. The DS4200 offers 16 colors from a palette of 4,096 on a 1,024-by-1,024-by-4-bit-map raster display. The products are among the first to use Texas Instruments Inc.'s dual-ported, video dynamic RAM components. Both compact models fit under a desk and measure 25 by 13 by 20 inches. They are said to execute as many as 2.5 million instructions per second. A hardware floating-point unit executes 600,000 single-precision Whetstones.

DG's Technical Products Division, which sells to technical OEMs and system builders, and its Information Systems Division, which sells systems for large businesses and office-automation environments, will both handle the product.

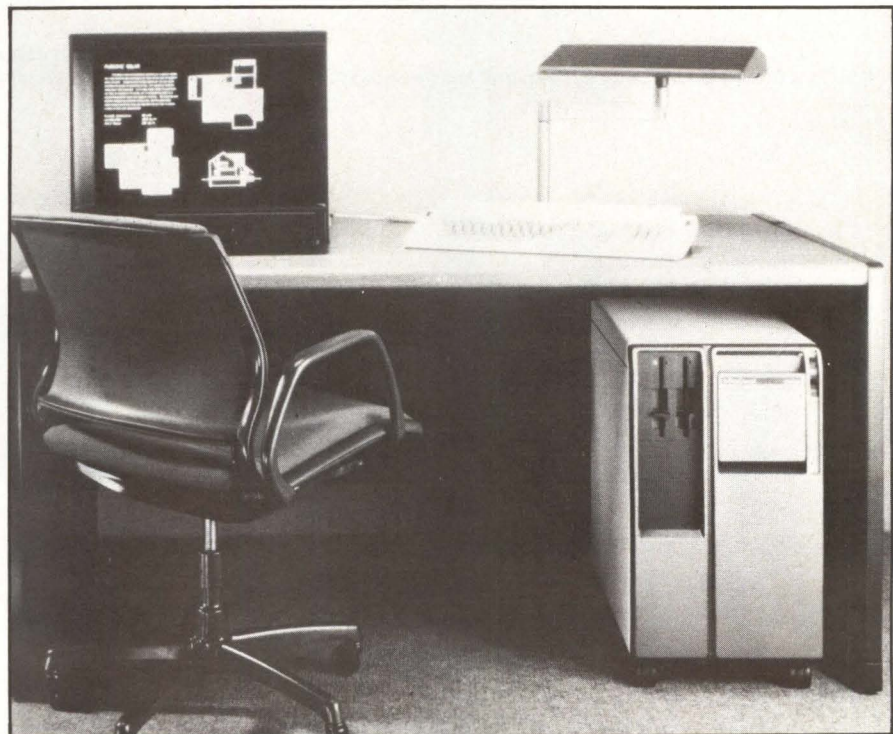
## Supports eight office users

The Information Systems Division's version, the MV/4000 small cluster (SC), supports four to eight office users. The new processors are not as configurable as standard MV/4000 models, which support 64 terminals. Also, they have comparatively limited mass-storage options because drives cannot be attached externally. It is the first MV/4000-based system to support 5¼-inch disk drives rather than 8-inch drives.



DG's DG/UX native UNIX runs faster than its MV/UX, which runs atop the AOS/VS operating system on DG's MV/ superminicomputers. DG/UX does not run with CEO software because of differing file structures and languages.

The new processors include three new boards designed to minimize system size. The integrated I/O controller board has floppy disk and hard disk drive controllers, extra asynchronous lines for a mouse or tablet, and an Ethernet local-area network (LAN) interface. The multiuser asynchronous board includes



DG's DS/4200 32-bit minicomputer-based engineering/graphics workstation is a low-priced tool that fits under desks.



# Mini-Micro World

NEWS

## A challenge from Apollo, Skok

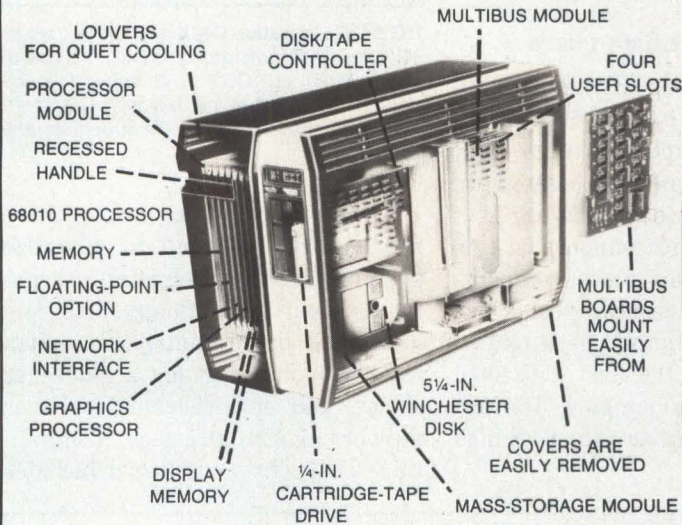
As Data General Corp. prepared to release its low-priced 32-bit minicomputer-based engineering/graphics workstations, competitors Apollo Computer Inc. and Skok Systems Inc., a Hewlett-Packard Co. system integrator, had a similar pricing notion

in mind when they introduced microcomputer-based systems.

Like DG's systems, Apollo's DN550 fits under a desk. It measures 24½ by 13½ by 28½ inches. Configured with Apollo's AEGIS operating system, 1M byte of memory, a color monitor, a

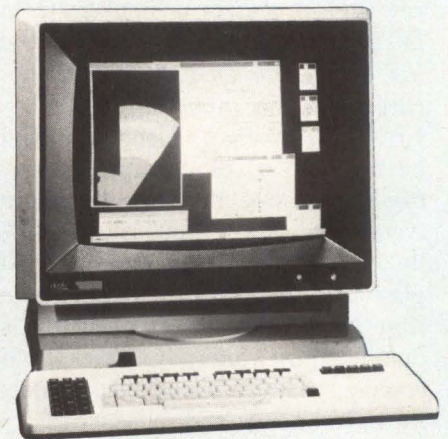
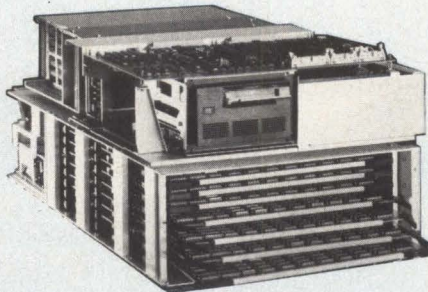
keyboard, and a Domain local-area network interface, the DN550 is priced at \$31,500. Adding a 50M-byte Winchester drive increases the price to \$40,000. A rack-mounted version for OEMs and system integrators also is available for \$30,000 with 1M byte

### APOLLO'S MODULAR DN550 MEANS EASY REPAIR



Apollo's DN550 under-desk system unit has three modules for easy repair.

Skok's Artech computer-aided-design and -drafting system competes with low-priced machines. Showing off the HP processor-based Skok system is Skok president and co-founder David Skok.



Apollo's low-priced Domain DN550 engineering workstation is available in under-the-desk (left) and rack-mount (center) versions. Display (right) shows multiple windows.



of memory, 1M byte of display memory, a 19-inch color display and a low-profile keyboard.

The monitor has 1,024-by-800-dot graphics and displays as many as 256 colors. The system is based on the MC68010 processor. Options include a 45M-byte, 1/4-inch cartridge-tape drive, a four-slot Multibus peripheral adapter and a floating-point hardware accelerator.

Apollo's processor is capable of 32-bit MC68020 processor performance, according to Lou Reynolds, product group manager for high-end systems and graphics at Apollo. Apollo is still sticking with a 16-bit bus. "When 32-bit CPUs [such as the MC68020] are available, then it will make sense to go to a 32-bit bus," he says.

One feature added across the Apollo DN processor line is the graphics metafiles resource (GMR), which Reynolds says appears to the application program like a series of functions or subroutines. Reynolds says GMR affords application independence and supports bit-mapped graphics devices. It creates and edits graphics primitives; handles interactive user input; provides scaling, translation, rotation and installation of graphics; and supports viewing 2-D objects. The company plans to add 3-D displays later. Users can distribute metafiles libraries across Apollo's Domain network, making it seem much like a distributed database for graphics routines. GMR software and firmware is free to Apollo users who are members of the software support program.

Also touting low price for its workstations is Skok. The company has based its Artech computer-aided-design and -drafting system on HP's 32-bit HP9920 microcomputer. An Artech DesignStation is priced at \$27,000. A fully configured entry-level system sells for \$59,500, including dual disk drives, a D-sized plotter, and Skok's Arplan 2-D design and drafting software. The 3-D Arview program sells for \$7,500 more. A graphics processor system adds \$35,000. The graphics processor is manufactured by Silicon Graphics Inc., Mountain View, Calif.

eight asynchronous and two synchronous ports and is for use with the MV/4000 SC eight-user commercial system. The graphics board supports a 19-inch color or raster-scan monitor.

### **DG announces native UNIX**

Along with the processor announcements, DG released a native UNIX operating system called DG/UX, which is based on UNIX System V Release 2 and supports the Berkeley extensions that are popular in engineering applications. Unlike DG's earlier MV/UX UNIX, which runs atop its AOS/VS minicomputer operating system, DG/UX runs directly on the CPU. Rome claims the DG/UX thus runs faster, requires half the memory and uses one-third the disk space. Programs written under DG/UX are said to be compatible with those written under MV/UX, so users have access to Ada development software running under the AOS/VS environment.

DG/UX works with all DG products except those running its Com-

prehensive Electronic Office (CEO) system software, which "sits" atop the AOS/VS operating system. CEO machines employ the AOS/VS operating-system file structure and a language different from DG/UX, Rome explains. The system also runs RT32, a subset of DG's AOS/VS operating system.

Other new products include IEEE 802.3 LAN support and transmission-control protocol/network protocol (TCP/IP) communications support, which allows DG equipment to coexist with non-DG equipment using the UNIX operating system in a LAN.

Price for the DS4000 with 1M byte of memory, a 19-inch monochrome display, a 38.6M-byte, 5 1/4-inch Winchester disk drive, a 736K-byte floppy disk drive, a LAN interface and software is \$35,500. The maximum 4M-byte DS4000 sells for \$50,000. Similarly configured DS4200s with color displays run from \$44,000 to \$59,000. Similarly configured MV/4000 SCs with CEO software are priced from \$34,400 to \$47,400. □

### **DOW PLANS SOFTWARE FOR SALES MANAGEMENT**

Dow Jones Software, Princeton, N.J., is expected to announce a modular software series this summer that focuses on sales-management functions. The modules are designed for tracking sales, forecasting, etc. The first module, Prospect Organizer, is expected to retail for \$395.

### **HIGH-END UNIX TO GAIN APPLICATION SOFTWARE**

Pyramid Technology Corp., Mountain View, Calif., is moving to close the application gap in software for high-end UNIX systems. In conjunction with approximately 20 software vendors, Pyramid planned to announce in June the establishment of a third-party software support program for its 90x SuperMinicomputer. The 32-bit 90x is one of the first dual-port UNIX systems that supports both American Telephone & Telegraph Co.'s UNIX System V and the popular Berkeley 4.2 version of UNIX. Among the programs successfully ported to the system are relational database management, spreadsheets, high-level languages, an IBM PC link, word processors, menu systems and advanced typesetting programs.



## New VAX/VMS version streamlines VAXcluster

David Bright, Assistant Editor

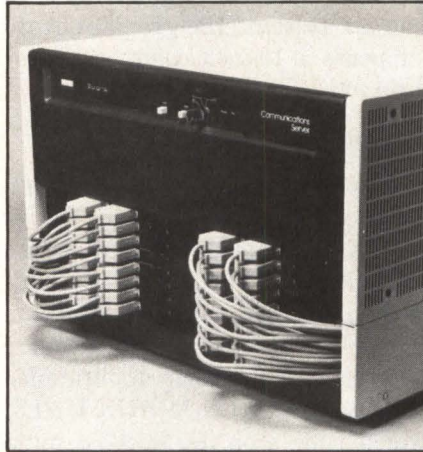
Digital Equipment Corp. recently announced a new version of the VAX/VMS operating system that makes a 16-node VAXcluster function more like a single, distributed system.

Along with the new product, called VMS Version 4.0, DEC also introduced several other VAX products: the MicroVMS operating system for the MicroVAX I computer, Common LISP, an enhanced FORTRAN, the VAX graphical kernel system (GKS) graphics software package, DECnet software with extended network addressing and a local-area network (LAN) terminal server.

Marion Dancy, VAX software marketing manager, describes the VAXcluster, a loosely connected group of VAX superminicomputers, as a cross between a tightly coupled multiprocessor scheme and a LAN. A passive star coupler links as many as 16 VAX-11/750s, 11/780s, 11/785s and hierarchical storage controllers over a 70M-bit-per-second coaxial cable. Dancy says several hundred VAXclusters have been installed since the product's introduction a year ago.

### VMS system balances jobs

A major feature of VMS 4.0 is the distributed job controller. The controller balances the number of jobs per system and maintains single-print and batch queues for the entire cluster. A distributed-file system manages all files in a cluster as a single entity; users don't have to specify the drive location when accessing a file. A distributed-lock manager provides concurrent control of the clusters' resources. One of the main advantages is that, should a system crash, the manager



DEC's new communications server provides load balancing to as many as 32 terminals across a VAXcluster or an Ethernet LAN.

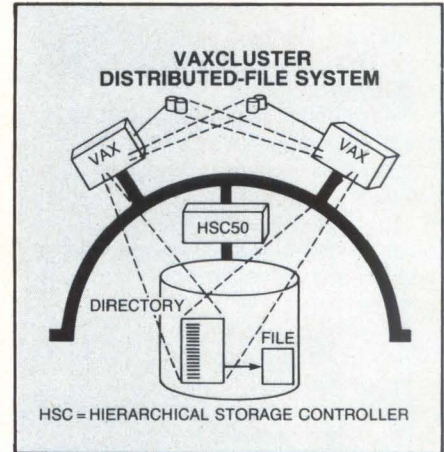
can direct another system to unlock any of its records.

The operating system also includes security enhancements such as a log-on retry limit and auditing of log-ons, log-offs, mounts, dismounts and file accesses. A VMS 4.0 license sells for \$10,000, which is the same price as that of the previous version. DEC plans to begin shipments in late 1984.

### PDP-11s convert to servers

The terminal server adds to the 4.0's job-balancing capability. It can be used in a VAXcluster or in an Ethernet LAN. Instead of hooking terminals directly to a host machine, the server distributes the hookups across the cluster or LAN, according to system use. The server can offload jobs from a host to intelligent terminals and personal computers.

The server, which can connect as many as 32 terminals, is based on the PDP-11/24 minicomputer. The 32-line version sells for \$20,000. DECnet-VAX 4.0 software converts a PDP-11 to a terminal server and extends the routing algorithm, ena-



With VMS 4.0's distributed-file system, users can transparently access all files from any system in a VAXcluster. However, specified files can be locked for security.

bling LANs and wide-area networks to include several thousand nodes. The previous limit was 1,023 nodes. The software, which also increases communication-interface support, runs on both VAX/VMS and MicroVMS and sells for \$3,000. The software should be available this summer.

### Recompiling unnecessary

MicroVMS is truly compatible with the VAX/VMS of the larger machines without recompiling or re-linking, claims Dancy. This is because the only code deleted from VAX/VMS concerns Massbus, Unibus and PDP-11 compatibility mode. (MicroVAX I uses the Q-bus but is based on the VAX architecture.) The only user-written application program changes that might be necessary, Dancy says, are to accommodate peripherals specific to the MicroVAX I. In addition to MicroVMS, DEC will continue to offer VAXELN, the MicroVAX I's first operating system. While MicroVMS is a general-purpose operating system, VAXELN is mainly for real-time development.



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MINI-MICRO SYSTEMS/August 1984

CIRCLE NO. 23 ON INQUIRY CARD

39



# EMULEX IMPROVES AND TAPE BACKUP BY

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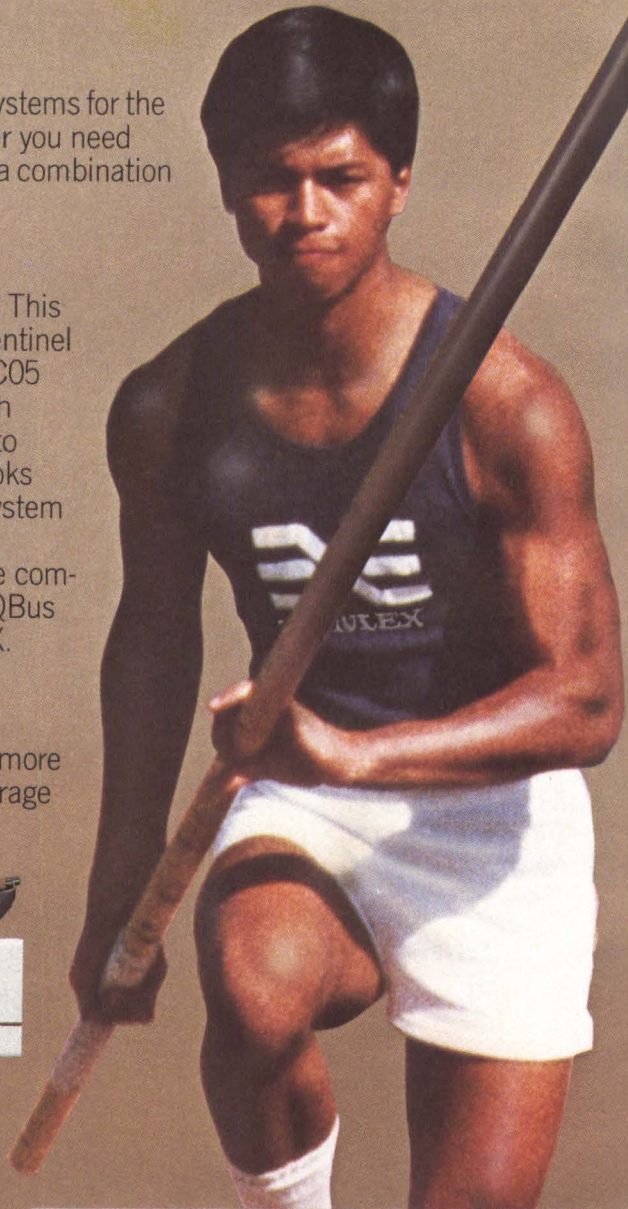
And since SABRE is an exact RL02 emulation, all existing operating and diagnostic software can be used as is.

SABRE is 5 1/4" high and slips into any 19" RETMA enclosure. A desktop version is also available. Both come complete with power supply, host adapter and connecting cables.

SABRE needs only one-eighth the space and one-quarter the power of four RL02s. And it eliminates the need for a separate system bootstrap, bus terminator and clock control board.

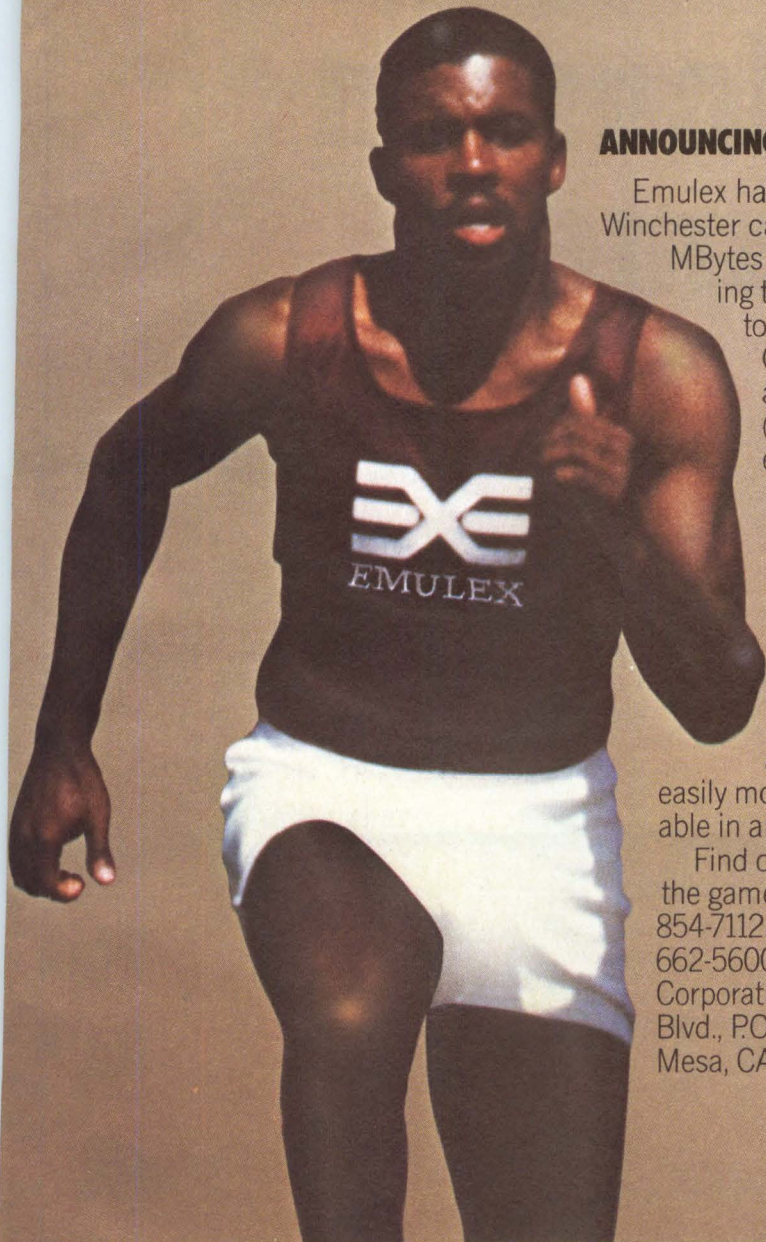
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Medley is interfaced to the system with a TC05/TC15 tape coupler and a UC02 (QBus) or UC12 (Unibus) host adapter. By using the Mass Storage Control Protocol (MSCP), the UC02 and UC12 allow the operating system to utilize the precise characteristics of the Winchester disk drive without patches or modifications to the operating system.

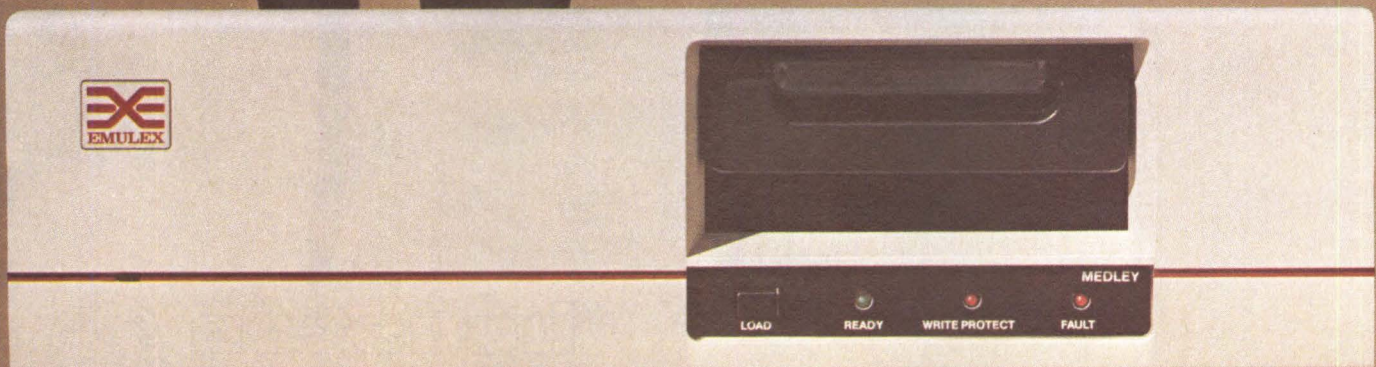
For convenience, Medley's disk drive, tape drive and power supply all fit into an attractive cabinet that easily mounts in a standard 19" rack. The Medley is also available in an attractive desktop version.

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CIRCLE NO. 24 ON INQUIRY CARD





# The lean, mean plotting machine from Houston Instrument

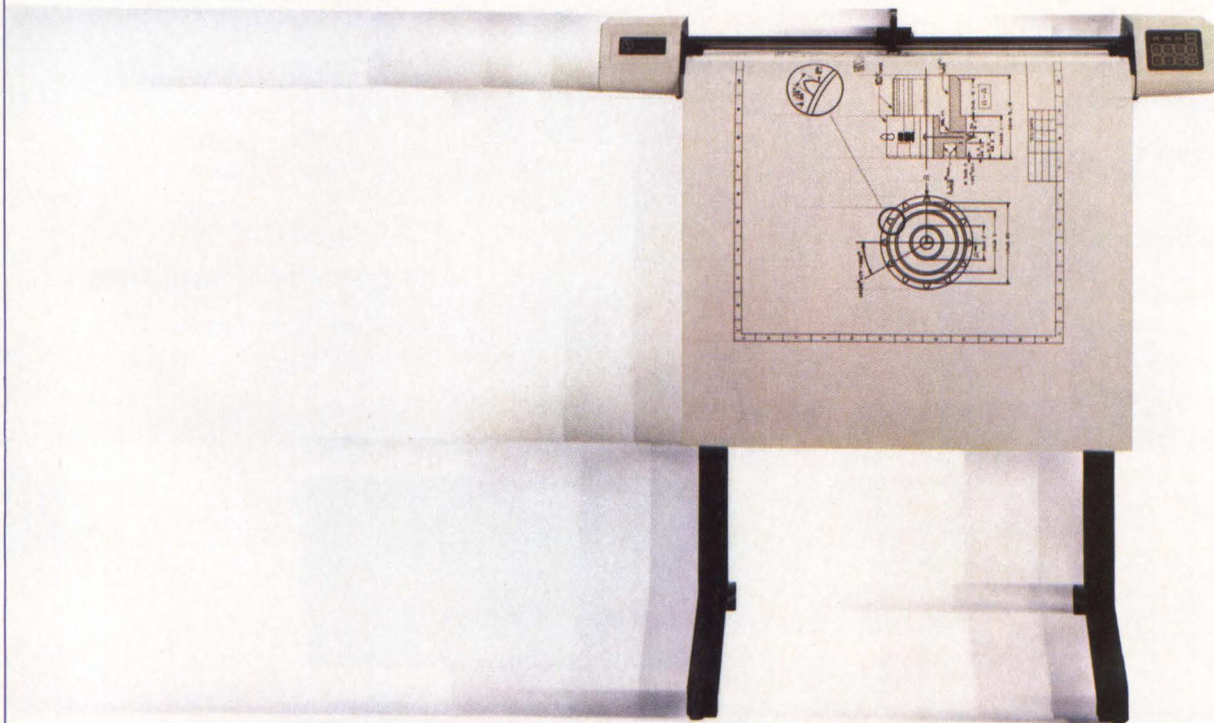
Houston Instrument's brand new servo driven DMP-51 is the fastest drum plotter we've designed to date. This superb plotter offers a pen speed of up to 22 inches/second; programmable accelerations, and a pen-on-paper resolution of 1/1000 of an inch! That means you'll turn out quality 17" x 22" and 22" x 34" drawings a lot faster, increasing your firm's productivity and profitability.

Now, for more good news. The DMP-51, priced at \$4,495\*, is as fast as other plotters costing three times more. At that price, you can afford to put a DMP-51 at individual drafting work stations.

This is the professional plotter that meets the needs—and the budgets—of all companies, large or small.

The DMP-51 is intelligent, too. The DMP-51 can execute complex graphics operations from the simplest commands. A mechanical/architectural version, the DMP-52, with its 18" x 24" and 24" x 36" paper size, is available for the same price from Houston Instrument.

So, watch our new plotter in action . . . it won't take much time to realize it's the best buy for your money. For the name, address and phone number of your nearest dealer or distributor, write Houston Instrument, 8500 Cameron Rd., Austin, Texas, 78753. You can also call 1-800-531-5205 or 1-512-835-0900 (Texas residents). In Europe, contact Houston Instrument Belgium NV, Rochesterlaan 6, 8240 Gistel, Belgium. Tel: 059-27-74-45. Tlx: 846-81399.



\*Suggested U.S. retail price

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CIRCLE NO. 25 ON INQUIRY CARD



# Mini-Micro World

## NEWS

MicroVMS should be available next month in modular form. The license for the basic system with the program-development module sells for \$1,500, while the DECnet group sells for \$1,450. DEC also expects to add the ULTRIX UNIX-like operating system to the MicroVax I late this year.

### Common LISP on VAX

DEC's VAX LISP is one of the first fully supported artificial-intelligence languages developed by a major computer manufacturer. With this implementation of Common LISP, DEC hopes to achieve standardization of the language.

Art Beane, product manager of DEC's artificial-intelligence technology group, claims VAX LISP is more cost-effective for application development than are dedicated LISP machines. Dedicated machines are best for research, he says.

VAX superminicomputers running the language must have at least 512K bytes of memory per user. Features include both interpreter and compiler modes, dynamic linking of compiled and interpreted code, lexically scoped variables, an editor with multiple window capabilities, integrated debugging facilities, a "pretty-printer" utility for enhancing print readability and the ability to call routines written in any other VMS language.

The new FORTRAN compiler reportedly improves application-program performance by as much as 50 percent. The compiler features a multiphase global optimizer that works across entire program units. Such operations include constant folding, arithmetic "if," logical "if," block "if-then-else," global elimination of common sub-expressions, removal of invariant expressions from loops and global allocation of general registers across program units. □

### Perkin-Elmer emulates latest AT&T UNIX V release

While Digital Equipment Corp. was attempting to help set an industry standard with its Common LISP implementation, Perkin-Elmer Corp. continued to stick with existing standards. P-E's new XELOS operating system for its Series 3200 line of superminicomputers is a "true derivative" of American Telephone & Telegraph Co.'s UNIX System V, release 5.2, says Jeffrey Bork, P-E's UNIX product manager. "We have made a commitment to follow the AT&T baseline standard," he asserts.

The XELOS operating system comes with the standard AT&T command interpreter shell as well as the C shell from the University of California at Berkeley. XELOS also includes an assembler, a C compiler, a FOR-

TRAN compiler Bork calls "the best optimizing compiler in the world" and a symbolic debugger. Another addition is the MenuMaker for creating menus that run XELOS and application programs. The Documenter's Workbench word-processing package also comes standard with XELOS. The popular RM/COBOL language system from Ryan-McFarland Corp. is optional. P-E plans to ship XELOS in October. Prices range from \$1,500 to \$30,000.

P-E at the same time announced the availability of the Unify relational database-management system on XELOS. Developed by Unify Corp., the system can interface with P-E's C compiler and RM/COBOL.

## HP phases out three terminals with low-priced model

Tom Moran, Associate Editor

Following a trend among major systems manufacturers to reduce competition from makers of plug-

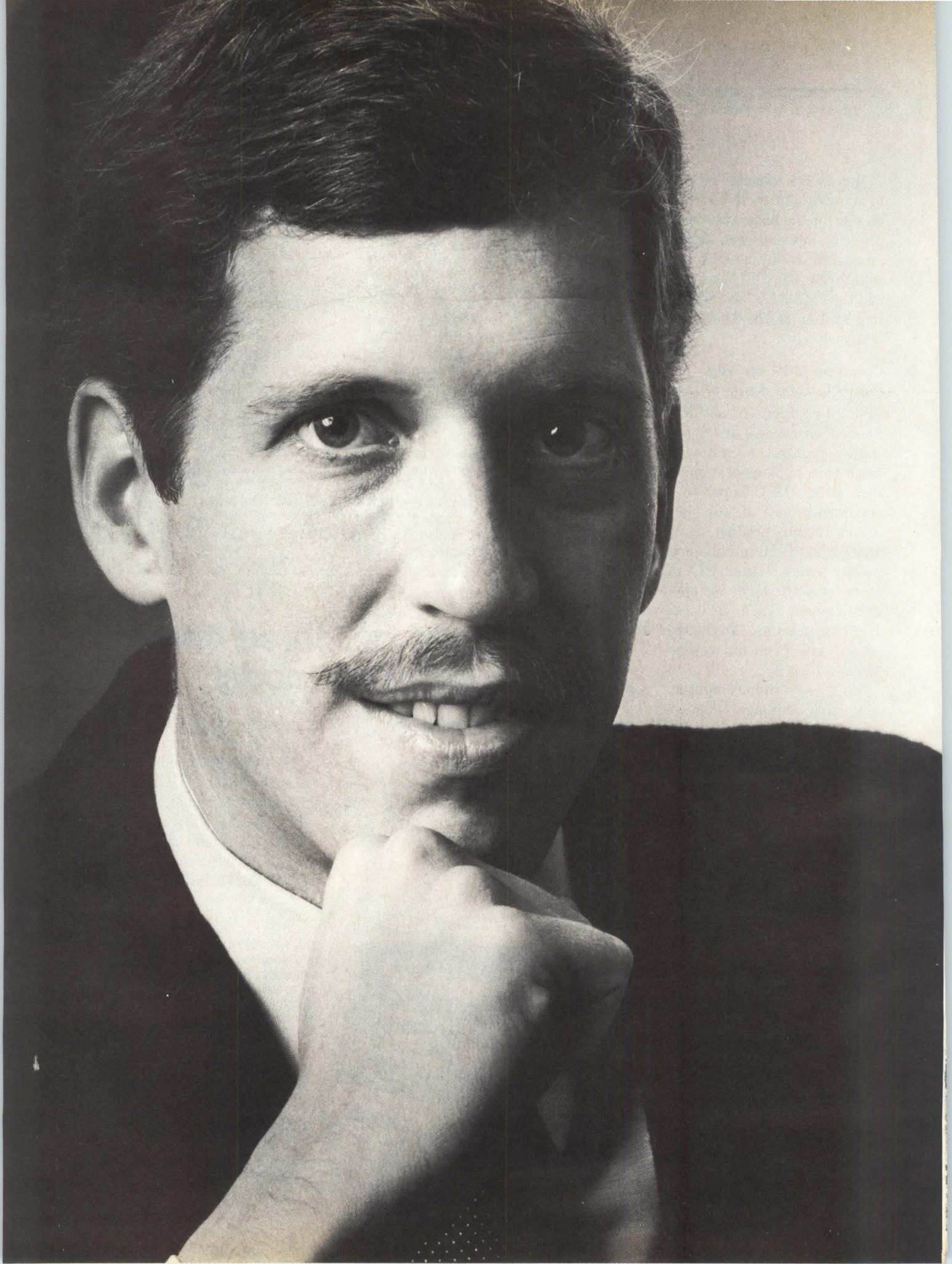
compatible devices, Hewlett-Packard Co. will "protect the ports" of its HP 1000, 3000 and 9000 computers with a \$1,295 HP 2392A ergonomic display terminal.

The 2392A will replace the HP 2622A block-mode terminal, the HP 2382A office display terminal and the HP 2621B interactive terminal.



The HP 2392A display terminal's ergonomic features include a tilt-and-swivel screen, adjustable-slant keyboard, and a non-glare green-phosphor screen. At \$1,295, the 2392A will replace three previous HP terminals and will be more competitive with terminals from other manufacturers.







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# Mini-Micro World

## NEWS

It is priced 40 percent less than the 2622A. Dan Jorgenson, product manager of HP's Roseville, Calif., terminals division, says the pricing helps differentiate the 2392A from personal computers. In a similar strategic move last year, both IBM Corp. and Digital Equipment Corp. introduced terminals priced 25 percent to 33 percent less than their previous models.

### Ergonomic features added

HP created the HP 2392A by adding ergonomics to a modified version of the 2622A. It has all the 2622A's functions but not its optional \$12,000 integral printer. New features are a tilt-and-swivel screen with smooth scrolling, an adjustable-slant keyboard, four pages of screen memory with an option for eight pages, a printer port option and a 19.2K-baud maximum transmission rate. The 2392A operates with HP 1000 real-time computers, HP 3000 business computers and HP 9000 engineering workstations. A further option allows compatibility with the ANSI X3.64 standard and DEC's VT100 terminal at no extra cost. Typical applications include block-mode and character-mode data entry, program development and data inquiry.

The HP 2392A swivels 360 degrees on a pedestal, while the separate CRT tilts 20 degrees inside the casing. The 12-inch, etched, antiglare screen displays text in a 24-lines-by-80-column format with two additional lines for function-key labels and one line for status information. The P31 green phosphor used for the display is refreshed at 60 Hz. Characters appear in a 7-by-11 dot matrix inside a 9-by-14-dot cell with 1/2-dot shift.

The 2392A's detachable, low-profile keyboard is identical to that of the HP 150 touch-screen personal computer. It can be adjusted to slant at 3 degrees or 11.5 degrees.

The 107 sculptured keys include a numeric keypad and independent user, editing and cursor keys. Seventeen international keyboard options will eventually be available. The documentation has been translated from English into nine major languages and is included in ROM.

A combined RS232/HP 422 port links the 2392A to the host system. The 2392A has full-duplex, asynchronous point-to-point transmission and is compatible with Racal-Vadic's VA3400, Bell Laboratories' 212A, Bell's 103A and other Bell-compatible modems. For \$150, users can add an optional Centronics port or a second RS232 port to support a printer.

### VLSI reduces costs

Jorgenson says HP was able to keep the cost of the 2392A down by using very-large-scale-integration (VLSI) circuits and improved manufacturing techniques. The 2392A's VLSI chips, all designed by an HP team in Grenoble, France, reduced the number of parts to 370 from 700 components in the HP 2622A. According to Jorgenson, the reduced chip count makes the 2392A more reliable than the terminals it will replace.

HP sources will not talk about intended production capacity or the number of terminals HP expects to sell. Dataquest Inc., a San Jose, Calif., research group, estimates that HP's domestic 1983 sales of non-graphics terminals amounted to

47,000 units. The total installed base is 200,000 units. HP's Jorgenson says that HP's worldwide installed base is more than 500,000 terminals.

According to Louise Herndon Wells, research analyst for Dataquest, HP's growth rate for terminals is strong. Wells cites the complexity of HP terminals as a barrier to would-be emulators. "Probably half of the development effort in a new HP terminal is spent ensuring its compatibility with previous HP products," she says. "I think that HP, like other system manufacturers such as IBM and DEC, is attempting to protect the ports of its systems from competitors with low-priced, full-functional products." Companies offering HP-compatible terminals include Direct Inc., Santa Clara, Calif., Falco Data Products Inc., Sunnyvale, Calif., and Semicoa Data Systems, Costa Mesa, Calif.

Wells points out, "HP's distinctive features have been high quality, high level of functionality and service. In today's very competitive terminal market, although these are necessary, they are not sufficient. At \$1,295, the 2392A should discourage potential emulators."

HP will produce the 2392A at its plants in Roseville, Calif., and Grenoble, France. The company expects to start taking orders around July 2, with a delivery time of six weeks. Distribution will be through HP's direct sales force. □

### INDUSTRY REVENUES TO REACH \$90 BILLION BY 1988

The computer services and software industry's annual revenues will hit \$90 billion by 1988, according to an Association of Data Processing Service Organizations survey. The industry grew from \$27.6 billion in 1982 to \$33.5 billion in 1983. Revenues per market segment during 1983 were \$9.3 billion in software products, \$12.7 billion in processing services, \$5 billion in turnkey systems and \$6.5 billion in professional services.



# Quality 5<sup>1</sup>/<sub>4</sub> Inch Drives.

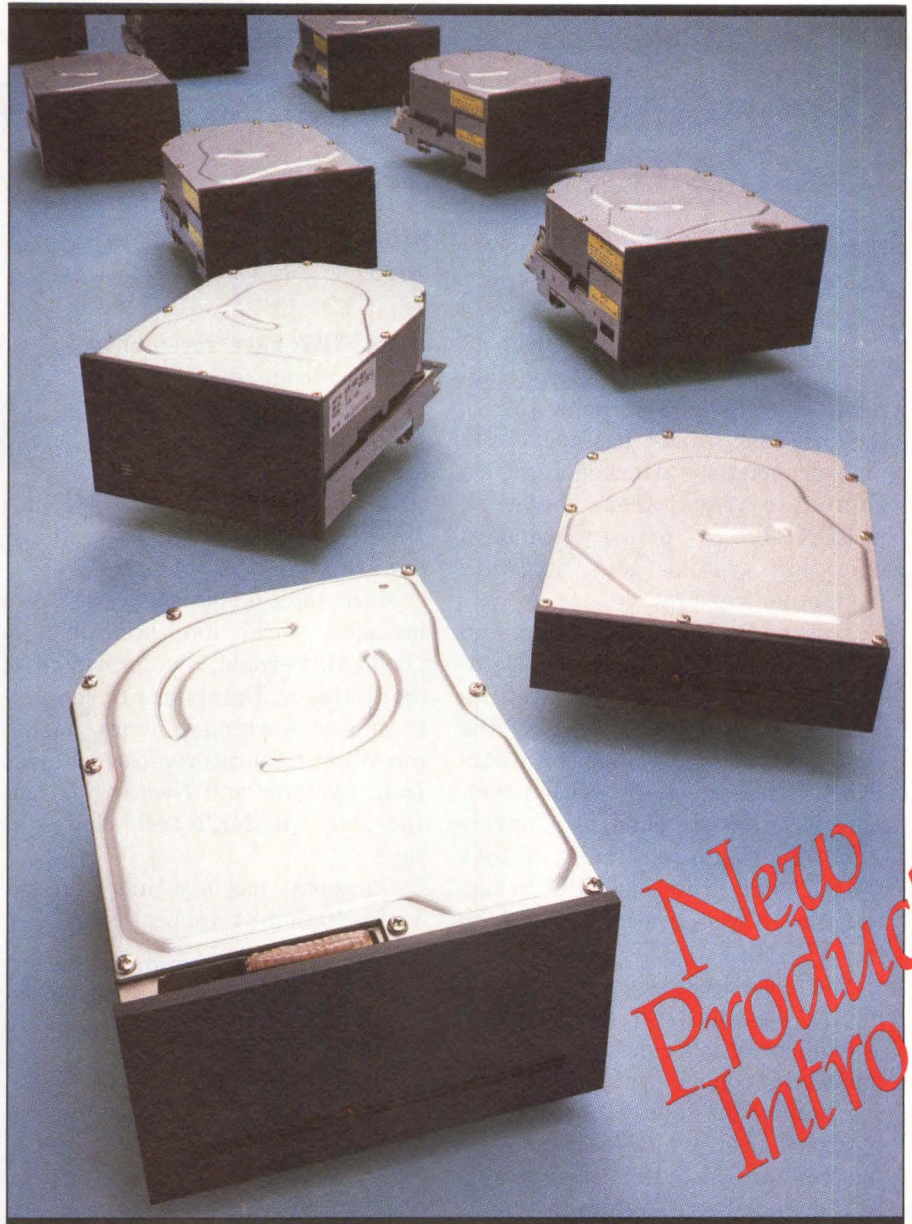
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INTERFACE	ST506 / SA4000	ST506 / SA4000	ST506 / SA4000
POSITIONING METHOD	Buffered Stepper	Buffered Stepper	Rotary Voice-Coil

New products are indicated in red.

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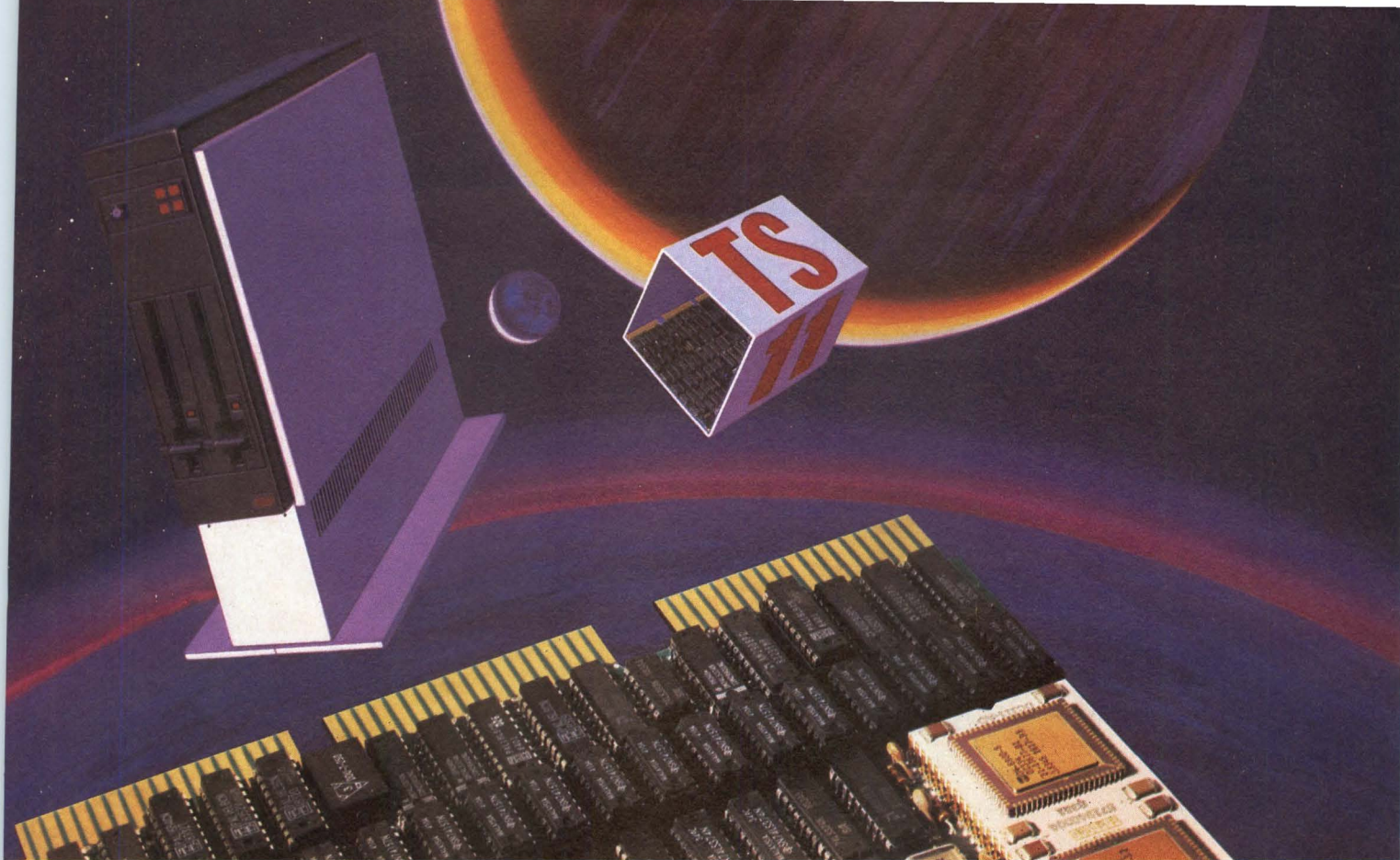
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Powerful is an understatement. The MLSI-JFEP11 is the first application of the DEC J11\* processor other than on the 11/73 single board computer. It features 512KB dual ported memories, two high speed serial ports (one megabaud each) and an external parallel bus for I/O expansion.

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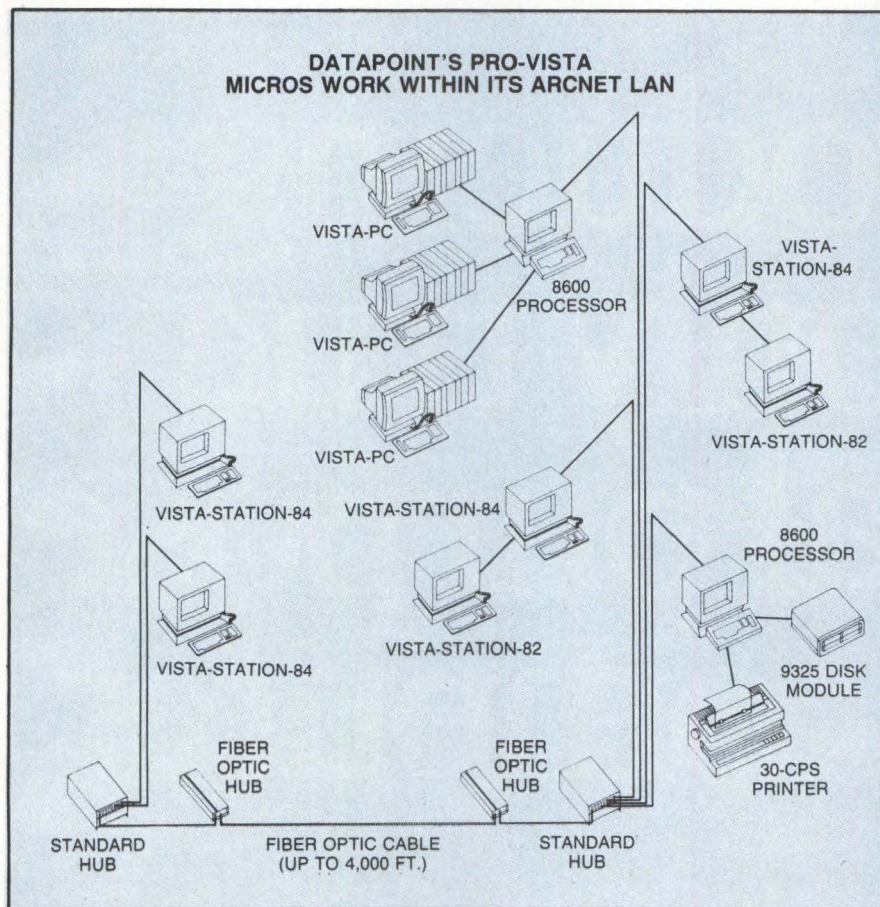
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# Mini-Micro World

## NEWS



Datapoint has opened its ARCNET LAN to outside vendors' products with the introduction of the Convergent Technologies-based Vista-PC. The PC operates as part of the Pro-Vista office-automation family.

RS232C or RS422 serial communications interface.

Vista-Station-82 provides I/O support through an RS422 link to Vista-Station-84. The price of Vista-Station-82 starts at \$2,295.

To provide simultaneous multiple-task management of computing resources within ARCNET, Datapoint offers Vista-View, a windowing technique that operates on Vista-Station-84 and Station-82, according to Gallup. Vista-View, which is licensed for \$1,000 per installation, enables users to switch back and forth from one application to another, as well as exchange data between these applications, Gallup says.

Datapoint has also developed a fiber-optic link that enables users to extend the distance between standard network junctions to 4,000 feet from 2,000 feet.

Datapoint is expanding its marketing channels to strengthen existing indirect and end-user sales, Fernald explains. The company will continue its emphasis on OEMs and Fortune 1,000 companies. □

tion-82 multifunction terminal, based on the Intel 80186. The application processor performs office-automation tasks such as word processing, electronic mail, financial

modeling and windowing. As part of the ARCNET, the application processor (prices start at \$8,550) offers from 0.5M bytes to 1M byte of error-correction code memory, and an

### Burroughs unveils Convergent-based microcomputer

Burroughs Corp. recently joined the flock of computer companies integrating Convergent Technologies Inc. microcomputers and unveiled its version, the B 25 desktop system. The B 25 is compatible with the earlier B 20, yet less expensive and more powerful, according to Edwin F. Carlson, president of Burroughs Information Systems Group.

The B 25 system has snap-together modules designed to meet the requirements of first-time and more experienced users as their needs expand. The system supports clusters of as many as 32 workstations when

used with the company's XE 520 shared-resource processor, which further expands the B 25's capabilities.

For a basic standalone system, including 256K bytes of RAM, a 12-inch display, a keyboard and a dual floppy disk storage module, prices begin at less than \$4,000. Price of a cluster workstation is less than \$2,700.

Burroughs, which claims to be Convergent's largest OEM customer for this line, has the right to manufacture the system, Carlson says, "if the quantities sold are beyond CT's capabilities to manufacture."

The B 20 operating system (BTOS),

MS-DOS and CP/M-86 are available for the B 25. BTOS enables MS-DOS and CP/M-86 to be used in a clustered environment in which multiple MS-DOS applications can concurrently access the same hard disk.

The B 25 and the XE 520 are available through the Burroughs direct sales force as well as the company's dealer network and distribution channels.

Burroughs is putting significant effort into developing application software for the B 25, and more than 250 third-party applications packages are being announced for the system.



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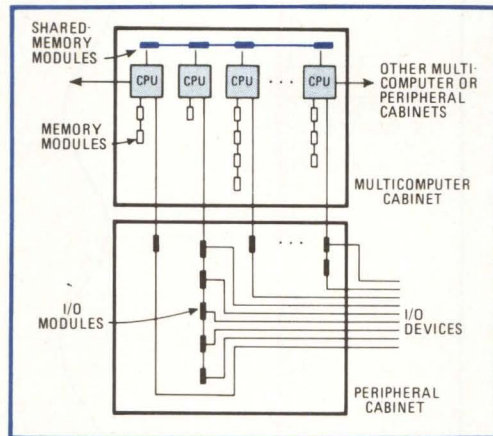
With an entry level system, you get two 32-bit computers with 2 megabytes of local memory, 128 kilobytes of common memory, and 2 VMEbus I/O interfaces all located inside one card cage. It's card cage can accept another 18 cards allowing up to 18 more computers or another 152 megabytes of memory. As you expand your multicomputer, additional computers, memories and interfaces are merely slipped into slots.

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### Virtual Microsystems adds PC-DOS compatibility to DEC micros

Chris Bailey, West Coast Editor

Will adding IBM PC capabilities to Digital Equipment Corp. microcomputers broaden the market for DEC's small computer offerings? Virtual Microsystems Inc. (VMI), Berkeley, Calif., thinks it will. It has DEC's support in the effort.

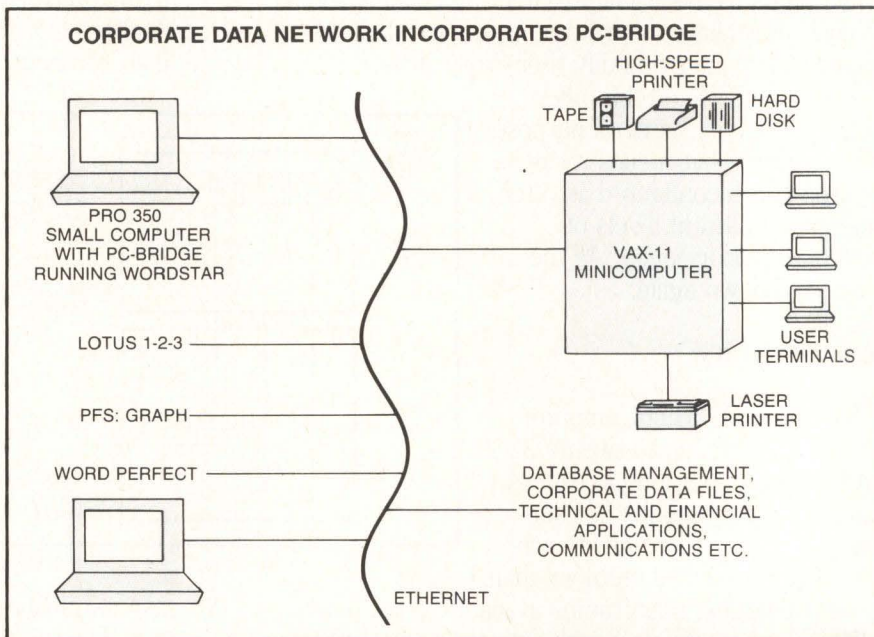
VMI's PC-Bridge creates an IBM PC environment on DEC's Professional 350 and Micro-11 small computers. Comprising a software package and an 8086-based coprocessor board, the PC-Bridge allows users to access such popular PC-DOS- and MS-DOS-based software packages as Lotus Development Corp.'s 1-2-3, MicroPro International Corp.'s WordStar and Ashton-Tate's dBASE-II. At the same time, it maintains the functionality of the underlying DEC system with its mass-storage and peripheral devices. The single-unit price is \$1,750.

#### Emulates graphics card

Using an 8-MHz 8086 and 256K bytes of RAM, the 8086 board fully emulates an IBM PC color graphics card, enabling the system to run programs that take advantage of the IBM bit-mapped graphics memory.

The specially adapted PC-DOS operating system runs as a task under the sophisticated P/OS operating system—a user-friendly version of DEC's popular RSX-11—that comes with DEC microcomputers. This allows users to run PC-DOS programs concurrently with P/OS applications.

Although developed and marketed by VMI, the PC-Bridge project received close technical support from DEC. Nathan Kolwaski, group



Using DEC equipment and Virtual Microsystems utilities, files can be transferred among microcomputers and minicomputers. Local applications running under PC-Bridge, such as Lotus 1-2-3, dBASE-II and WordStar, can access corporate data files stored under VAX-11-based database-management systems.

product manager for the Professional 300 series, says DEC has committed to volume purchases of the VMI product.

Kolwaski believes the new products will have a significant impact on sales of the Professional line. Because the PC-Bridge is highly compatible with PC-DOS software at the basic input/output system (BIOS) and bit-mapped graphics levels, almost all popular IBM PC software packages should generate on DEC microcomputers. "This should appeal to our targeted customer base and help us broaden our market penetration," Kolwaski says.

Michael Stone, senior analyst with Future Computing Inc., a Richardson, Texas, market research concern, agrees that the availability of IBM PC software packages will

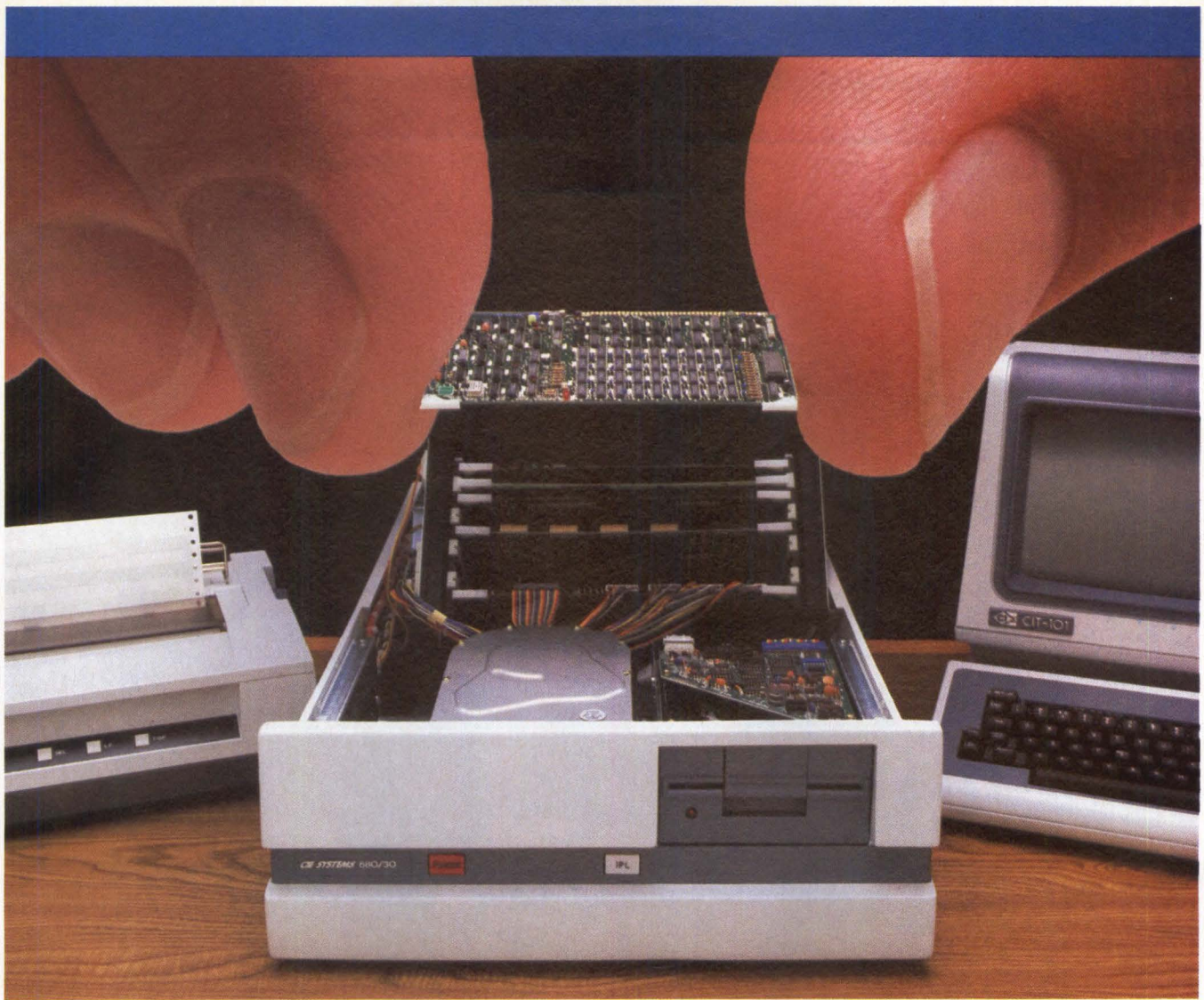
help sell the Pro and Micro-11 system products.

Ken Churilla, vice president of the microcomputer industry group at Creative Strategies Inc., San Jose, Calif., concurs, adding, "The product concept is a good one. The low cost and widespread availability of IBM PC-based software would be a plus for anyone considering the purchase of a Pro or Micro-11 system."

#### Target: networks

Lance Batten, vice president of VMI, says the company targets distributed-processing applications for PC-Bridge. "Micros make user-friendly front ends for network access, and systems such as the [DEC] VAX-11 make very good back-end nodes for handling central functions such as data management, commu-





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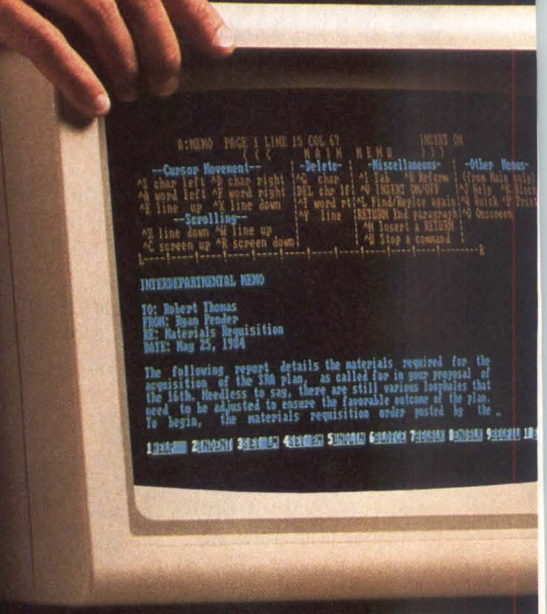
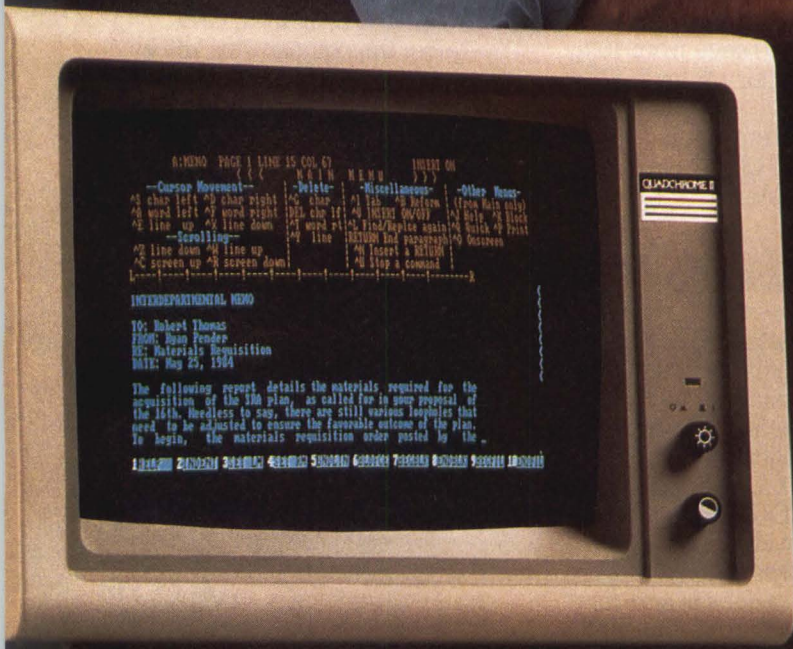
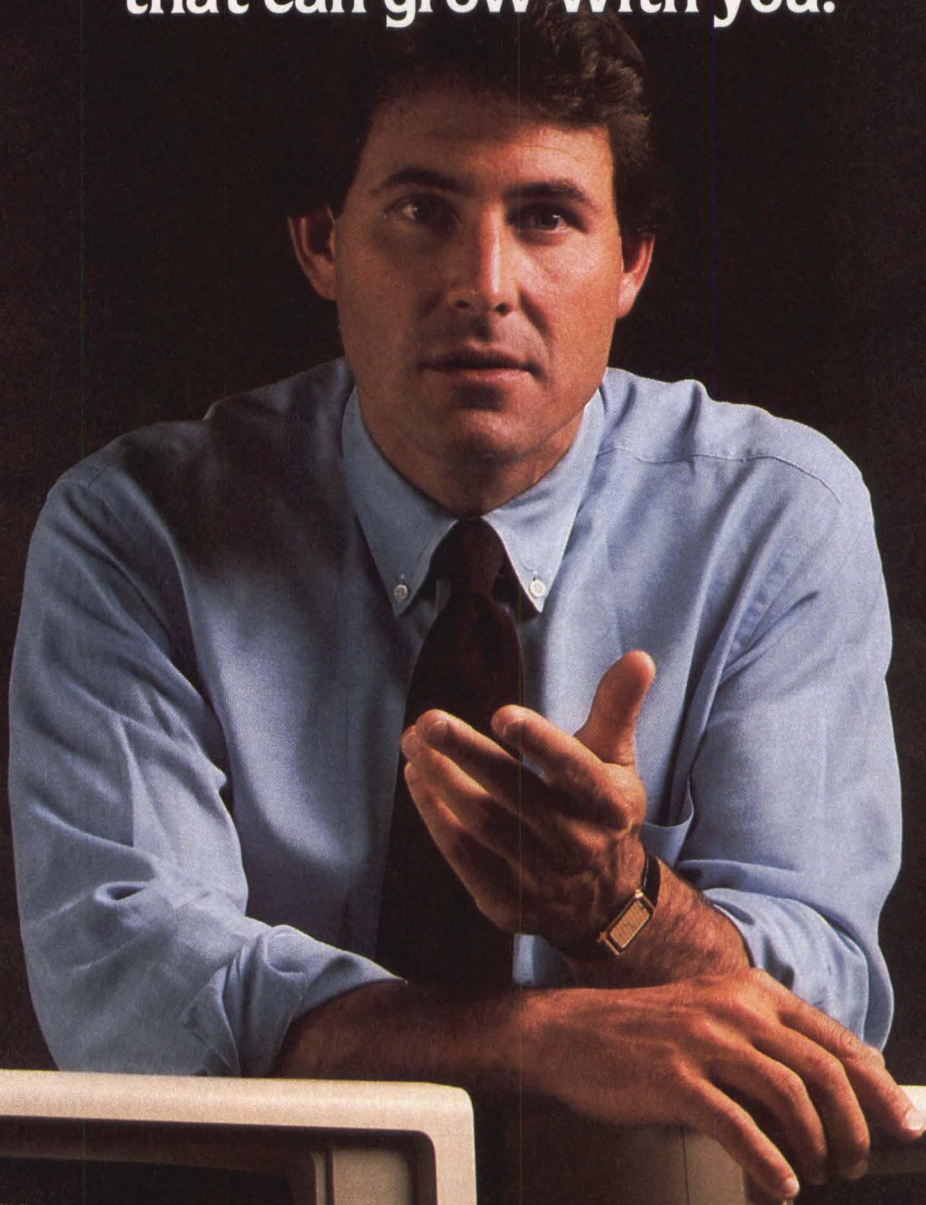
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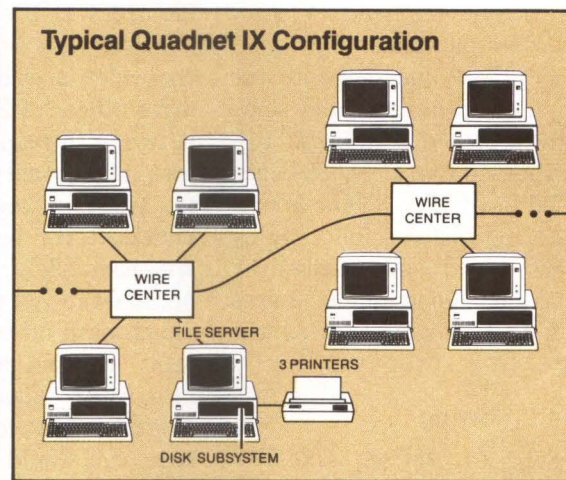
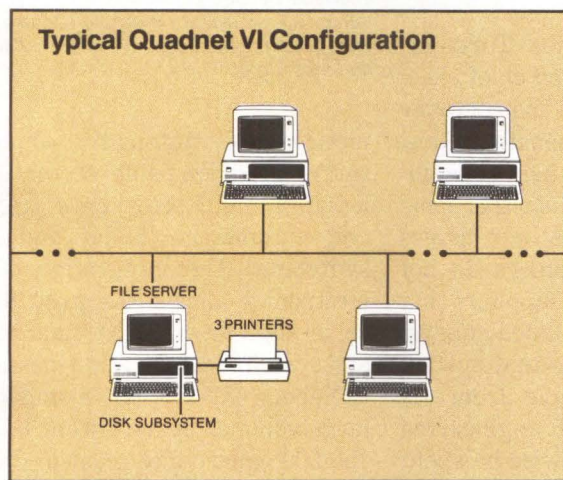
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nications and peripheral management. With the PC-Bridge product, DEC's front-end product line is improved through the availability of popular IBM software packages."

Kenneth Lim, a personal computer research analyst at Dataquest Inc., likes PC-Bridge's technology but wonders how big a market exists for it. He points out that purchasers of DEC Professional 350 systems may not have cared about IBM PC compatibility; otherwise, they wouldn't have bought DEC equipment.

A three-year-old company with \$3 million in annual sales, VMI has established itself with the DEC after-market community and UNIX microcomputer market as a supplier of hardware and software packages. These products add CP/M, MS-DOS and p-System compatibility to DEC's VAX-11 and PDP 11 systems and to several 68000-based UNIX systems, including those from Altos Computer Systems and Victory Computer Systems Inc.

These VMI products fit into the minicomputer mainframe and service locally attached terminals. PC-Bridge differs in that the 8086 board is installed in the Pro 350 or Micro-11 chassis and is accessible only by local users. Other users, linked by communication lines or local-area networks (LANs), can access the files.

### Good and growing

According to Batten, the PC-Bridge market is a good fit now for his small, software-oriented company. But he sees even greater growth in the future as personal computers are integrated into corporate data networks.

Analyst Stone agrees, adding that half of large companies recently surveyed by Future Computing are planning LANs or distributed data-processing networks with small systems as workstations. □

## Xebec Owl combines on-board controller, electronics

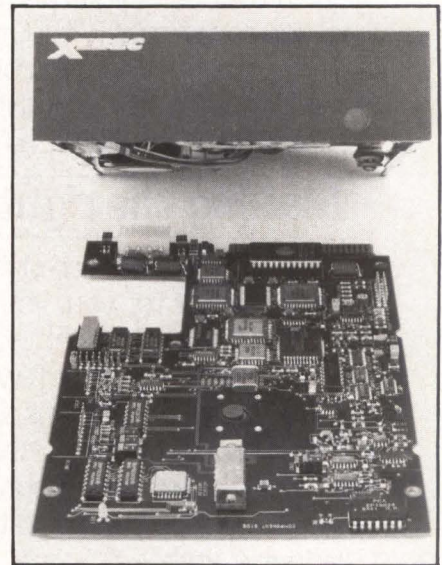
Tom Moran, Associate Editor

Xebec, San Jose, Calif., maker of intelligent Winchester disk drive controllers and subsystems, is introducing the Owl, a half-height, Shugart Associates systems interface- (SASI-) compatible, 5¼-inch Winchester disk drive with drive electronics and controller combined in one built-in printed-circuit board. Xebec claims the 10M-byte Owl is the first 5¼-inch drives with an on-board controller.

Xebec has also begun pilot production of its own head/disk assemblies (HDAs) at its plant in Sunnyvale, Calif. Previously, the company had manufactured only controllers, selling them and also complete subsystems that contained other manufacturers' HDAs.

According to James Toreson, chairman, president and chief executive officer of Xebec, the company is trying to reap the benefits of low cost, high quality and high reliability. He adds that, when the same manufacturer provides both drives and controllers, customers do not become the victims of suppliers that blame each other for failed subsystems. Toreson projects that system integrators should save from six months to a year of engineering time that would otherwise be spent in evaluation and compatibility testing of a new system.

The Owl measures 1.63 by 5.75 by 8 inches. The drive's data-transfer rate is 5M bits per second, and average access time is 99 msec. A band actuator and an open-loop stepper head position the four heads over the two metal-oxide platters. The Owl's controller is compatible with Xebec's S1410 controller and offers position verification, auto-



The half-height, 5¼-inch Xebec Owl Winchester disk drive includes a single printed-circuit board incorporating both drive electronics and controller. Elimination of the interface between controller and drive electronics allows system integrators to use high-level SASI fault-status and system-configuration messages.

matic seek, automatic command retry, programmable sector interleaving, multisector data transfer and automatic cylinder and head switching. The integration of the electronics allows the host to receive high-level SASI fault-status and system-configuration messages.

Xebec expects to manufacture large volumes of the Owl at its new 150,000-square-foot plant in Carson City, Nev. The facility will have three HDA assembly lines, each with a 5,000-square-foot clean room. Toreson says Xebec will announce a second source for the Owl that, if necessary, will augment the company's ability to produce HDAs.

### Owl uses LSI technology

Xebec was able to combine the Owl's drive electronics and controller by using surface-mounted chips



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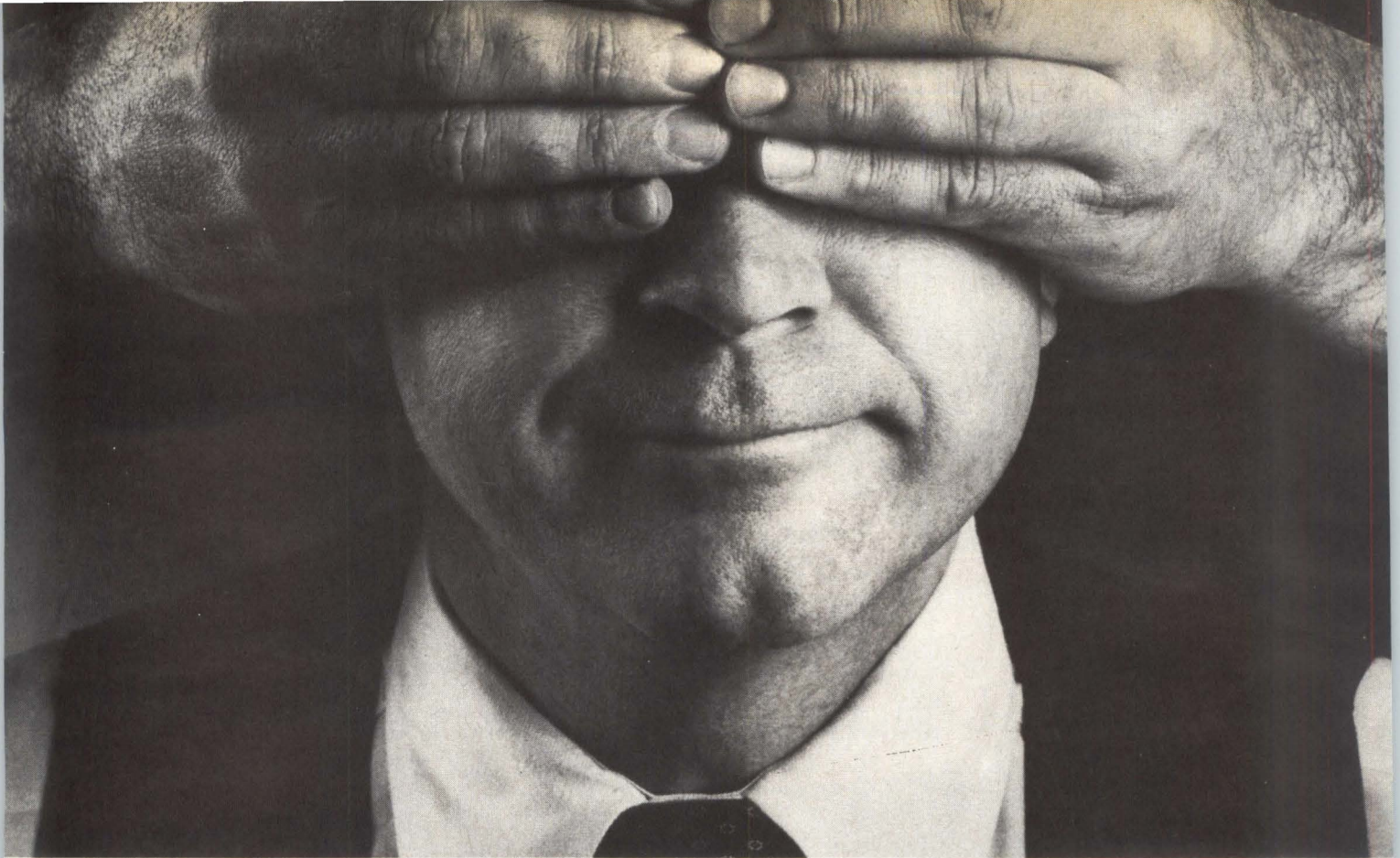
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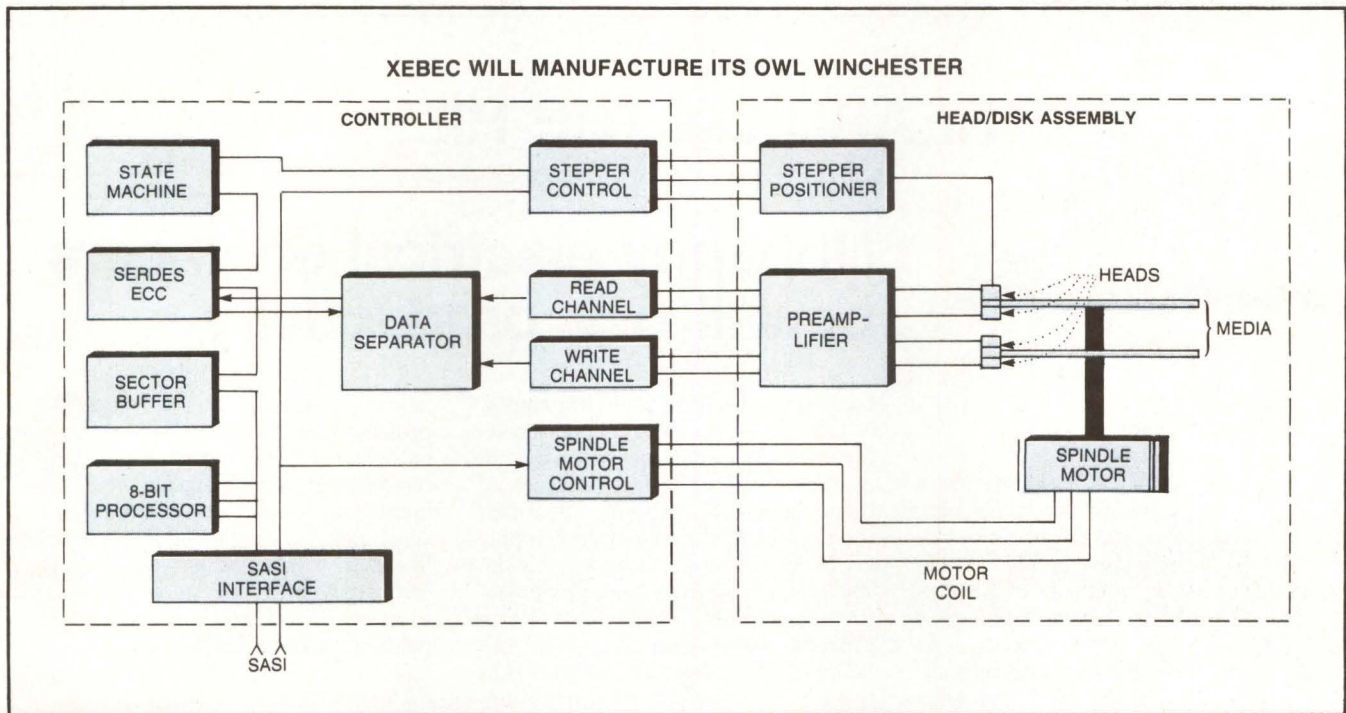
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# Mini-Micro World

## NEWS



The Xebec Owl's one integral printed-circuit board incorporates both disk controller and drive electronics. LSI surface-mounting technology allows Xebec to eliminate one printed-circuit board and the ST-506 analog interface.

and large-scale integration and by eliminating the need for the separate ST-506 interface that normally connects the controller to the drive electronics. The interface cable, drivers and receivers, a micro-processor and its support chip are all unnecessary. Xebec also eliminated the controller's ability to support multiple drives, a function that Toreson says is seldom-used in the small systems for which the Owl is intended.

Xebec expects to announce a 3½-inch version of the Owl. Toreson says the initial capacity of the 3½-inch drive will likely be 10M bytes and will be raised to 20M bytes when improved heads and media become available. Xebec will sell the Owl through its direct sales force and selected distributors, with units possibly going to large computer chain stores by next year.

Jim Porter, editor of *Disk/Trend Report*, Los Altos, Calif., says the Owl has a good chance of success.

"[Xebec is] offering a very appropriate product that potentially has a very wide customer base. The general climate among system manufacturers is acceptance of SASI and the small computer system interface (SCSI), which is closely related, for a very high proportion of the sys-

tems now under development. This is the beginning of [realizing] a long-established Xebec intent to make its own disk drives."

The company expects to ship the Owl in pilot production quantities in August. They will be priced at less than \$500 in OEM quantities. □

### IBM EUROPE ALTERS DEALER STRUCTURE

IBM Europe has altered its dealer sales structure for the first time, giving it some semblance of a Value Added Reseller (VAR) program (MMS, April, Page 25). IBM is not using that terminology but instead has come up with an Authorized Reseller tag that would allow dealers to buy Series/1 minicomputers and CS9000 MC68000-based microcomputers at 15 percent to 30 percent discounts. In return, the dealer would have to attend IBM-sponsored classes, get IBM approval of marketing plans, buy demonstration machines and provide suitable sales sites and adequate user support. In addition, IBM now has the Application Resellers program, which offers third parties the 4300, System 36 and System 38 hardware at 12 percent to 18 percent off list. The operating system carries a 25 percent discount, provided the remarketer is addressing a vertical market. For software and systems houses not adding much value but focusing on sales, support and installation, IBM offers the Complimentary Marketing Program with 3 percent to 8 percent discounts on hardware.



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### Unhappy electrical engineers bewail U.S. productivity

**Stephen J. Shaw**  
Washington Editor

One-quarter of electrical engineers (EEs) are dissatisfied with their jobs, according to a recent survey conducted by Louis Harris and Associates Inc. for the Institute of Electrical and Electronics Engineers (IEEE). The Harris poll also found that U.S. productivity is the top concern among EEs surveyed, and more than seven out of 10 rate this country's productivity only "fair" or "poor."

Electrical engineers are highly critical of their own managers' productivity and efficiency. More than one in three flatly stated that engineering managers in their organizations are not at all effective or productive. This harsh view is also shared by 28 percent of the engineering managers surveyed.

The survey was conducted to determine the EEs' perceptions of their training, profession, social responsibilities and co-workers. Earlier this year, Harris contacted 4,000 IEEE members and received 1,646 responses to its questionnaire and follow-up telephone calls.

"It's a surprising indicator of problems that must exist in engineering management today in U.S. firms," says Ellis Rubinstein, managing editor of IEEE *Spectrum*, the official publication of the engineering association and sponsor of the survey.

The Harris study should be placed on the required reading list of all electrical engineering companies. The study's insights into the thinking of U.S. engineers, and some of its recommended responses to the disturbing trends, could prove valuable in shaping the future role of EEs in

business and academic environments.

The survey suggests telling characteristics of the EE profession's composition today. The largest block of respondents, 17 percent, identified themselves as working in the computer hardware and software fields. Thirteen percent work in communications, and only 1 percent work in consumer electronics.

The survey base also indicates that the EE profession is still overwhelmingly male-dominated. A minuscule portion of the respondents, 3 percent, are women. But the study does show that women are slowly entering the profession in greater numbers as they complete their educations. Ten percent of the EEs under 30 years old are female.

The most disturbing findings are the relatively high rate of job dissatisfaction and the concern expressed about the nation's productivity. According to the Harris analysis, the number of EEs not satisfied with their jobs (25 percent) is twice as high as among lawyers, and five times as high as among doctors. Productivity worries, and the ability of the United States to compete in world markets, far outstripped EEs' concerns about the nuclear arms race and threats to job security posed by automation.

Not surprisingly, dissatisfaction is most prevalent among those under 30 years old (29 percent) and among those with 1983 incomes of less than \$35,000 (32 percent)—almost twice the percentage of those earning more than \$50,000. The youngest EEs also reported the greatest disappointment with their careers, symptomatic of what Harris calls "me-generation attributes." "It is nonetheless jarring to see signs that the new generation of electrical engi-

neers—who hold the future of the profession in their hands—show less enthusiasm for the future of the profession than for satisfying their own immediate needs," states the report. The majority of under-30 EEs are not likely to be concerned about U.S. competitiveness (51 percent), their companies' technical reputations (65 percent) and national politics unrelated to engineering and technology (67 percent).

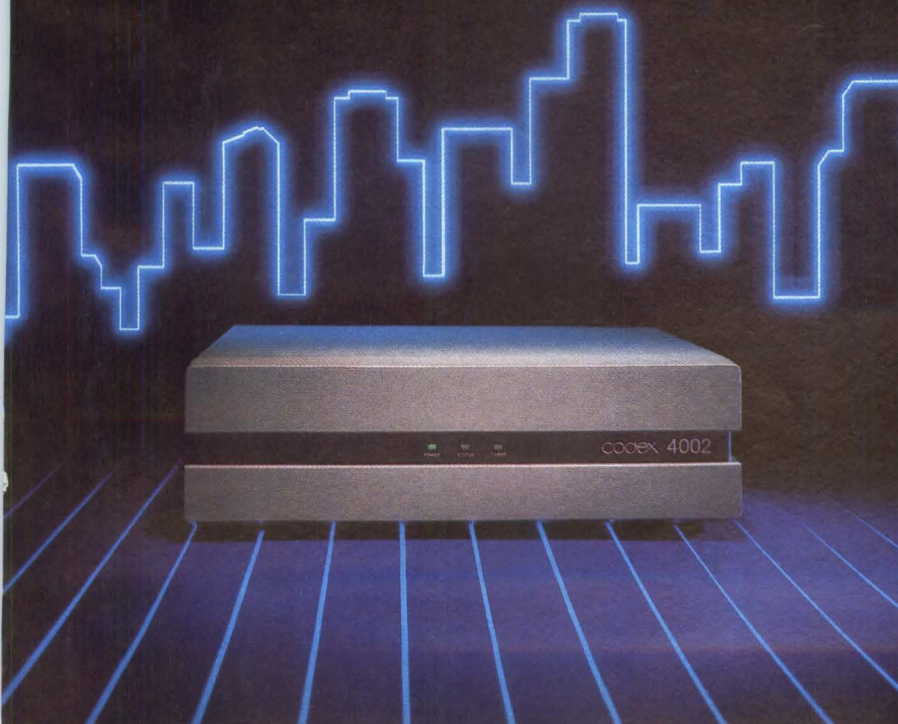
However, the nation's competitive position in world markets ranks as the chief worry of EEs of all ages, suggesting their anxiety about the erosion of U.S. technological superiority. EEs who feel that poor productivity is to blame for the decreasing ability of the United States to compete internationally are far more likely to point to labor unions as the chief cause. But almost one-third say that managers of engineers must bear the primary responsibility for poor productivity, and 10 percent blame engineers. Among EEs working in computer hardware, one-third describe U.S. productivity as "excellent" or "pretty good," which is somewhat more than any other EE employment category.

Engineering managers are classified as neither effective nor productive by 35 percent of the EEs surveyed. Supervisors are more likely than any other group to be considered highly effective (24 percent) and are perceived to be the most likely group to work "somewhat" (41 percent) or "considerably" more than the required work week.

For a copy of the report, contact the IEEE Service Center, 445 Hoes Lane, Piscataway, N.J. 08554. Publication number TH-0112-3. □



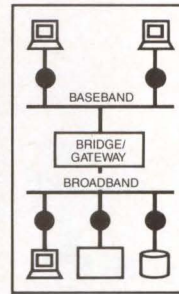
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### Calcomp plotters provide drawings at workstation economies

Ron Shinn, Senior Editor

The new 1040 series of eight-pen vector plotters from California Computer Products (Calcomp) Inc., Anaheim, Calif., brings A- through E-sized drawings on cut-sheet or roll-feed media into the \$7,500 to \$12,000 price range, making high-speed, large-sized plotting available at workstation economies.

The series comprises four plotters with performance levels designated as either "low" or "high"—0.5G acceleration at 6 inches per second (ips) and 1G at 14 ips, respectively. Two machines are offered in each designation, one handling cut-sheet only and one handling both cut-sheet and roll-feed (dual-mode) media. Resolution for all four plotters is 0.001 inch.

According to Calcomp president Bill Conlin, the new series addresses the high end of the personal computer market. "We are very serious about going after this market because it represents a big, untapped potential," he says.

#### Series boasts new design

The 1040 series incorporates many new design features and sets Calcomp standards for the other products that fall between the company's \$2,000 model M84 and the \$15,000 to \$25,000 1070 series of plotters. The 1040's supports are made of injection-molded structural foam, and most pen block parts are made of injection-molded plastic. The three lower-priced units incorporate a grip drive instead of a traditional sprocket drive, and the plotters include 68008 microprocessor intelligence, 6803 servo controllers for the linear voice-coil motor in the pen block, and user-

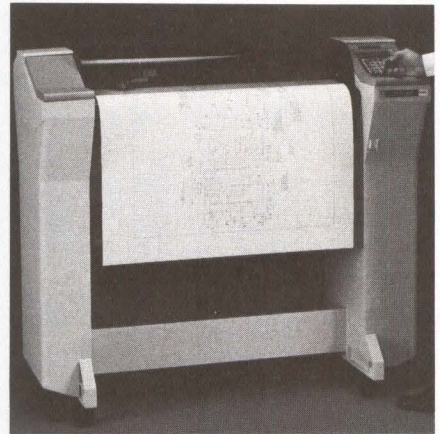
programmable electrically erasable read-only memory (EEROM) holding four sets of plotting parameters.

The eight-pen, turret-type pen-exchange mechanism rotates a pen into place directly above the writing site on-the-fly, eliminating the slow throughput of pen-picking schemes that position the pens from the side. Calcomp engineers claim that the turret should yield throughput increases of as much as 40 percent, depending on applications, over competitively priced units with side pen-picking designs.

Analysts see Calcomp's new plotter as a significant addition to the vector plotter market. For example, Laura Nichols, an industry analyst for Dataquest Inc., San Jose, Calif., says, "Look to Calcomp to be active in the low end of the market in which microcomputers have been constrained by a lack of software interfaces. When a company with this kind of graphics background enters the market, [it] could be fairly potent."

Neil Kleinman, general manager and analyst at International Data Corp.'s Pacific Technology Center, Santa Monica, Calif., believes that Hewlett-Packard Co.'s 7500 series of plotters defined the market for computer-aided-design/computer-aided-manufacturing systems selling for \$50,000 to \$100,000. He sees the Calcomp product as a response to the emerging market for computer-aided-engineering systems that will sell for \$15,000 to \$40,000. "[The Calcomp product] makes large, high-speed plotting affordable at the workstation level instead of at the low-cost, turnkey, computer-aided-design system level."

Kleinman sees desktop pen plotters as a 50,000-unit-per-year mar-



Calcomp's new 1040 series of eight-pen vector plotters handles A- through E-sized drawings at 6 or 14 ips. The model 1043 (shown) is the cut-sheet-, high-performance version. Prices for the series range from \$7,495 to \$11,995.

ket, freestanding units as a 10,000-unit-per-year market and the new 1040 series in "volumes of 20,000 to 25,000 per year by 1987 or 1988, as it gains market-wide acceptance."

Kleinman believes the number of pens is the key to the 1040 series' effectiveness because the use of eight will provide users with multiple windows (integrated software) and allow them to issue plot commands without changing pens for each task. "Someone with a single workstation doesn't want to spend \$15,000 for a plotter, and this [product provides] high performance for only \$7,000 to \$8,000."

The 1040 series uses Calcomp's 960 Driver software and will have a built-in controller for serial and parallel interfaces. The interfaces reside in a ROM pack and are field-level replaceable. The first available ROM pack will serve RS232C serial and IEEE 488 parallel interfaces, and a second version, scheduled for early 1985 availability, will have RS232C and HP Graphics Lan-



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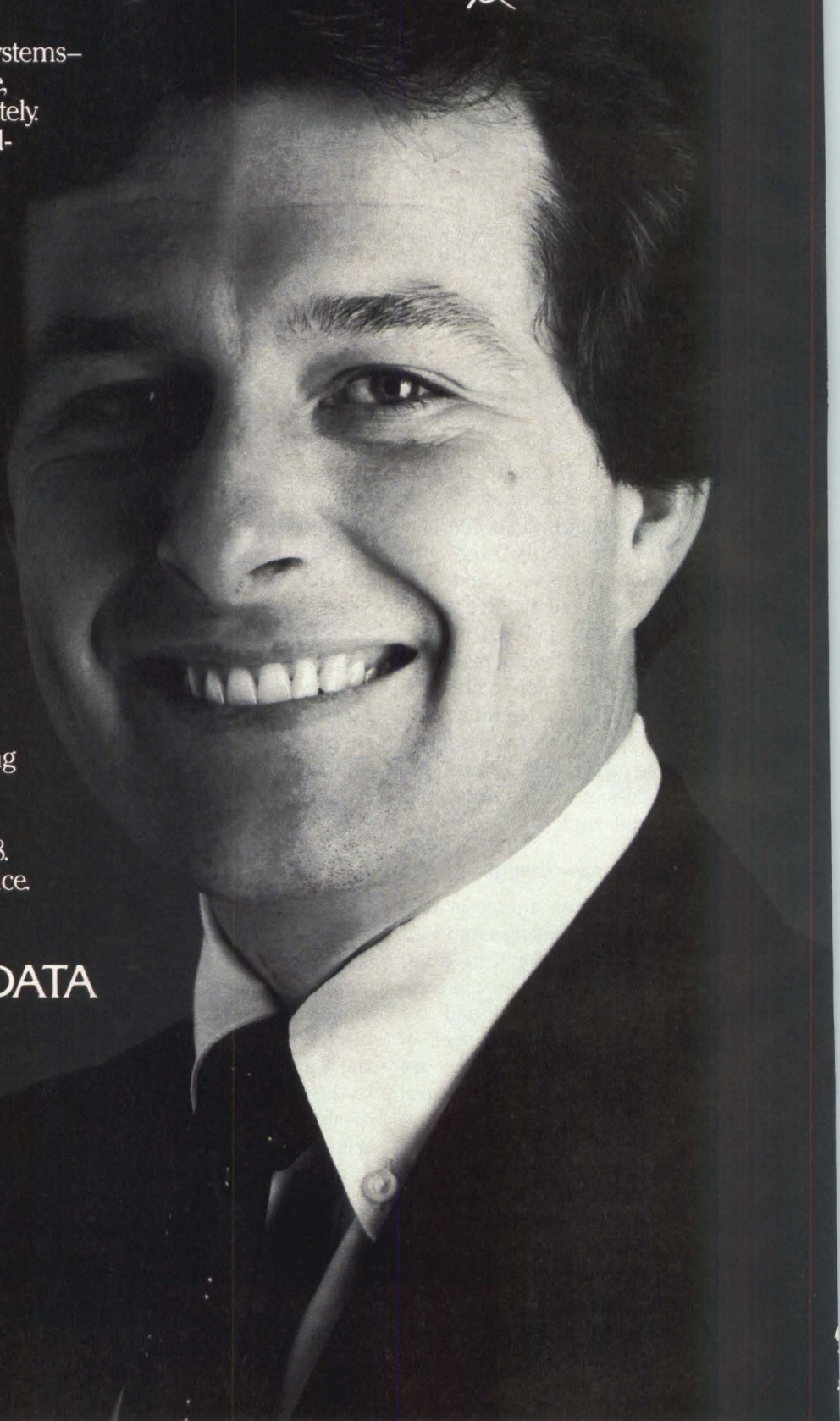
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CIRCLE NO. 35 ON INQUIRY CARD





# Mini-Micro World

## NEWS

guage compatibility.

The pens used in the new plotters can be liquid ink, nylon-tipped or ceramic-tipped. To select a pen, the turret's optical sensors read the metallic-band code integral to each pen as it travels toward the writing surface. A user selects pen pressure, which is stored in the EEROM, to set parameters for media such as mylar or paper. The pens are unique to the series, and Calcomp is setting second-sourcing and prices that will be comparable with competing pen plotters.

A built-in automatic logging feature using the on-board microprocessor allows users to set up a plot using a 40-character, 2-line liquid-crystal display and an associated, tactile-feedback keypad rather than a separate control terminal.

Adding a standard modem enables the plotters' built-in display and intelligence to communicate in conversation mode with a host.

### Self-diagnostics for all

Each plotter has ROM-based self-diagnostics that are included on the plotter's two standard boards—a system controller board and an analog board. The sprocketed, high-performance, dual-mode model uses a third board that incorporates Calcomp's Sonic Sensor to determine paper position within the castors. The two basic cards can be interchanged among the plotters.

Calcomp offers service contracts with a standard 90-day warranty period for the plotters. Service contracts could be priced as low as 5 percent of purchase price, says Con-

lin. Because the new plotters weigh approximately 120 pounds each, Calcomp will most likely provide on-site service.

The company plans to begin production shipments of the cut-sheet low- and high-performance versions by October, the dual-mode, low-performance version by November and the dual-mode, high-performance model by December.

Preliminary single-unit prices are \$7,495 for the cut-sheet, low-performance model 1041, \$8,495 for the dual-mode, low-performance model 1042 and the cut-sheet, high-performance 1043 and \$11,995 for the dual-mode, high-performance 1044. The 1041 can be field-upgraded to the 1043. According to Conlin, OEM quantity discounts will be competitive. □

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CIRCLE NO. 36 ON INQUIRY CARD



## Half-height Winchester family offers 57M to 202M bytes

Carl Warren, Western Editor

To address the increasing demand for more storage on a 5¼-inch spindle, Advanced Storage Technology Inc. (ASTI) has been privately showing its family of high-performance, high-capacity Winchester half-height drives.

The family of drives ranges in capacity from 57M to 202M bytes and uses thin-film media and heads from parent company Cybernex Corp., San Jose, Calif., of which ASTI is a recently formed subsidiary. The equipment is said to provide tighter margins and what

ASTI vice president Dan Klang states is superior disk-to-head compliance.

Besides employing thin-film media and heads, the drives use a voice-coil-driven linear carriage. Electronics are contained on a single printed-circuit board in very-large-scale-integration (VLSI) circuits. To ensure data reliability, a dedicated quadrature servo surface, rather than an embedded wedge servo, has been incorporated. Klang insists that a wedge servo is primarily for drives with stepper motors and smaller areal densities, adding that, for drives that use a voice coil

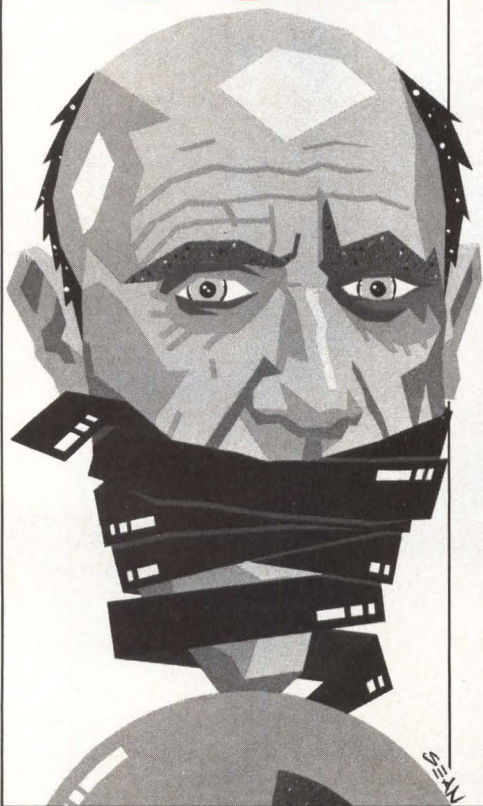
and have track densities of around 1,200 tracks per inch (tpi), the wedge servo tends to limit performance.

### ESDI needed

Because the drives have been designed as a reduced version of storage module device (SMD) drives and sport 10M-bit-per-second (bps) transfer rates, ASTI has found it necessary to employ the enhanced small disk interface (ESDI). Until now, ESDI has been offered only by such companies as its primary developer, Maxtor Corp.

According to Klang, the goal is to compete on a cost-per-byte and box basis with SMD drives. Moreover, he contends that SMD has run out of gas and something else has to step in to replace it. For the ASTI family

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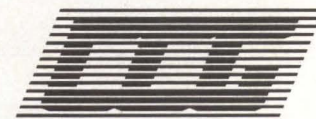
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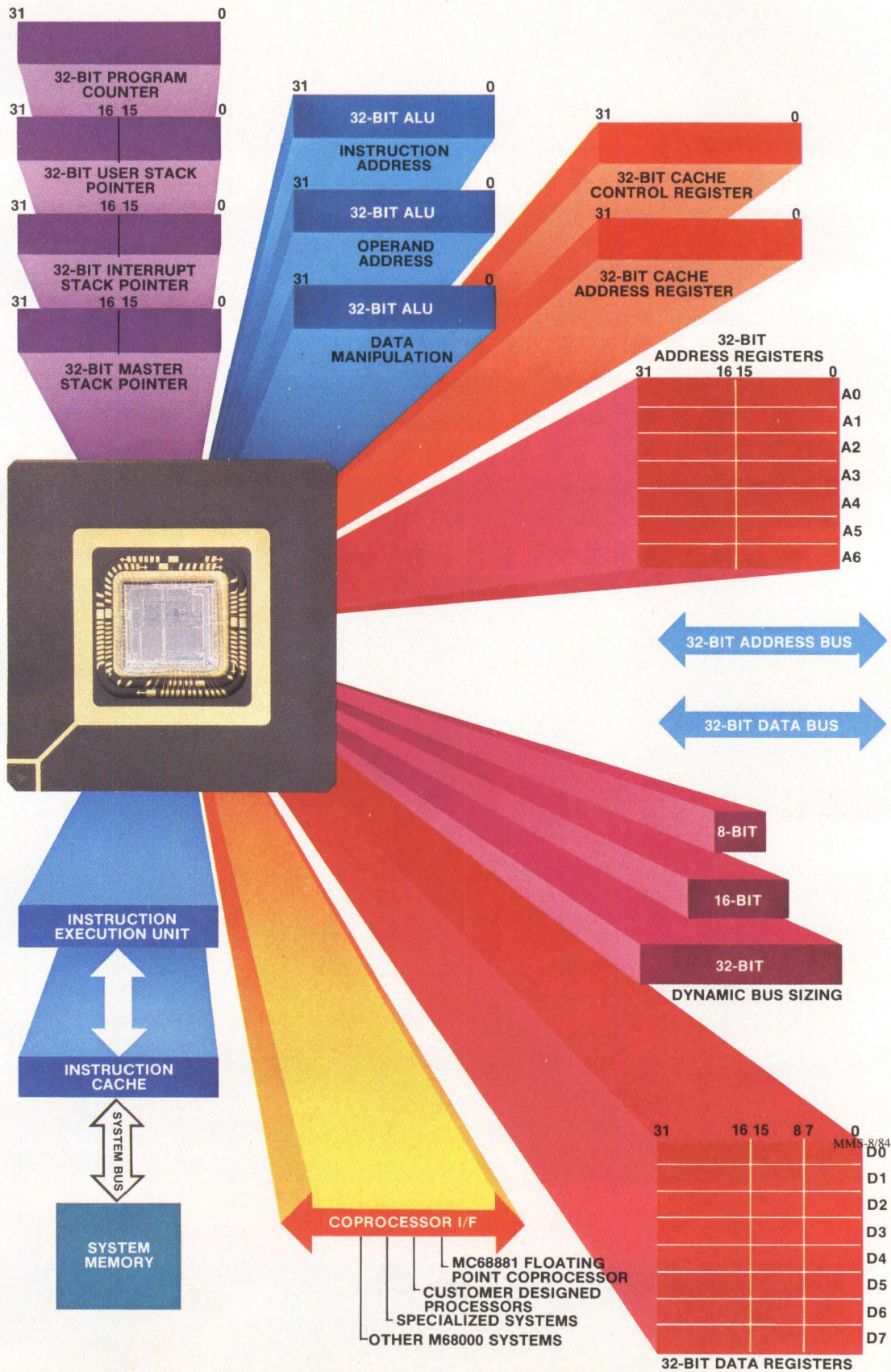


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## A fully compatible M68000 Family member.

Yes, the MC68020 has features new to the M68000 Family to maximize its true 32-bit capabilities.

Yes, it's an all new design built with advanced, highly manufacturable HCMOS technology.

And, yes, it's a fully-compatible member of the M68000 Family of MPUs and peripherals. All user object code written for previous M68000 Family MPUs executes without revision. In fact, MC68020 enhancements allow it to run more than three times faster.

Family compatibility is further enhanced by dynamic bus sizing, which supports the use of 8-, 16- and 32-bit ports in 68020-based systems. In fact, the MC68020 can be used in existing 8- or 16-bit systems.

## New features enhance 32-bit architecture.

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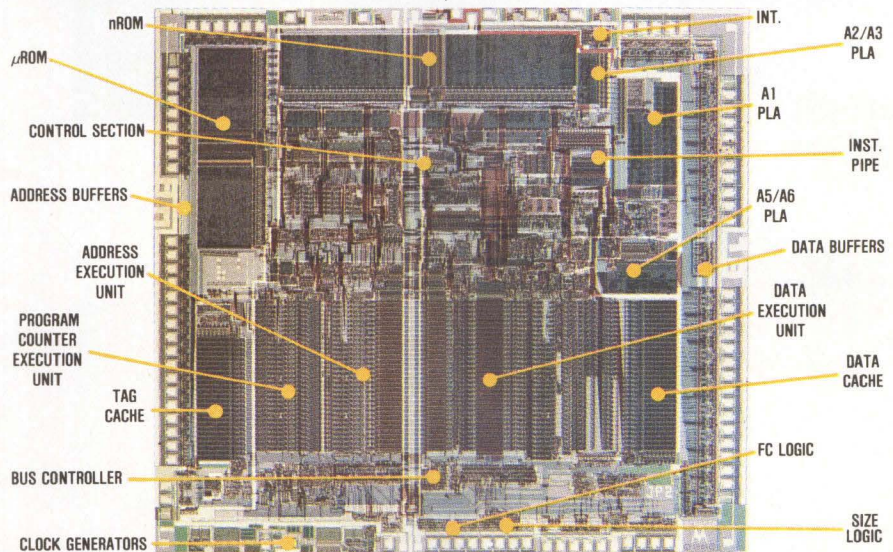
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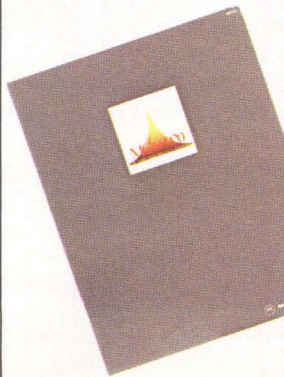
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# Mini-Micro World

## NEWS

96200, consisting of the 57M- and 103M-byte models, EDSI meets part of the need. "It may not be the best interface, but it does put the data separator on the drive, where it belongs, and that's the beauty of it, especially for drives with high

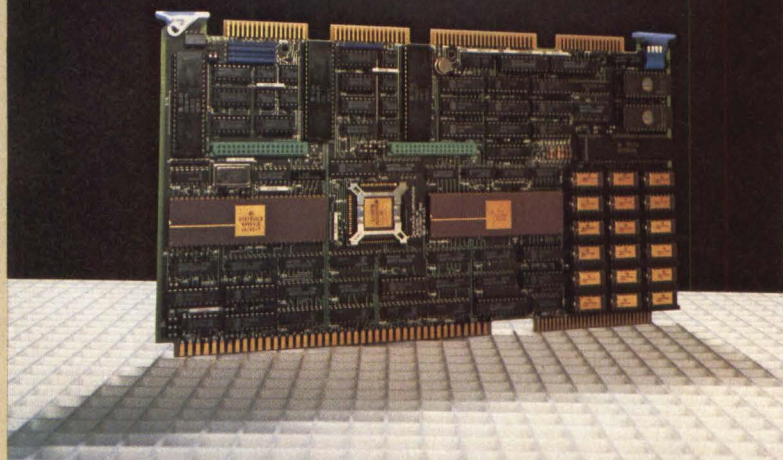
transfer rates," says Klang.

ASTI plans to sell the "low-end" family for as little as \$850 for the 57M-byte model and \$1,100 for the 103M-byte model—prices that are almost 20 percent lower than market rates. But Klang is quick to

point out that the prices are for very large OEM quantities.

Although achieving 57M and 103M bytes seems like an optimistic goal to reach by September—when evaluation versions are anticipated—Klang asserts that the 96200 drives represent only a small part of the family architecture. "We are taking a full-family approach to propel us, as a company, into the 1990s," he says. For example, Klang expects the 12200 (76M- and 127M-byte) and the 12330 (121M- and 202M-byte) series to be available for sampling by mid-1985. He says the families represent the next step up the performance ladder and will require a better system architecture. The 12330 series, for example, offers a 15.87M-bps transfer rate and a 1,200-tpi track density. To achieve the high areal densities required to provide high capacities in half-height configurations using a maximum of three disks for the 202M-byte model, ASTI is relying on 2,7 run-length-limited code. As a result, a recording density of 30,502 bpi is easily achieved.

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CIRCLE NO. 38 ON INQUIRY CARD

### Looking beyond ESDI

As ASTI sets its sights on the higher-performance family, it is also convinced that a more powerful, almost-SMD-like interface is required. "ESDI can take it to one plateau. To get to the performance levels we need, it looks like the intelligent peripheral interface (IPI) is the way to go," says Klang.

According to chairman William Roberts of Emulex Corp., Costa Mesa, Calif., IPI is a better device-level interface for high-performance drives. Roberts expects that, as more drives like ASTI's become available, controller manufacturers will embrace IPI.

Specifically, ASTI will use the IPI 2 version when implemented, which is a device-oriented interface. IPI 2 allows transfer rates greater



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# Mini-Micro World

## NEWS

### THE ASTI HALF-HEIGHT WINCHESTERS AT A GLANCE

Specification/model number	96202	96203	12202	12203	12332	12333
<b>Capacity unformatted</b>						
• per drive (M bytes)	57.5	103	76.5	127.5	121	202
• per surface (M bytes)	19.2	20.6	25.6	25.6	40.5	40.5
• per track (bytes)	20,880	20,880	20,880	20,880	33,060	33,060
<b>Transfer rate (M bits/sec)</b>	10	10	10	10	15.87	15.87
<b>Access time (msec. incl. settling)</b>						
• average	30	30	30	30	20	20
• track to track	5	5	5	5	4	4
• maximum	50	50	50	50	35	35
<b>Rotational speed (rpm)</b>	3,600	3,600	3,600	3,600	3,600	3,600
<b>Average latency (m sec.)</b>	8.33	8.33	8.33	8.33	8.33	8.33
<b>Recording density (2.7 RLL code)</b>	18,462	19,405	19,264	19,264	30,502	30,502
<b>Recording density (FCI-flux changes/in.)</b>	12,308	12,937	12,843	12,843	20,335	20,335
<b>Track density (tpi)</b>	960	960	1,200	1,200	1,200	1,200
<b>Cylinders</b>	921	987	1,225	1,225	1,225	1,225
<b>Tracks</b>	2,763	4,935	3,675	6,125	3,675	6,125
<b>Data heads</b>	3	5	3	5	3	5
<b>Servo heads</b>	1	1	1	1	1	1
<b>Platters</b>	2	3	2	3	2	3

Note: All drives measure: 1.625 x 5.750 x 8 in. However, the three platter version is 1.95 inches in height.

than 10M bps and offers more attributes and control but keeps such things as error-correction code (ECC) and other control functions on the controller—where most drive and controller makers believe they belong. Further, Priam Corp.'s I. Dal Allan, a member of the American National Standards Institute's X3T9.2 committee for IPI, speculates that with the availability of higher-performance differential line drivers—such as the American Micro Devices 2638—transfer rates of 10M bps and higher can be easily achieved.

High-volume production of the ASTI 96200 family is set for the first quarter of 1985. Evaluation models of the 12200 and 12330 families also are planned for the first quarter of next year. □



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TOEI, experienced Display Monitor specialists, offer a wide selection of Color CRT Displays. You can choose from our versatile standard models or OEM versions to meet your exacting requirements.

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Versions CRT Size	RGB Version	NTSC Version	PAL Version	NTSC & RGB Version	PAL&RGB Version	IBM PC Compatible only
12" (CRT Pitch)	FTC-1201-R* (0.47mm Stripe)	FTC-1200-N (0.64mm Stripe)	FTC-1200-P (0.64mm Stripe)	FTC-1201-NR (0.47mm Stripe)	FTC-1201-PR (0.47mm Stripe)	FTC-1203-H* (0.38mm Dot trio)
	FTC-1203-R* (0.38mm Dot trio)	FTC-1201-N (0.47mm Stripe)	FTC-1201-P (0.47mm Dot trio)			FTC-1208-H (0.28mm Dot trio)
	FTC-1208-R* (0.28mm Dot trio)					
14" (CRT Pitch)	FTC-1423H-R (0.42mm Stripe)	FTC-1410H-N (0.52mm Stripe)	FTC-1410H-P (0.52mm Stripe)	FTC-1410H-NR (0.52mm Stripe)	FTC-1410H-PR (0.52mm Stripe)	FTC-1435-H (0.39mm Dot trio)
	FTC-1435H-R (0.39mm Dot trio)	FTC-1416-N (0.64mm Stripe)	FTC-1416-P (0.64mm Stripe)			FTC-1455-H (0.31mm Dot trio)
	FTC-1455H-R (0.31mm Dot trio)					

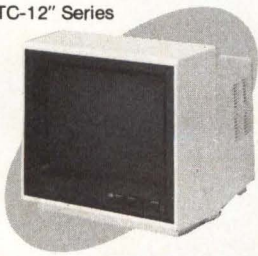
Application/NTSC: PAL (Commodore Apple II, IIe), RGM (IBM PC Apple II, IIe, III RGB TTL & Analog)

\*FTC-1201-R, 1208-R: Applying for FCC Standard (Class B).

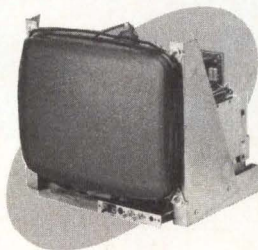
\*through Interface-Module

\*FTC-1203-R: Acquired FCC Standard (Class B). FTC-1203-R, 1203-H: Non-Glare

FTC-12" Series



CDM-14" Series



### CDM Series (Unit for OEM)

Model	CRT Size	CRT Pitch
CDM-1208	12"	0.28mm Dottrio
CDM-1203	12"	0.38mm Dottrio
CDM-1201	12"	0.47mm Stripe
CDM-1455H-R	14"	0.31mm Dottrio
CDM-1435H-R	14"	0.39mm Dottrio
CDM-1423H-R	14"	0.42mm Stripe
CDM-1410H-R	14"	0.52mm Stripe

- Green/Orange CRT Displays are also available. (Included IBM Compatible.) CRT size: 9" or 12". Horizontal frequency: 15.75-64kHz. [15.75kHz version: acquired FCC Standard (Class B).]
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CIRCLE NO. 40 ON INQUIRY CARD



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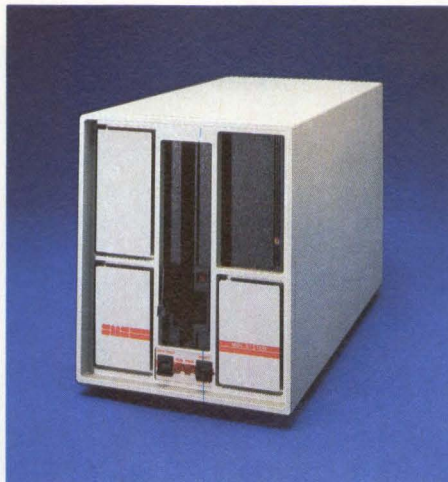
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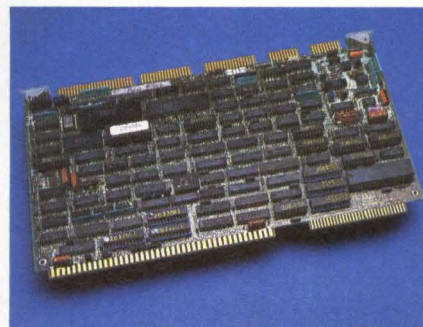
Small table top applications can use the MDX80000 foundation system with five Multibus slots, 10, 15, or 40Mb of 5-1/4" Winchester storage plus an 8" IBM compatible floppy.



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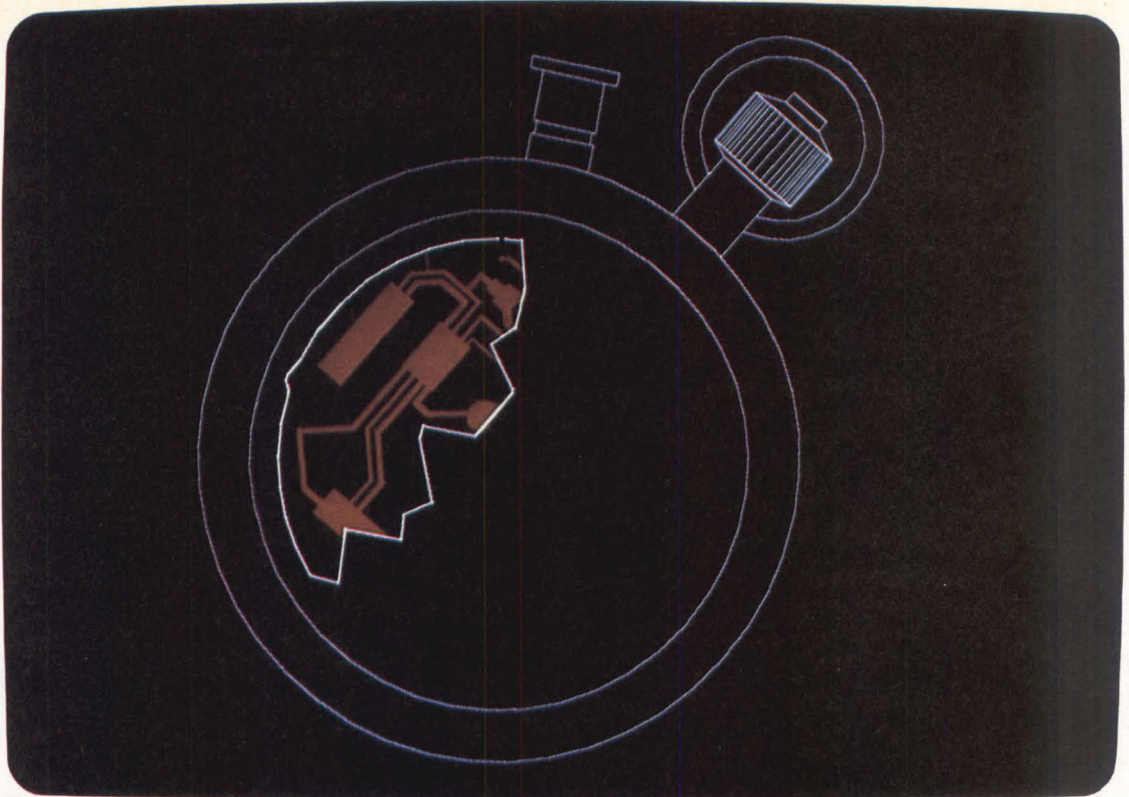
MINI-MICRO SYSTEMS/August 1984

CIRCLE NO. 41 ON INQUIRY CARD

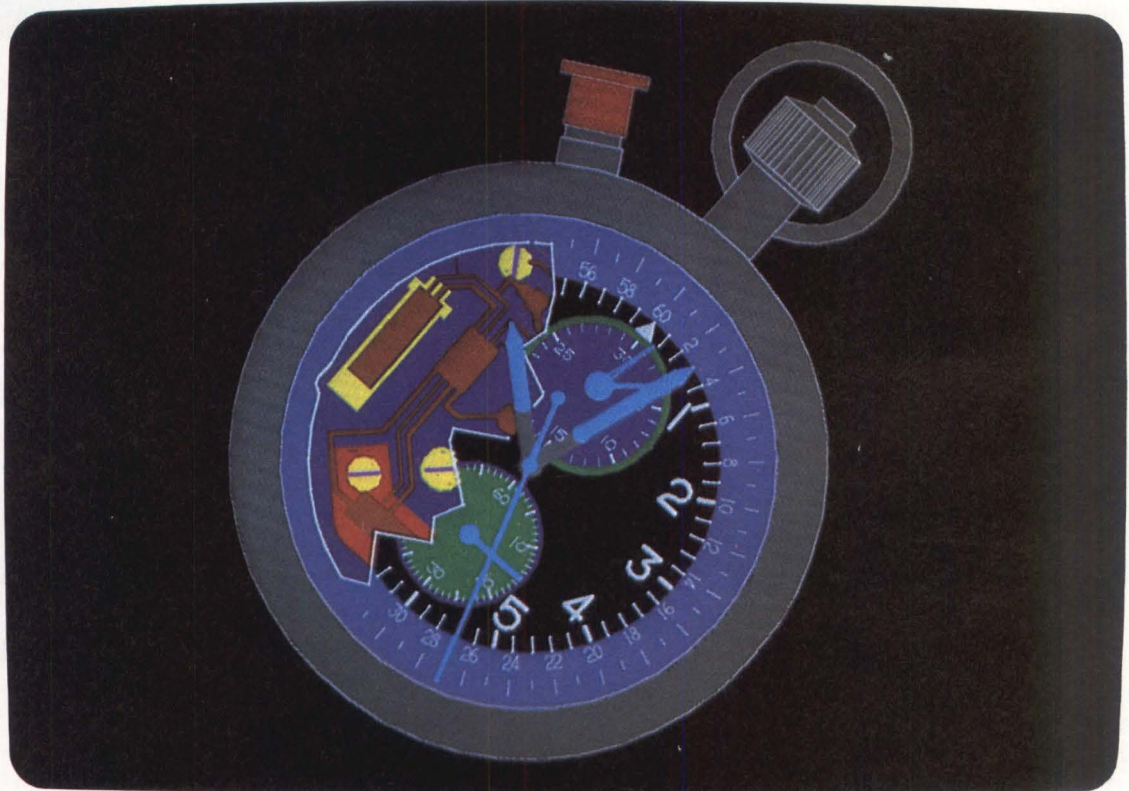
75



*An average terminal gets this far in 1.4 seconds. You'll twiddle your thumbs for 14 seconds before it's finished.*



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- 16 host definable or user programmable function keys to provide 48 functions. User programmable functions are programmable from the keyboard and saved in non-volatile memory.

- \* "MT" video attribute control means the ERGO 201 can display 17 combinations of reverse, underline, half, blink and blank on the same screen without using a character space.

- Custom mode allows the operator to define the terminal's control codes and escape sequences and save designations in non-volatile memory.

All these features, plus a built-in tilt mechanism, 7 x 9 character matrix, green, non-glare screen. Check the comparison chart at left and you will agree that ERGO 201 is the performance leader.

FEATURE	ERGO 201	Visual 50	ADDS Viewpoint	Hazeltine Esprit II	TeleVideo 925
<b>LIST PRICE</b>	<b>\$795</b>	<b>\$695</b>	<b>\$650</b>	<b>\$645</b>	<b>\$995</b>
User defined function keys	16	0	3	0	11
"MT" Video Attribute Control	Yes*	No	No	No	No
Custom Mode	Yes	No	No	No	No
Keyboard LED's	7	1	0	0	0
25th Status Line	Yes	Yes	No	No	No
2-Speed Smooth Scroll	Yes	No	No	No	No
Graphics Characters	Yes	Yes	No	No	No
Configurable Print & Send	Yes	Yes	No	No	No
Set Up Mode	Yes	Yes	No	No	Yes
Settable Tabs	Yes	Yes	No	No	Yes
Choose Protected Attribute	Yes	Yes	No	No	No
Screen Saver	Yes	Yes	No	No	Yes
Max. Number of Displayable Characters on one screen	**	256	128	128	128
2 Pages of Memory	Opt	No	No	No	Opt
Amber Phosphor	Opt	No	No	No	No
Plot 10 Graphics from Manufacturer	Opt	No	No	No	No
Warranty (Days)	365	90	90	90	90

\*\* 128 Characters Standard; 256-Optional

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# Mini-Micro World

CORPORATE AND FINANCIAL

## Fortune revamps management, aims for value-added resellers

Chris Bailey, Western Editor

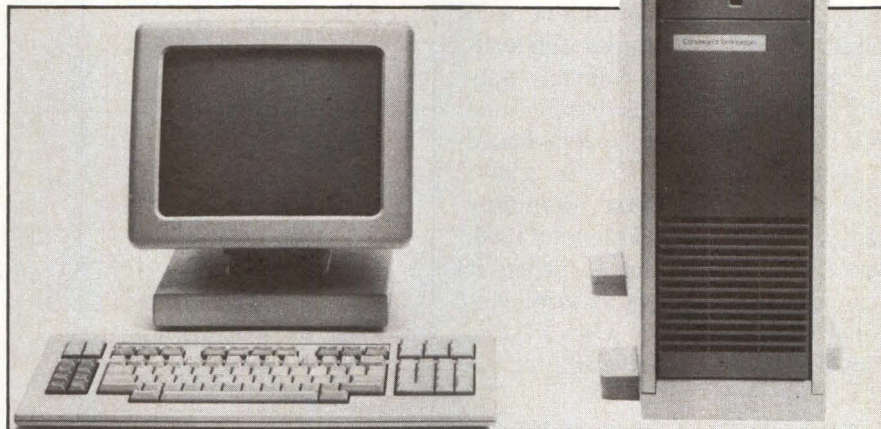
Buffeted by misfortune in the second half of 1983, Fortune Systems Corp., Redwood City, Calif., is working on a comeback. Its strategy includes new management, improved product performance and greater reliance on value-added resellers (VARs) such as system houses. James S. Campbell, president since December, believes Fortune's major problems are solved and that the company will be profitable by mid-year. Fortune has not been profitable for a full year since its founding in 1981.

"Fortune's multiuser systems did not achieve the performance levels demanded by typical customer applications, and, as a result, sales suffered during 1983," Campbell says. "But the company acted decisively to solve the performance problems and has added new products that make the systems compatible with Wang [Laboratories Inc.] and IBM [Corp.] office-automation products, and the changes have paid off."

In addition to personnel changes, Fortune has revamped its 32:16 product, a 68000-based multiuser system, by improving the hardware and its FOR:PRO operating system. Because multiuser UNIX makes heavy demands on the disk system, due to swapping pages of memory back and forth from RAM to disk, Fortune upgraded the system. The company's systems now use a Control Data Corp. Winchester disk with a 35-msec. average access time. This compares favorably with the 90-msec. average access time of the previous systems.

The company also increased sys-

tem performance by optimizing the menu-handling, multitasking-scheduler and file-blocking portions of the UNIX Version 7-compatible



**Competitors abound**, with Convergent Technologies' MiniFrame representing a threat to Fortune's low-end system. Although the two companies rarely compete directly—Convergent's main thrust is OEM and Fortune's is VARs and direct sales—the MiniFrame is priced at less than \$5,000, and its OEMs can effectively compete with the Fortune resellers. The eight-user MiniFrame boasts a virtual-memory capability and UNIX System V compatibility.

FOR:PRO operating system. The result is a system that supports six to eight users—or as many as 13 in non-I/O-intensive applications—with little performance degradation, the company says. Previously, the Fortune system was hard-pressed to support five users.

Fortune achieved industry compatibility by creating software products that can link 32:16 systems to Wang office-automation systems and IBM mainframes. Campbell points out that 75 percent of Fortune 1,000 companies have Wang or IBM mainframe installations. The new software will help Fortune link into corporate-wide information networks using these systems.

Sales reflect these improvements, with fourth-quarter 1983 results 40 percent higher than the depressed third-quarter figures. This momentum carried through to 1984, with

first-quarter sales surpassing \$15 million.

Throughout its sales slump, Fortune continued to spend heavily—in the neighborhood of \$12 million—on research and development. Thanks to the \$100 million raised on its initial public offering, the company had a cash position of more than \$53 million as recently as May and a total working capital balance of more than \$92 million. "This healthy financial position will enable us to continue to support our systems and customers and refute those observers who may feel that Fortune might go the way of Osborne [Computer Corp.] or Victor [Technologies Inc.]. We're committed to spending over 15 percent of annual revenues on R&D," explains Campbell. While company officials are reluctant to project sales or earnings, analysts predict sales of more than



# Mini-Micro World

## CORPORATE AND FINANCIAL

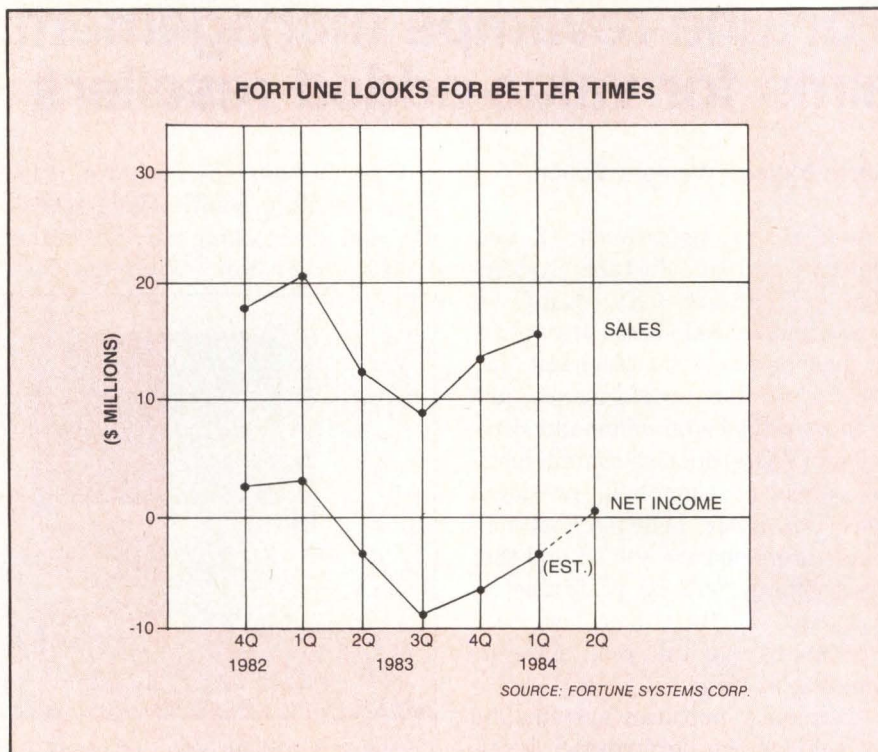
\$80 million for 1984, compared to sales of \$26 million in 1982 and \$54 million in 1983.

### Customers like the new systems

While agreement on Fortune's future is far from unanimous, many observers like the changes they've seen. Jean Yates, president and founder of Yates Ventures, the leading market research company specializing in UNIX, predicts Fortune will be among the top UNIX-based system manufacturers in 1984. Notes Yates, "Fortune definitely had performance problems in 1983, but they seem to have turned it around. I expect Fortune to release a more powerful system in 1984 and remain a serious competitor in the UNIX arena."

More important, customers are lining up to purchase the revised systems. BellSouth of Atlanta took delivery of more than 800 systems this year. Because of the system's hardware and software improvements, BellSouth can run 13 users on the Fortune 32:16 XT30. Other large Fortune 1,000 companies, such as Ford Motor Co., the Crocker Bank of San Francisco and Crown Zellerbach Corp., Oakland, Calif., have major installations. Private-label OEMs such as Bunker Ramo Information Systems, Trumble, Conn. and France's Thomson-CSF are major contributors to sales.

One area in which sales are not expected to improve is at the retail computer store level. States Robert Ruebel, senior vice president of marketing, "In the past, Fortune expended a lot of energy with storefront dealers. Unfortunately, these outlets were ill-equipped to handle sophisticated multiuser systems. They lacked software knowledge and the support needed to be successful." As a result, he says, Fortune is steering away from retail outlets and taking aim at VARs,



**After shaky mid-1983 results, Fortune is back on track. With a revamped product and new marketing strategy, sales have recovered, and the company expects profits by midyear.**

Fortune 1,000 companies and OEMs.

Besides directing efforts at dealers who can add support and application software, Fortune has created a direct sales force to sell to large companies. Also, Ruebel has created a customer-support center with company-wide responsibility for customer satisfaction. As part of that effort, the company is attempting to duplicate in-house customer configurations that can be used to track problems faster.

### Making inroads on AT&T

While Fortune is making progress, its competitors have also been active. In particular, Convergent Technologies Inc., Santa Clara, Calif., has announced an OEM agreement with AT&T Information Systems to release a Convergent-designed system this year. Although details of the system and the quantities involved are not yet

known, the system is expected to be a variant of Convergent's Data Systems Division's MegaFrame and MiniFrame systems. Both are multiuser systems based on the 68000 processor family, as is the 32:16 system, and can support as many as 128 and eight users, respectively.

The MiniFrame, featuring an OEM price of less than \$5,000, runs the CTIX UNIX System V-compatible operating system and, in its more advanced configurations, can support as many as eight users. Unlike the Fortune FOR:PRO operating system, it supports demand-paged virtual memory through the use of the 68010 processor. It does not come with a built-in display unit like the Fortune system, but Convergent offers a high-speed RS422 intelligent terminal that can reduce I/O-processing overhead in the main CPU—a traditional problem with single-processor UNIX-based systems. It also allows the use of win-



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# Mini-Micro World

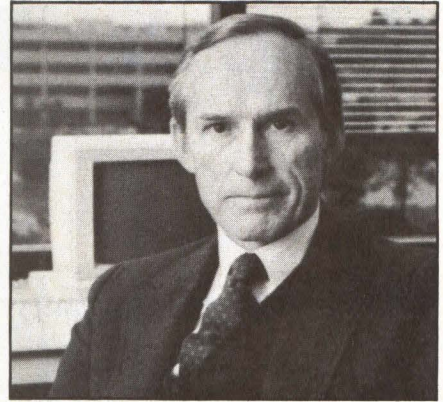
## CORPORATE AND FINANCIAL

dows similar to those gaining popularity on the IBM PC.

A companion product to the MiniFrame is PCworks, a software package from TouchStone Software Corp., Seal Beach, Calif. PCworks links IBM PCs and compatibles to the MiniFrame by making the MiniFrame a UNIX file server, thus allowing PCs to be networked and to transfer data files, mail and messages, and print reports. Steve Blank, vice president of marketing for Convergent's Data Systems Division, underlines Convergent's enthusiasm: "PCworks provides the

first available MS-DOS-to-UNIX link and opens an enormous market in the base of PC users for Convergent."

Fortune president Campbell discounts the significance of the Convergent/AT&T agreement. He notes that AT&T is also marketing its own UNIX-based OEM systems and believes that there will be room for everyone. Confirming that is a Yates Ventures study that predicts that the UNIX system market will grow from \$4.5 billion this year to nearly \$7 billion in 1985. □



**James S. Campbell**, president since December, has made changes designed to turn around Fortune's fortunes.

## Financings

Computerworks, Westport, Conn., has acquired \$5 million in venture capital to finance nationwide expansion of its corporate sales, service and retail operations. Participating in the funding were General Electric Venture Capital Corp. and Harrison Capital Corp.

Davox Communications Corp., a Merrimack, N.H., supplier of data and voice workstations, has secured \$6.4 million in venture financing. Hambrecht & Quist led the group of investors. Just before the financing, Daniel Hosage, formerly of IBM Corp. and Datapoint Corp., was named president as part of a corporate reorganization. President John Tincler, previously president of Centronics Data Computer Corp., and founding chairman Rubin Gruber have left Davox.

Portland, Ore., start-up Sequent Computer Systems has completed a \$7.5 million second round of venture funding. Sequent is developing computers for OEM customers based on National Semiconductor Corp. 16032 and 32032 microprocessors and running the UNIX operating system. Kleiner Perkins Caufield & Byers and Hambrecht & Quist participated in the financing.

Fault-tolerant start-up company,

Sequoia Systems Inc., recently garnered \$8.4 million to help introduce its transaction-processing systems. Investors in the Marlborough, Mass., company include Sperry Corp. and Citibank Investments.

## Wet ink

Apollo Computer Inc., Chelmsford, Mass., recently signed an 18-month agreement with Racal-Redac Inc. The agreement, worth as much as \$10 million, involves Apollo's Domain workstations, which will be sold with Racal-Redac's new CIEE electronic-design-integrated software. . . . Arete Systems Corp., San Jose, Calif., will sell \$3.6 million worth of its transaction-processing computer systems to field marketing Inc. over the next 18 months. . . . Control Data Corp. (CDC) has announced what it believes is one of the largest single OEM contracts for peripherals in history. Under a \$540 million, multiyear agreement, CDC will supply AT&T Technologies Inc. with disk drives, tape drives and media to be used with AT&T's 3B computer line. . . . Western Digital Corp., Irvine, Calif., has received a multimillion-dollar contract from Matsushita Electric Industrial Co. Ltd., Osaka, Japan. Western Digital will supply custom Winchester con-

troller boards for Matsushita's new Sr. Partner IBM PC-compatible portable computer, which was introduced under the Panasonic label in May at Comdex. Western Digital says the contract is its largest for custom Winchester controllers sold to the Japanese market.

## Quarterly reports

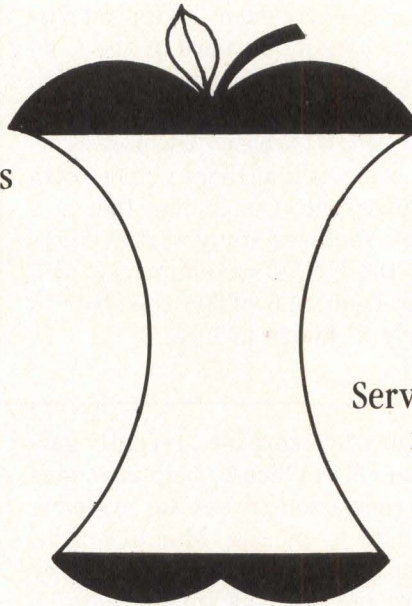
Centronics Data Computer Corp. has reported losses for the second quarter in a row. The Hudson, N.H., printer manufacturer suffered a net loss of \$1.9 million, or 17 cents per share, for the quarter ended April 1, compared to a gain of \$200,000, or 2 cents per share, in the same period a year earlier. Sales for the quarter were \$39.5 million, compared to \$43.7 million a year earlier. In the quarter ended Jan. 1, the company lost \$6.2 million, or 55 cents per share, on sales of \$46.9 million.

Centronics president John Morrison points to two factors he hopes will help turn the company around. First is a corporate reorganization that added management from Control Data Corp., Digital Equipment Corp., Memorex Corp. and Data Terminal Systems. Second is a previously announced OEM contract that could garner as much as \$100



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**More than compatible.** ANSI and DEC<sup>1</sup> VT52<sup>1</sup>, VT100<sup>1</sup> and VT132<sup>1</sup> compatibility, plus a special TAB mode for even more capabilities. All standard. The TAB 132/15 also gives you four page memory, 14 function keys, status line and

English prompts on the screen. With options like printer port and current loop.

**More capability with full graphics.** TAB's optional graphics package is full featured and emulates Tektronix 4010<sup>2</sup> terminals and is compatible with PLOT IO<sup>2</sup>, TELLAGRAF<sup>3</sup>, DISSPLA<sup>3</sup>, Template<sup>4</sup> and Plot Pak<sup>5</sup> software. Features include arc and vector drawing, point plotting, area fill, selective erase and more.

**More desk space with internal modem.** TAB terminals are now available with a new Internal Modem that is Bell 212A compatible. This 1200/300 Baud modem with memory is keyboard controlled to initiate calls and automatically answer calls. Ten phone numbers can be stored for auto-dialing. For a free photo print or a demonstration of the TAB 132/15 Series Terminals, call or write TAB Products Co., 1400 Page Mill Road, Palo Alto, CA 94304, (415) 852-2400. Outside Calif. (800) 672-3109.



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PRODUCTS CO**

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2 Trademarks of Tektronix Inc.  
3 Trademarks of Integrated Software Systems Corp.

4 Trademarks of Megatec  
5 Trademark of Digital Engineering



# Mini-Micro World

## CORPORATE AND FINANCIAL

million over the next three years. Centronics will not reveal the other party involved in that contract.

TeleVideo Systems Inc., Sunnyvale, Calif., reported record sales of \$48.4 million for its second quarter, ended April 30. Sales for the comparable quarter a year earlier were

\$41.6 million. TeleVideo attributed the gain to volume shipments of its IBM PC-compatible computers, the Tele-PC and the Tele-XT, which were introduced this year.

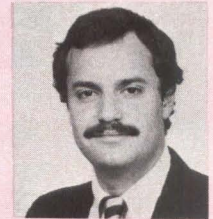
Sales for the first and second quarter of this year rose to \$91.7 million from \$80.5 million in the

same period a year earlier, while net income increased to \$11.4 million from \$10.5 million. As a result of the company's initial public offering, earnings per share decreased to 27 cents from 28 cents between the first two quarters of this year and last. □

## GUEST FORUM

*The voice for guest experts*

Lee B. Kauffman is director of the Industry Analysis Center for The Office Systems Consulting Group Inc., Cambridge, Mass.



## Users must carefully weigh PBX/office-equipment purchases

**Lee B. Kauffman**

The Office Systems Consulting Group Inc.

The use of private-branch-exchange (PBX) systems as a conduit for office-automation communication has been evolving slowly (but noticeably) over the past few years. Several factors are responsible for a marked acceleration in this development in the past six months. Chief among them are the demand for voice/data network integration in the office-automation (OA) environment, the increasing number of desktop workstations and the need to "network" these systems, IBM Corp.'s postponed introduction of its local-area network—which forced some prospective buyers to stop waiting and seek other solutions—and the divestiture of American Telephone & Telegraph Co.

Three distribution channels from which to buy a PBX system have emerged. Most OA vendors either have or are forming relationships with the leading PBX vendors. The two best-known examples of this are Rolm Corp./IBM and Wang Laboratories Inc./Intecom Inc. Since the divestiture of AT&T, the Bell Operating Companies have also been anxious to market PBX equipment, thus assuming the role of system integrators. Finally, a main channel for PBX distribution is the PBX vendors themselves.

There are approximately 32 vendors scrambling for a market share in

the PBX industry. Most industry analysts predict a major shakeout, leaving only a few competitors. While from the buyers' perspective this might simplify the market, they will still have to contend with multiple distribution channels. The new question is: what is the difference in buying a PBX from a PBX vendor, from a Bell Operating Company or from an OA vendor?

All seven of the Bell Operating Companies have multiple-vendor distribution rights for PBX systems. Five of the seven have multiple-vendor distribution rights for OA systems as well. While this positions them well in terms of "one-stop shopping," prospective buyers must still scrutinize the level of integration these systems offer. A PBX may be compatible with an OA vendor's offerings, but this does not necessarily ensure that the PBX environment will provide full functionality—or enhancement of the OA system's functionality.

In the recent Wang/Intecom agreement, Wang purchased 1.5 million shares of Intecom stock and will acquire 3.5 million more shares over the coming year (approximately 30 percent ownership). Both companies intend to share development and marketing projects.

Concurrently, Wang revealed its attitude toward the PBX industry as

a whole. It has created what it terms "the four levels of connectivity":

- Wang intends to interface with all leading PBX vendors to provide the basic communication transport between Wang and non-Wang equipment,

- Wang will provide the basic connectivity plus value-added services by integrating with the leading PBX vendors,

- Wang will work closely with interested PBX vendors to provide the full features and functions of Wang systems and to develop application packages for selected market segments and

- Wang's strategic affiliation with Intecom will enable it to pursue joint development and marketing projects and to share technology.

These levels of connectivity establish differing levels of integration.

As yet, there's little evidence of products arising from the strategic affiliations between OA and PBX vendors, yet it seems clear that the fully integrated (fully functional) products will first become available through these channels. This does not imply that the Bell Operating Companies will not have a role in the industry. Rather, it suggests that customers requiring high levels of OA-PBX integration and functionality in the near future will most likely find their solutions from OA vendors that are strategically affiliated with PBX vendors. □



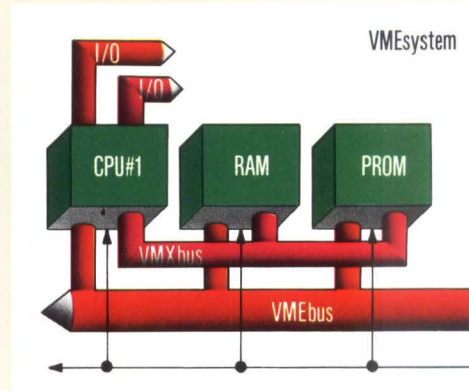
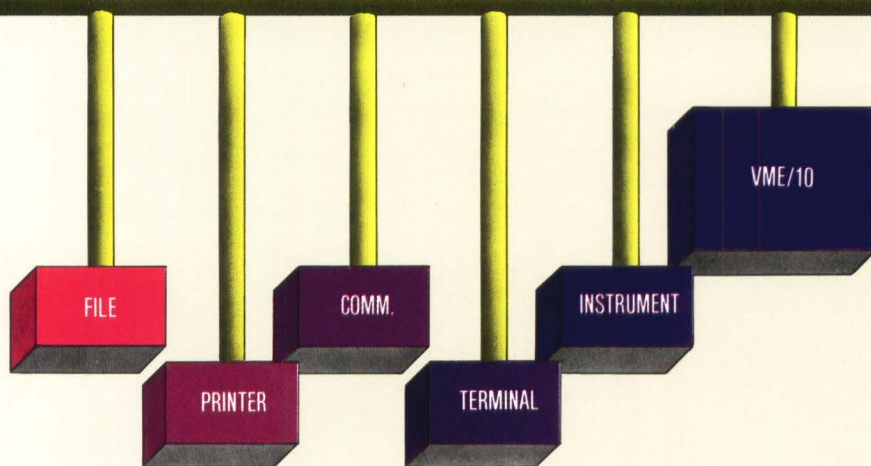




# VMEsystem

TOKEN BUS

ETHERNET



The VMEbus is part of the Motorola porated into the VME module system and the

Your high-tech future is speeding toward you requiring you to combine technical and business considerations when making your design-in decisions. As a systems integrator, you face a major decision in your choice of a microcomputer system architecture.

Major because in order to utilize 32-bit microprocessors or 32-bit microprocessor based boards in the next five years you must choose between high performance system buses that support 32-bit machine functionality. Your decision will last throughout the computer system's lifetime. VMEsystem Architecture is the systems designers leading choice in providing high performance support of 32-bit designs, according to the Electronics News 1984 MPU Based Processor Study.

VMEsystem leads also with the broadest line of available modules and support products for 8/16/32-bit applications. With over 400 products now available from over 90 manufacturers. The line continues to expand while providing smooth, planned growth for the future.

Rugged VMEmodules and standardized VME-system architecture coupled with a broad base of manufacturer and vendor support guarantee tomorrow's compatible growth.

## VMEbus: the heart of VMEsystem.

Originally introduced in 1981, VMEbus has become the standard high performance system interconnect structure through several years of intensive design activity. It is the bus of choice for the present and future of microcomputer architecture, supporting data transfer rates as high as 30Mbytes per second with today's chip technology.

VMEbus has a master/slave asynchronous non-multiplexed data transfer structure, seven levels of priority interrupt, four levels of arbitration with rapid fault detection and control for bus, system and AC failures.

One of the many features of the 32-bit configured VMEbus system is that the bus dynamically senses whether 8-, 16-, or 32-bit data paths are needed and adjusts automatically.

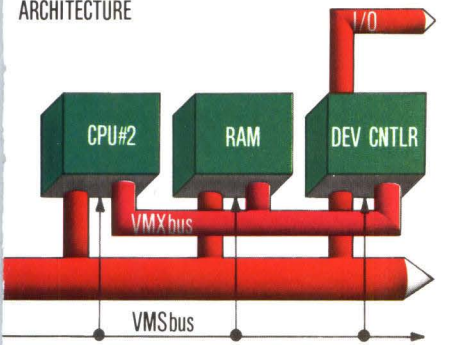
VMEbus specifications were originally developed jointly by Motorola, Mostek, and Signetics/Philips and have been accepted by close to 100 manufacturers worldwide.

In integrating 8-, 16-, and 32-bit system components VMEbus is innovative, publicly documented, and eminently adaptable to new technologies. LSI/VLSI technology is providing interface and peripheral chip functions that vastly increase the functionality/cost ratio of VMEbus modules.

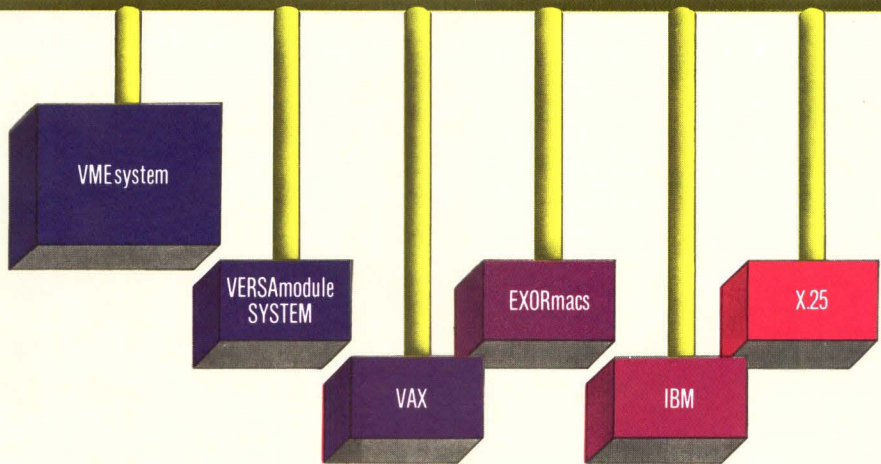
Based on the most popular Eurocard formats with DIN pin and socket connectors, VMEbus is presently being formally standardized by both the IEEE (P1014) and the IEC (47B) standards organizations.



## ARCHITECTURE



Microsystem Architecture. VMEbus is incorporated in VME/10 microcomputer system.



To the hundreds of present VMEbus users this is a formality. VMEbus has earned its position as the standard through hard usage, not through mere speculation based on paper specifications.

VMEbus is designed from the ground up for multiprocessing applications while still providing a high level of fault tolerance. Consider its full 32-bit address and data paths, clear arbitration and interrupt schemes and diagnostic capability.

VMEbus is also *the* cost-effective system bus. It can be economically configured according to design requirements for multiple processors and controllers. Manufacturers now provide VMEbus compatible modules for many applications.

## VMXbus: *high speed private access.*

Designed for multiprocessing applications, VMXbus is a high speed, parallel, private access bus that allows local operation between the MPU and memory. Its local interconnection between processor and memory takes the load off the main bus for rapid, efficient multiprocessing.

In communicating to I/O or other functions over the dedicated VMXbus, the processor can carry out operations independent of the VMEbus.

VMXbus has a 32-bit data path with a 16M byte address range. It handles up to six functional modules per "group" and runs on either a backplane or cable.

## VMSbus: *self arbitrating, global access.*

VMSbus is designed as a self arbitrating, serial global bus for short messages between processors while allowing for diagnosis and fault tolerance.

Its 3.2 Mbit/second transfer rate allows rapid communication of brief messages between system modules using only two conductors (clock and data) to provide an efficient "party line" between system components. It provides urgent event message passing in both tightly and loosely coupled multiprocessing environments.

## I/O Channel: *Motorola enhancement*

The Motorola I/O Channel provides low cost modular I/O expansion on a local processor bus not tied to a specific board or enclosure.

It permits interconnection of slower peripherals up to two megabytes per second directly with their respective processor, freeing the VMEbus to handle simultaneous high speed data exchange and multiprocessor activities.

I/O Channel utilizes 12-bit address with 8-bit data bus and 4K byte memory mapped I/O. Its asynchronous operation combines 4 levels of interrupts. Modules can be selected for a wide range of requirements including analog conversion, discrete parallel, serial I/O, plus mass storage.



# VMEsystem vs. MULTIBUS II

There are significant business reasons for the systems integrator to make the Motorola VMEsystem design-in decision. In a comparison with the proposed MULTIBUS II the business advantages of wide industry support for VME-system Architecture become apparent.

## Proprietary constraints.

VMEbus carries no patents or trademarks on the bus nor are the bus specifications copyrighted. A sound business advantage.

There are trademarks on the MULTIBUS II components, patents pending on MULTIBUS II, copyrights on all specifications and licensing and fees required by Intel to use MULTIBUS II.

The VME system is free of licensing fees and other proprietary restraints. A truly open system geared for broadbased use *today*.

## Reliability and the migration path.

The VMEbus has shown no significant problems since being originally released in 1981. It owes much of this reliability to the orderly migration path from its dependable precursor VERSAbus. MULTIBUS II as specified is synchronous and highly multiplexed while its predecessor MULTIBUS I is neither. There is no orderly migration path.

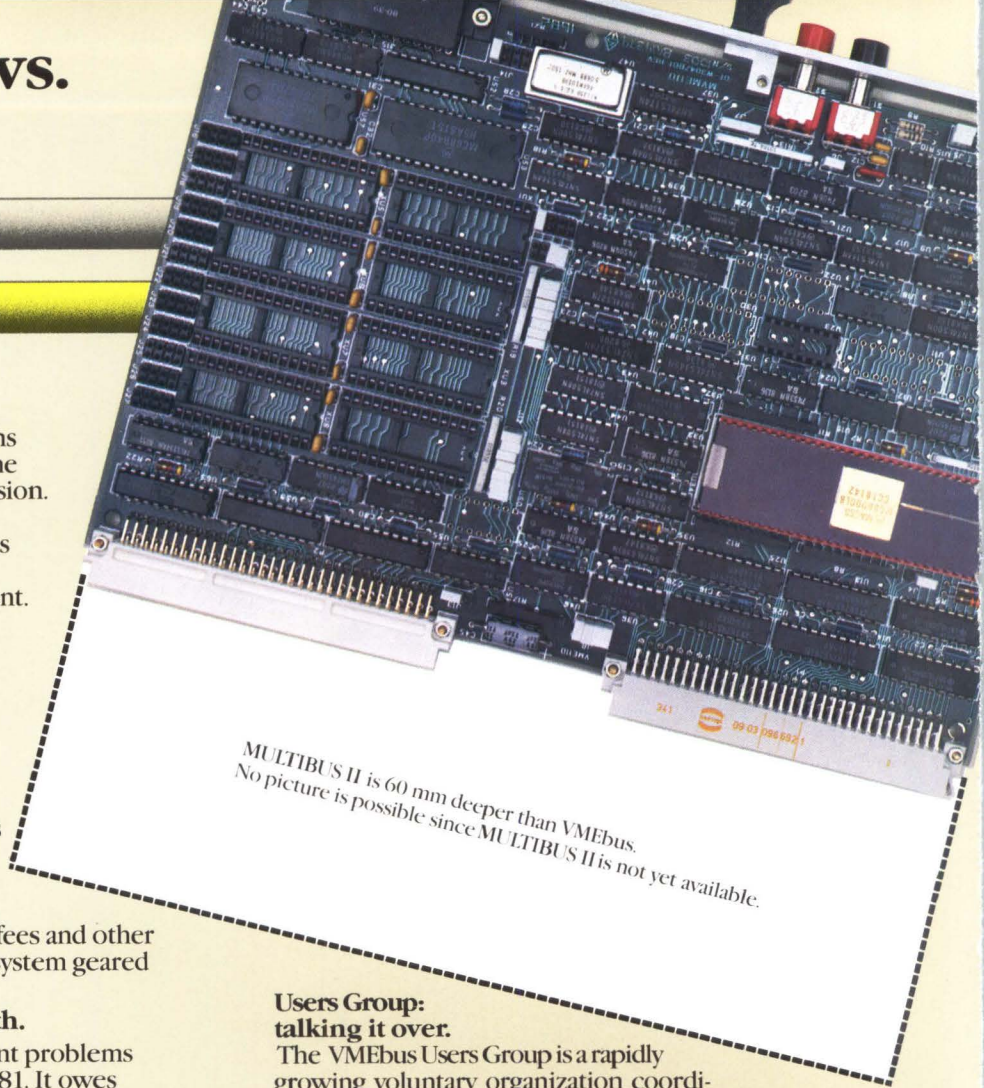
## VMEbus Manufacturers Group: getting together to promote compatibility.

The VMEbus Manufacturers Group is an international association of independent manufacturers who support the VMEsystem standard. The purpose of the group is to create a forum for technical exchange to promote VMEsystem as a compatible industry standard.

Key goals are to maintain and enhance the standard, encourage other independent manufacturers to produce compatible products and provide identification of compatible equipment.

The active VMEbus Manufacturers Group has a mail list of over 500 individuals and convenes 4 times a year. The Group publishes the VMEbus Compatible Products Directory listing vendors, addresses and products. To receive a copy of the Directory check the appropriate box on the request card.

The Manufacturers Group also administers the VME-system specifications. A comprehensive VMEsystem Architecture Manual with complete specifications is available. Check the appropriate box on the response card.



MULTIBUS II is 60 mm deeper than VMEbus.  
No picture is possible since MULTIBUS II is not yet available.

## Users Group: talking it over.

The VMEbus Users Group is a rapidly growing voluntary organization coordinating user meetings in North America and corresponding with affiliates in Europe.

There are active sub-committees on product compatibility, application support and distribution media. The group publishes application notes, and encourages detailed presentations on VME applications at its meetings.

For membership information on the VME Manufacturers or Users Groups check the appropriate box on the request card.

## Future VLSI: The world continues to get smaller.

The major movers behind VMEsystem Architecture have announced additional bus support chips in various stages of planning and production;

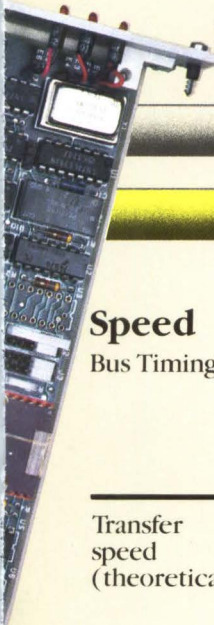
Number	Function	Company
68452	Bus Arbiter	Motorola
68153	Bus Interrupter	Motorola
68154	Bus Interrupter	Signetics
68155	Interrupt Handler	Signetics
68172	Master/Slave Interface	Signetics
68174	Bus Arbiter and Clock Driver	Motorola
68171	VMSbus Controller	Signetics
68173	VMSbus Interface	Signetics

LSI is not available for competitive 32-bit buses. VMEsystem is well designed, well defined, solidly supported and publicly available.

The reasons are clear for a Motorola design-in decision.

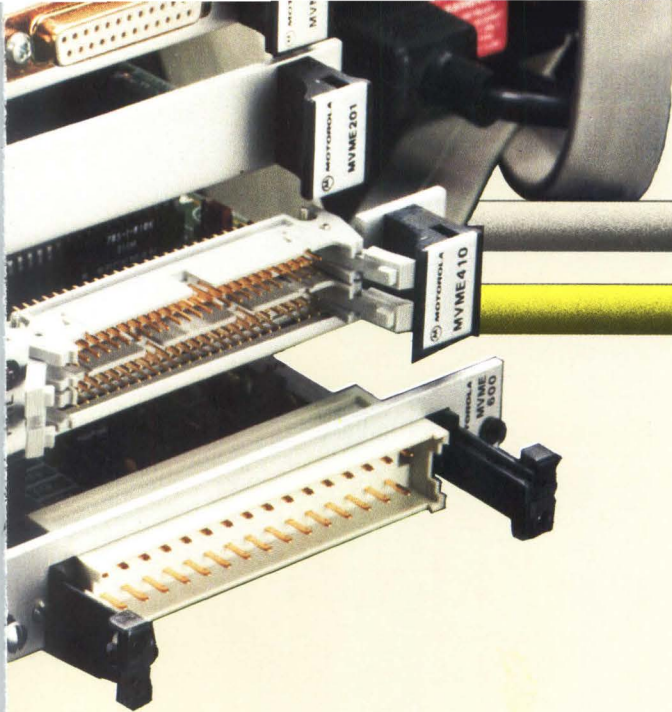


# Specifications



	VMEsystem	MULTIBUS II	Comments
<b>Speed</b>			
Bus Timing	Asynchronous (except VMSbus)	Synchronous (Fixed at 10 MHz clock rate)	Today's technology exceeds 10MHz clock rate. The MULTIBUS II fixed clock rate degrades high performance processors.
Transfer speed (theoretical)	VMEbus 57Mbyte/sec. VMXbus 80Mbyte/sec. VMSbus 3.2 Mbit/sec.	iPSB 40 Mbyte/sec. iLBX II 48 Mbyte/sec. iSSB 2 Mbit/sec. MULTICHANNEL 8 Mbyte/sec.	VMEsystem offers higher total system throughput
Serial Bus Protocol	Sender self check Collision Tolerant	CRC CSMA/CD	VMS rate stabilizes under heavy usage. CSMA/CD declines under heavy usage.
<b>Flexibility</b>			
Bus Timing	Asynchronous	Synchronous	VME transfer rate adjusts better to processor clock rate: 12.5 MHz with MC68000; 16 MHz with MC68020
Arbitration	Centralized or Distributed Control (4-level daisy chain) Priorities 4 (20 per level)	Distributed Control Parallel Contention Priorities 2 (20 per level)	Flexible arbitration and interrupt configurations of VMEbus simplify the use of multiprocessors.
Interrupt Request Lines	7	0	
Address width	a.) 16 bits b.) 24 bits c.) 32 bits	a.) 16 bits b.) 32 bits	Only Multibus II <u>requires</u> full 32-bit decoding logic in ALL applications.
Interrupt Request Structure	Allows deterministic protocol on VMEbus	Does not allow deterministic protocol on iPSB	VMEbus offers significantly greater flexibility for the system designers.
Arbitration	a.) Priority b.) Round Robin c.) Single level	a.) Priority	
Requester	a.) Release when done b.) Release on request c.) Release on BCLR d.) Release on AC Fail	a.) Release when done	
Number of Address Spaces	64	4	
<b>Size</b>			
	Double Eurocard (233.3mm x 160mm)  Single Eurocard (100mm x 160mm)	Double Eurocard (233.3mm x 220mm)  Single Eurocard (100mm x 220mm)	VME card sizes are popular and accepted today and will maximize functionality/cost tomorrow. MULTIBUS II card size is unpopular and hard to fit today and will be too cumbersome for tomorrow.





*VME/10 Microcomputer can be custom configured through rear-panel plug-in of VME modules and I/O modules.*

### **600 Series-Industrial I/O Modules**

**MVME 600/601** analog/digital converter with 8, 16 input channels

**MVME 605** digital/analog converter with 4 output channels

**MVME 610** AC sensing with 8 input channels

**MVME 615/616** AC switching with 8 output channels

**MVME 620** DC sensing with 8 input channels

**MVME 625** DC switching with 8 output channels

### **700 Series-Non-Eurocard I/O**

**MVME 700\*** 6U x 80MM wire wrap board

**MVME 701\*** 6U x 80MM DIN connector To DB25 and 50 Pin dual row header (Used with MVME 050)

**MVME 702\*** 6U x 80MM. Provides 50, 34 & 20 pin dual row headers for mass storage extension (Used with MVME 820/821)

### **800 Series-Mass Storage Support Products**

**MVME 820\*** 6U (double high) plug-in mass storage module including 15 MByte Winchester drive and 1 MByte DS/DD 5¼" floppy drive

**MVME 821\*** 6U (double high) plug-in mass storage module including two 1-MByte DS/DD 5¼" floppy drives

### **900 Series-Packaging Hardware Backplanes**

**MVME 920** 20 slot VMEbus

**MVME 921** 9 slot VMEbus

**MVME 922** 5 slot I/O channel

**MVME 924\*** 3 slot I/O channel

#### **Extender Boards**

**MVME 930** VMEbus extender

**MVME 932** VMEbus and I/O channel extender

#### **Wire Wrap Boards**

**MVME 931-1** VMEbus wire wrap

**MVME 933-1** I/O channel wire wrap

**MVME 940-1** chassis with 7 double-high VMEbus slots, 2 I/O slots

**MVME 941** card cage with 9 double-high VMEbus slots and 2 I/O slots

**MVME 942** card cage with 20 double-high VMEbus slots

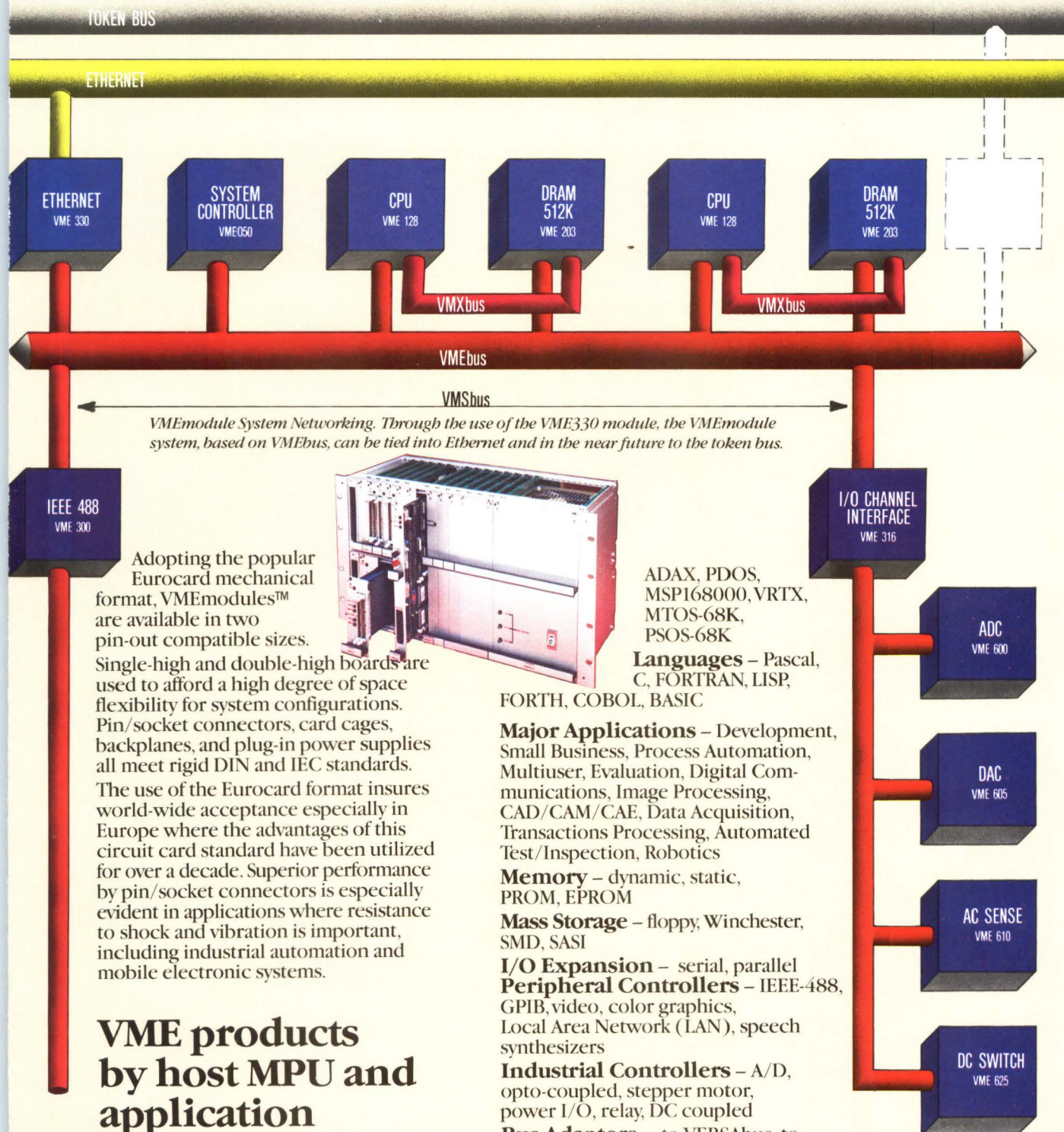
**MVME 943\*** chassis with 8 double-high VMEbus slots, 6 I/O channel slots (front) and 16 I/O channel or 80MM double-high slots (rear) and accepts MVME 820/821 mass storage devices

**MVME 944\*** chassis with 20 VMEbus slots (front) and 16 I/O channel or 80MM double high slots (rear)

\*In development. Contact your Motorola sales representative for current availability.



# VME modules: Today's rugged standard.



VMEmodule System Networking. Through the use of the VME330 module, the VMEmodule system, based on VMEbus, can be tied into Ethernet and in the near future to the token bus.

Adopting the popular Eurocard mechanical format, VMEmodules™ are available in two pin-out compatible sizes. Single-high and double-high boards are used to afford a high degree of space flexibility for system configurations. Pin/socket connectors, card cages, backplanes, and plug-in power supplies all meet rigid DIN and IEC standards. The use of the Eurocard format insures world-wide acceptance especially in Europe where the advantages of this circuit card standard have been utilized for over a decade. Superior performance by pin/socket connectors is especially evident in applications where resistance to shock and vibration is important, including industrial automation and mobile electronic systems.

## VME products by host MPU and application

**Single Board Computers** – 68000, 68008, 68010, 16032, 32032, Z80, Z8000, 80186

**Operating Systems** – UNIX, CPM, VERSAdos, PVS, UNIPLUS, DSSDOS,

ADAX, PDOS, MSP168000, VRTX, MTOS-68K, PSOS-68K

**Languages** – Pascal, C, FORTRAN, LISP, FORTH, COBOL, BASIC

**Major Applications** – Development, Small Business, Process Automation, Multiuser, Evaluation, Digital Communications, Image Processing, CAD/CAM/CAE, Data Acquisition, Transactions Processing, Automated Test/Inspection, Robotics

**Memory** – dynamic, static, PROM, EPROM

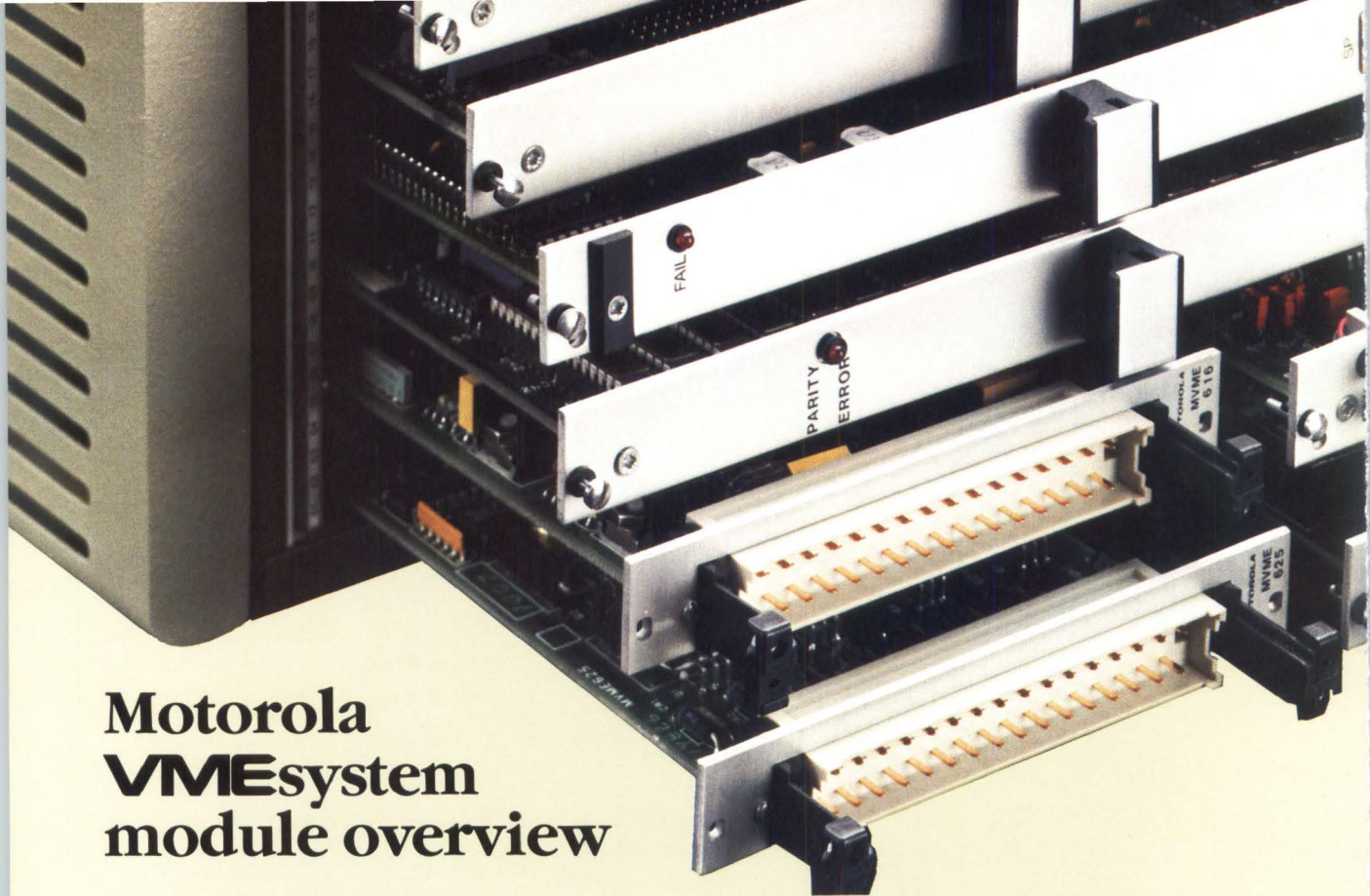
**Mass Storage** – floppy, Winchester, SMD, SASI

**I/O Expansion** – serial, parallel  
**Peripheral Controllers** – IEEE-488, GPIB, video, color graphics, Local Area Network (LAN), speech synthesizers

**Industrial Controllers** – A/D, opto-coupled, stepper motor, power I/O, relay, DC coupled  
**Bus Adapters** – to VERSAbus, to MULTIBUS I

**Other Boards** – SCM, floating, point CPU, BASIC interpreter, real time executives, bus debug, EPROM programmer





## Motorola VME system module overview

### 100 Series-Monoboard Computers and System Controllers

**MVME 101** MC68000 (8MHz) monoboard with 2 RS-232C serial ports and 2 parallel ports

**MVME 110-1** MC68000 (8MHz) monoboard with RS-232C debug port and I/O channel interface

**MVME 115M** MC68010 (8MHz) monoboard with MC68451 MMU optional plus 2 RS-232C serial and 2 parallel ports

**MVME 120\*** MC68010 (10MHz) monoboard with 12.5MHz optional. MC68451 MMU optional. 4 KByte cache option with 128/512 KByte dual port RAM, plus RS-232C debug port.

**MVME 128\*** MC68010 (12.5MHz) monoboard with 10 MHz optional; MC68451 MMU optional; 4 KByte instruction cache optional. 256 KByte dual port RAM and VMXbus interface plus RS-232C debug port

**MVME 130\*** MC68020 (16MHz) monoboard with 512 KByte dual port RAM or MC68851 (16MHz) PMMU optional. MC68881 (16MHz) math co-processor optional.

**MVME 025** Used With MVME 115 and 120. Provides: bus arbitration, AC fail and system clock functions.

**MVME 050\*** Used with MVME 115, 120, 128 and 130. Provides: interrupt handlers, bus arbitration, system clock, time-of-day clock, plus eight 28-pin sockets.

### 200 Series-Memory Modules

**MVME 200** 64K DRAM

**MVME 201** 256K DRAM

**MVME 202/222** 512K/2M DRAM

**MVME 203/223\*** 512K/2M DRAM with VMXbus interface

**MVME 210** Up to 128 KBytes ROM and up to 32 KBytes static RAM

**MVME 211** Up to 1 MByte ROM and up to 128 KByte static RAM

**MVME 212\*** same as MVME 211 with VMXbus interface added.

### 300 Series-Peripheral Controllers

**MVME 300** GPIB controller with up to 500 KByte/Sec transfer rate

**MVME 310** Universal IPC with 4 channel DMA

**MVME 315** Intelligent SASI interface with floppy controller for 4 5¼" or 8" floppies

**MVME 316\*** I/O channel interface

**MVME 320** Winchester/floppy controller for 5¼" drives

**MVME 330** Ethernet 2.0 compatible controller with MC68000 (10MHz) and LANCE chip and SIA

**MVME 331\*** 6-Channel serial I/O controller

**MVME 340\*** 6-Channel parallel I/O interface

### 400 Series-I/O Channel Modules

**MVME 400** dual channel serial port

**MVME 410** dual channel parallel port and Centronics compatible printer interface

**MVME 420** SASI™ interface adapter

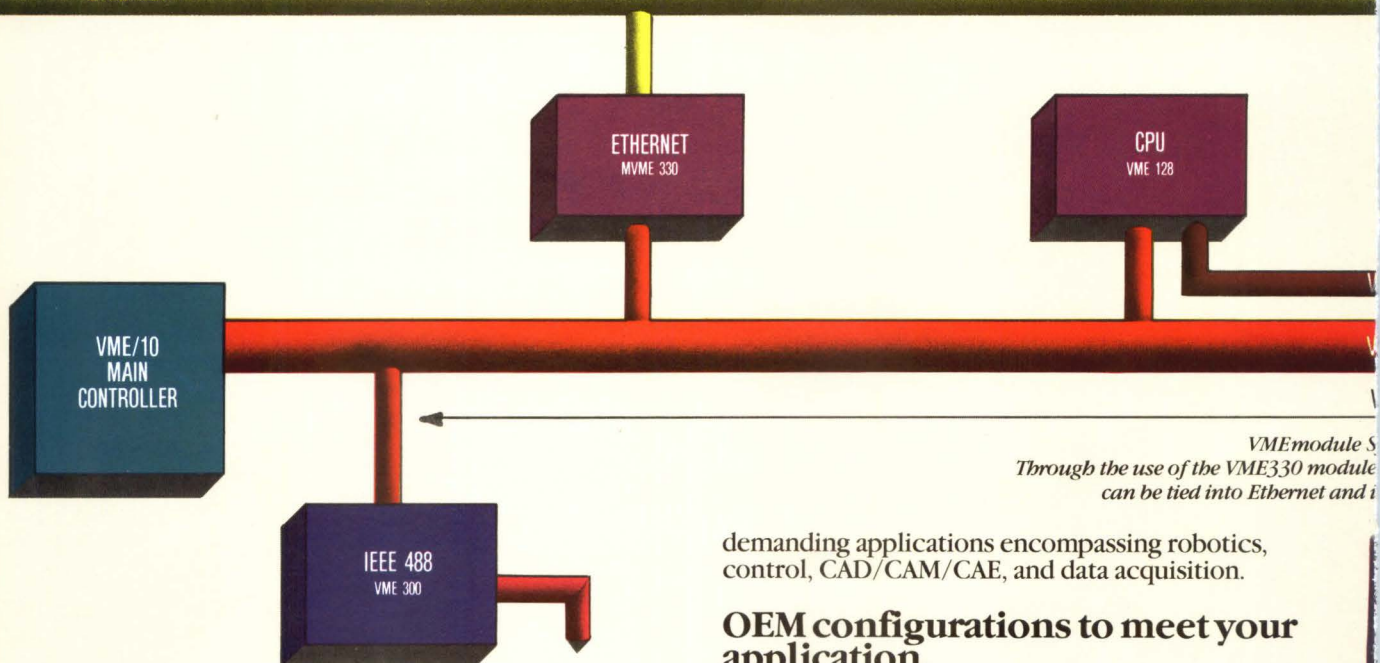
**MVME 435** ½" magnetic tape adapter



# OEM VME/10 microcomputer system

TOKEN BUS

ETHERNET



*VME module S  
Through the use of the VME330 module  
can be tied into Ethernet and i*

## Notes to the OEM marketer

A full range of integrated products is of prime importance for the value added resale marketer. For the OEM, selecting a vendor that provides the full range of integration from chip, board or box is essential.

The Motorola choice can minimize your initial risk while maximizing your flexibility. Combine Motorola's half billion dollar R&D budget with its third party hardware and software and you have a complete vendor solution. From M68000 Microprocessor Family to Ethernet, VERSAdos to UNIX Operating Systems and VMEbus to I/O Channel, Motorola utilizes reliable, compatible and competitive products that remain, time after time, the smart assured investment for your future.

## VME/10. OEM microsystems from Motorola.

M68000 performance, UNIX™ portability. VMEbus flexibility. Modern tools for the system integrator. In a field overrun with specialized, dedicated, and limited OEM micro's, there is the VME/10 System alternative. It's the only VMEbus based user-configurable OEM "engine" combining the high-performance mainframe capabilities of the MC68010 Microprocessor with standard VMEsystem Architecture and a choice of two powerful operating systems.

The VME/10 System is designed to allow OEMs and system integrators to harness a wide range of

demanding applications encompassing robotics, control, CAD/CAM/CAE, and data acquisition.

## OEM configurations to meet your application.

The VME/10 Control Unit starts with 384K Bytes of RAM, a 655K Byte floppy disk drive, and 5M, 15M or 40M Byte Winchester disk drive unit. High resolution color graphics system is also standard. An optional keyboard, plus separate color or monochrome display unit mean you use only what you need for your application.

And the VME/10 goes far beyond simple "one-on-one" applications. As a Level II supervisory control computer, multiple VME/10s may be networked together for large-scale distributed control usage.

## Mainframe performance, micro simplicity.

At the heart of the VME/10 OEM system is the MC68010 MPU – the latest addition to the upward-compatible, 16/32-bit M68000 microprocessor family. The combination of the MC68010 MPU and the MC68451 memory management unit provides processing power permitting multiple tasks to proceed simultaneously with full protection for program code and data in each task. You get fast, efficient application development on the VME/10 System.

## VMEbus, global standard.

VMEbus makes the VME/10 System highly configurable. The bus structure is currently being approved as a global, standard, 16/32-bit microsystem architecture by working committees of both the IEEE (P1014) and the International Electrotechnical Committee (47B). Increasingly widespread adoption of VMEbus means that you can customize your



# The intangible extras... from Motorola.

Since the earliest days of semiconductors, Motorola has earned for itself an enviable reputation as a frontrunner in both technology and support. Its leadership, first in discrete devices... then in integrated circuits... has quite naturally expanded to encompass the still-infant field of microcomputers where the M68000 microprocessor family has become an internationally-sourced 16-, 32-bit standard.

First with the component "chips," then with board-level microcomputer modules, finally with box-

- Field-proven Motorola quality and reliability... backed by the Motorola warranty.
- Field application assistance... available through an extensive network of over 50 Motorola semiconductor sales offices in North America.
- Comprehensive technical training seminars... on a wide variety of hardware, software, and systems topics... at the factory, at diverse locations throughout the world, even at your own plant site!
- Field and factory service arrangements... on-site installation and repair... in over 125 cities nationwide... maintenance contracts... factory repair/exchange services.

level system entries... Motorola offers equipment manufacturers both the appropriate building blocks and advanced development support instrumentation to streamline the implementation of their end-system products.

And beyond these direct benefits, Motorola offers the following unique combination of advantages to users of VMEsystem products.

- Third party software support... a continuing program of assistance to independent software vendors, to encourage development of both systems and applications packages for VMEsystem products.
- Commitment to VMEsystem architecture... with Motorola's active participation and support of the VMEbus Manufacturers Group, and of the VMEbus IEEE and IEC standardization activities.
- Comprehensive reference documentation... covering all hardware and software elements of the VMEsystem product offering.

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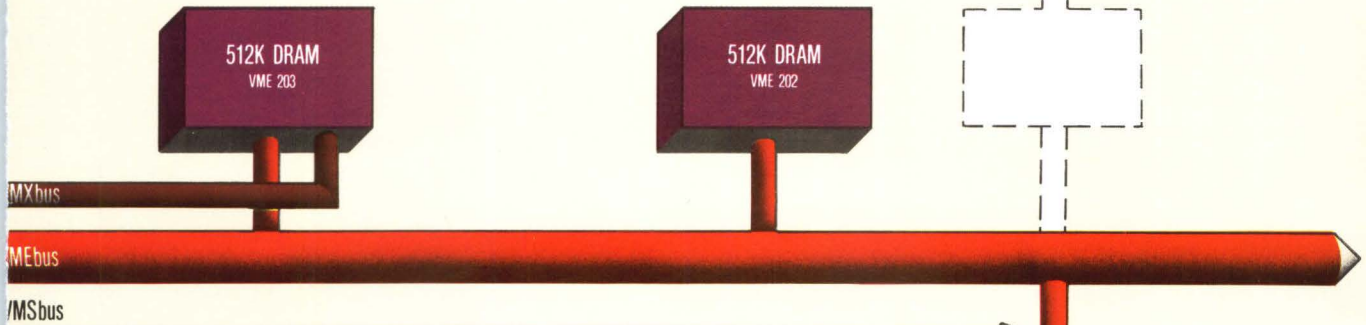
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System Networking.

the VME module system, based on VMEbus,  
in the near future to the token bus.



VME/10 System for your particular applications with a broad array of over 400 VMEbus based hardware and software products available today from over 90 manufacturers worldwide. You avoid the high cost of specialized custom system designs while still tailoring the VME/10 to your individual situation.

### Two powerful operating systems

With the VME/10 microcomputer you can choose between two powerful operating system packages, both fully supported by Motorola.

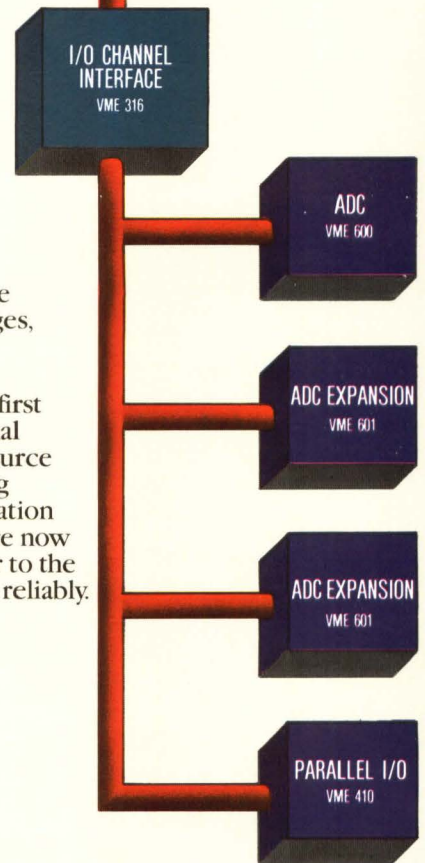
For the expanding UNIX™ environment, select Motorola's SYSTEM V/68 Operating System, the first validated by AT&T through exhaustive functional testing against the original UNIX System V source code. For the system integrator, the emerging standard of UNIX means increased "application portability." UNIX System V applications are now portable from mainframe or minicomputer to the M68000 micro world... quickly, efficiently, reliably.

For real-time applications, take VERSAdos – the original M68000 Family operating system. It has all you need to control multiple real-time application tasks, even in a multiuser environment.

### Total VME/10 support: A Motorola pledge

The VME/10 System is supported by Motorola's professional field service network, with facilities in over 125 cities nationwide offering technical assistance, parts, repair services, regular software updates, and a problem-reporting hotline. Our comprehensive user documentation and technical training seminars are complete and available.

Quality, standards, performance and support. Important reasons why you should make Motorola your OEM Systems vendor.





## **Broad based support: A league of interdependent vendors.**

Continuing support by Motorola, Mostek and Signetics/Philips insures that VMEbus and its supporting bus structures VMXbus, VMSbus and Motorola's I/O Channel undergo further refinements in response to market needs.

### **VMEbus compatible manufacturers\***

AEG-TELEFUNKEN CORP.  
AMP INC.  
AMPHENOL NORTH AMERICA  
ASTRAEA COMPUTER CORP.  
AUGAT INTERCONNECTION SYSTEMS GROUP  
BFE FERNMELDE + ELEKTRONIK KG  
BICC-VERO ELECTRONICS INC.  
BURR BROWN  
DATARAM CORP.  
ELTEC ELECTRONIC GmbH  
FORCE COMPUTERS INC.  
HEMENWAY CORPORATION  
HUNTER & READY INC.  
MOSTEK-UNITED TECHNOLOGIES  
MOTOROLA INC.  
PANDUIT CORP.  
PHILIPS  
SIGNETICS CORP.  
VECTOR ELECTRONIC COMPANY  
XYCOM INC.

\*This is a partial list of over 90 manufacturers. For a complete list check the VMEbus Compatible Products Directory box on the response card.

## **MC68000: quality right from the start.**

Motorola's full line of VME integration starts with the MC68000 Microprocessor. From this preferred building block for systems design come VME processor and support modules, VME module chassis plus the all-in-one VME/10, the emerging leader in user configurable OEM microcomputers.

The MC68000 is preferred for multi-processing applications where performance and reliability are required. Its asynchronous interface to the system solves bus arbitration problems in large configurations and its powerful instruction set allows automatic execution of repeated program sequences for reducing high level development efforts.

The M68000 Family includes the economical MC68008 with its 8-bit bus, the MC68010 with virtual memory capabilities and, the latest addition, 32-bit MC68020 with co-processing and cache memory.

Direct object code compatibility up the M68000 line allows utilization of previously developed code. This allows the use of modular software designs that minimize development costs.

The cutting edge of technology is a double edged sword. If some outdated elements of an integrated system are replaced, adjustments ripple through the system, translating into cost and lost benefits of being "state-of-the-art." With Motorola's M68000 Family you won't be backed into a corner by a design that can't be upgraded.

VMEsystem Architecture is the only standard allowing full utilization of the impressive power of the M68000 Family.

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# Mini-Micro World

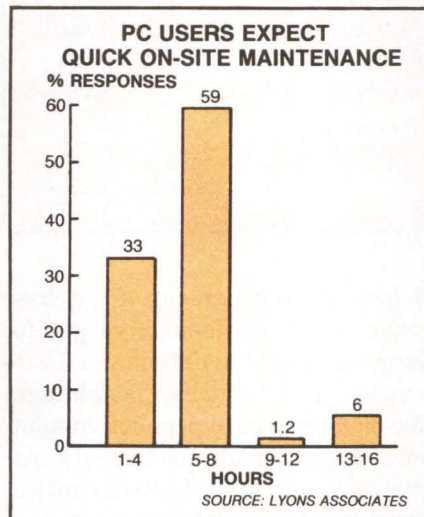
INTERNATIONAL

## European PC users demand high-quality, on-site maintenance

Keith Jones, European Editor

European companies using multiple personal computers will not accept depot maintenance only; they also want the kind of same-day, on-site arrangements enjoyed by large computer users, according to a new survey published by Lyons Associates, Reading, England. Coincidentally, IBM Corp. recently changed its personal computer service policy in Europe to allow its engineers to provide customers with on-site maintenance as an alternative to depot service.

Lyons surveyed about 500 users in Britain, France and West Germany, most of whom are employed in companies with annual revenues of more than \$1 million. Nearly half of those questioned said they planned



to buy 10 or more personal computers over the next two years.

The survey also indicates that personal computer users often dislike dealer maintenance. Lyons

principal David Lyons understands this attitude. He says many dealers have only one service engineer, so the user may end up without maintenance if that engineer becomes ill or quits. He notes that the quality of dealers' service engineers can vary considerably, even when the manufacturer provides training. Another danger users see in dealer maintenance is that many dealers have the right to cancel their agreements with manufacturers within three months of signing.

Third-party maintenance can solve the service problems of personal computer manufacturers lacking large, established field engineering staffs. However, research company Input Ltd., London, sees a shortage of third-party maintenance companies in Europe, except

### Bell and Howell seeks partners for maintenance deals

Bell and Howell Service Co., Ashford, England, is seeking European, Japanese and U.S. computer manufacturers needing third-party maintenance in West Germany, Britain, France and the Benelux countries (Belgium, the Netherlands and Luxembourg). One of the first independent companies to serve most of Western Europe, Bell and Howell offers nearly 300 service engineers.

"A big attraction of Bell and Howell is that it does not compete in the computer business," declares Richard Bernholt, marketing and sales manager of the new company. Bernholt points to the considerable experience of Bell and Howell engineers in maintaining the computers incorporated in its micrographics and document-handling systems. The machines serviced include Digital Equipment Corp. and Data General Corp. minicomputers.

General service manager Mike

Brereton says the activities of Bell and Howell Service will largely parallel those of a similar enterprise set up last year in the United States. He says equipment the company maintains there includes personal computers from Eagle Computer Inc., Los Gatos, Calif., and Columbia Data Products Inc., Columbia, Md. Brereton explains that Bell and Howell is looking for products sold to commercial users, such as computer system manufacturers.

He stresses that Bell and Howell is seeking long-term agreements in accordance with its intended commitment level. It will appoint an account manager to handle relations with each client manufacturer and with the manufacturer's distributors. The manufacturer must train Bell and Howell's instructors and supply spare parts at agreed-upon prices.

Before the company can strike a deal with a manufacturer, both sides

must agree on the rates Bell and Howell will charge. Rates will vary, depending on type of equipment and Bell and Howell's estimate of maintenance requirements. Each country will have a separate price list, although Brereton expects charges to be roughly equal in all countries.

Bernholt assumes that most users will want on-site maintenance, and the company plans to provide resident engineers if required.

Bernholt notes that the Bell and Howell service will cover all types of minicomputer and microcomputer systems and peripherals, except for repairing head/disk assemblies of Winchester disk drives. The repair of these assemblies requires the clean-room facilities offered on a pan-European basis by specialist companies such as Memory Maintenance Ltd., Swindon, England, and Kode Services Ltd., Calne, England (MMS, October 1983, Page 126).



# Mini-Micro World

INTERNATIONAL

for Britain. Input estimates that 70 percent of the 150 third-party organizations in Europe are based in Britain.

Compounding manufacturers' problems is the lack of pan-European third-party maintenance service similar to that covering the United States. One of the few maintenance groups operating in more than one country is Euroserve, an association of five third-party companies covering Northern Europe. They offer their services jointly to large multinational users and thus compete with the maintenance organizations of large vendors such as IBM Corp. A spokesman for Euroserve's British member, Computer Field Maintenance Ltd., Hitchin, England, notes that Euroserve is also interested in maintenance deals with manufacturers needing service for customers in Britain, West Germany and Scandinavia.

Andy Thomas, principal consultant of Input, notes that a number of large U.S.-based companies have expressed an interest in European third-party maintenance business opportunities. One company has already taken the plunge: the European service organization of Bell and Howell Corp., Chicago.

## Distributors also offer service

Another possible maintenance solution Lyons identifies is the distributor-owned organization. One example is Geveke Electronics B.V., Amsterdam, the Netherlands, which operates a service division in the Benelux countries of Belgium, the Netherlands, and Luxembourg. Eagle Computer Inc., Los Gatos, Calif., has appointed Geveke to sell and maintain Eagle's IBM PC-compatible microcomputers.

The Lyons survey identifies a price dilemma affecting all personal computer vendors in Europe. Lyons says the vendors are trapped by the

## MEAN TIME BETWEEN FAILURE EXPECTED FOR SYSTEM COMPONENTS

Component	MTBF (months)
CPU	16.6
Hard disk	13.5
Software	10.0
Floppy disk	8.7
Printer	6.3

Source: Lyons Associates

7 percent to 8 percent of purchase price rates traditionally charged for large computer maintenance. Users expect to pay similar percentages for maintenance of personal computers, even though the amount per machine is far less. Lyons estimates the average cost of one on-site service call to be \$200, about equal to the charge of maintaining a low-

priced personal computer, so a maintenance vendor could lose money if its engineer has to repair the same machine more than once a year.

The 20 personal computer vendors Lyons surveyed charge on-site personal computer maintenance fees of 7 percent to 15 percent—more than the charge for depot maintenance.

A spokesman for IBM's European Personal Computer marketing center in Feltham, England, notes that IBM's service charges vary from country to country, but he reveals that the new on-site service will be priced 50 percent more than the existing carry-in depot service. Each country will decide whether to offer on-site service; it is available in the Netherlands and is in its final implementation in other countries, he says. □

## DG ANNOUNCES RELATIONAL DBMS

Data General Corp. recently announced the DG/SQL relational database-management system (DBMS) targeted for technical applications on Eclipse MV series minicomputers that run the AOS/VS operating system. The DBMS is based on the SEQUEL data sub-language and stores data in a collection of tables. DG/SQL features system-wide referential integrity. That prevents mistakes such as deleting a customer record when order records exist for that customer. The system has COBOL, FORTRAN 77 and PL/1 interfaces. Initial licenses are \$20,000. Subsequent licenses are \$15,000.

## AT&T FORMS ISV PROGRAM

AT&T has started an independent software vendor (ISV) support program to encourage vendors to write applications for the company's UNIX System V and 3B computer line. The company will offer both discounts and training to qualified ISVs and will publish selected packages.

## PRINTRONIX SUES MANNESMANN TALLY

Printronic Inc., Irvine, Calif., has filed a lawsuit in the U.S. District Court for the Central District of California, against Mannesmann Tally Corp., New York. The suit alleges patent infringement by Mannesmann Tally in the design, manufacture and sale of the MT630, MT660 and MT690 dot-matrix line printers. Printronix is seeking damages and an injunction against further infringement.



**FINALLY,  
A CORPORATE NAME CHANGE  
MADE FOR THE  
BEST POSSIBLE REASON.**



# WE DIDN'T LIKE THE OLD ONE.

## DATA SYSTEMS DESIGN

January 1, 1984

Does it make sense for us to think about changing our company name? Your comments please.

Route to: list

*RPD*

*WE DON'T JUST DESIGN, DO WE?*

*FUD FACTOR  
WILL OUR CUSTOMERS KNOW WE'RE IN THE BUSINESS?*

*How 'bout "DecStorage" or "International MULTIBUS Storage State-of-the-Art Corporation"?*

*Are we really getting into the "systems" biz?*

*Bert*

*How many co's named "Data Systems"? Must be 50!*

*Milt*

*FSMOT*

*Don*

*New name say: hi oriented, responsible, competitive market*

*Shouldn't say "Systems"?*



Leadership certainly has its advantages. As well as its problems.

Consider a corporate name change. Problem is, most people expect a long-winded rationale. Full of "new commitment" and "new dedication" and other such profundities. Boring stuff to be sure.

But one of the rewards of leadership is that you don't have to create excuses. If your heart is true. And your products are outstanding.

So good-bye Data Systems Design. Hello Qualogy.

We didn't really like the old name. And we've become quite attached to the new one.

Qualogy represents where we've been. And where we're going. It stands for the quality OEMs have banked on for over nine years. Quality that's sold through to customers. And supported for the life of a system.

It also represents technology. Practical. User-oriented. And reliable.

The Qualogy name will appear on the industry's foremost line of DEC®-compatible mass storage devices. Products that are currently shipping. And others that are being developed to meet market demands.

The name will also appear on our complete family of MULTIBUS® products. Our current line. With innovations to help you compete. And win.

Look for some surprises on the way, too. Products that will fit very nicely into your future profit picture. Products that are being readied for introduction in the very, very near future.

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## Olivetti acts as AT&T's counterpart to push AT&T micros in Europe

Keith Jones, European Editor

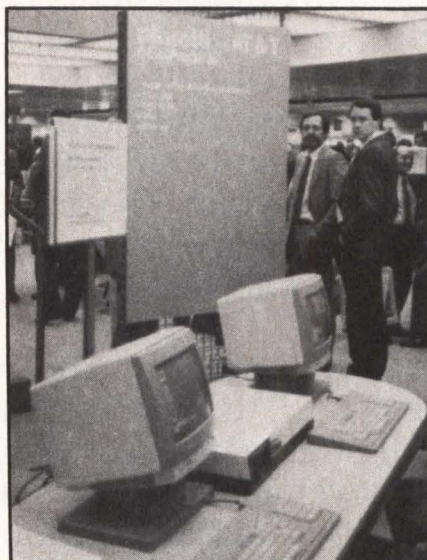
Olivetti & Co. SpA, Ivrea, Italy, is paralleling AT&T Technologies Inc. by moving AT&T's recently introduced 3B microcomputers into Europe (MMS, June, Page 34). Olivetti is seeking OEM customers and value-added resellers as the main sales channels for the 32-bit 3B computers built by AT&T Technologies' Lisle, Ill., computer division. AT&T Co. acquired 25 percent of Olivetti late last year; the 3B computers are among the first AT&T products Olivetti has made available in Europe.

The 3B machines run under the UNIX System V operating system, the version of UNIX that AT&T Technologies is promoting as a standard. AT&T formed AT&T Technologies last year to take over most of AT&T's manufacturing activities. AT&T's group also includes Bell Laboratories, which developed UNIX in the late 1960s.

### Olivetti micros use 32-bit chip

The three machines Olivetti offers center on AT&T's 32-bit WE32000 microprocessor. The two larger models sold as the Olivetti-AT&T 3B5 line compete with the VAX superminicomputer family from Digital Equipment Corp., says Giovanni Gurrieri, director of sales and marketing support for minicomputers and microcomputers at Olivetti's international marketing headquarters in Milan, Italy.

The 3B5 machines are both floor-standing units. The 3B5/100 is configured around the 7.2-MHz version of the WE32000, and the more powerful 3B5/200 employs the 10-MHz WE32000 chip. The third machine is



Olivetti-AT&T's 3B2 32-bit microcomputer attracted crowds to Olivetti's booth at the recent Hannover Trade Fair in West Germany.

the 3B2, a desktop computer that is the size of a personal computer. It incorporates the 7.2-MHz WE-32000. All the models should be available in high volumes by September, says Gurrieri.

Gurrieri underlines Olivetti's strategy of selling the machines only to customers who can add value: "Olivetti will provide just the hardware and UNIX System V. We are leaving our customers to add the rest of the hardware and software, including languages and database-management systems." Customers can add their own workstations or use the terminals offered by Olivetti, such as the AT&T graphics terminals and the DEC VT100-compatible WS584.

Gurrieri notes that Olivetti is preparing a local currency price list for each European country and that the translation of prices for each country is Olivetti's problem. How-

ever, to give a rough idea of prices, he quotes \$15,000 as the single-unit price of an entry-level 3B2 with 0.5M bytes of main memory, a 1M-byte integral floppy disk drive, an integral 10M-byte Winchester disk drive and two asynchronous communication ports. The single-unit price for an entry-level 3B5 is \$67,000, including 1M byte of main memory, an 8K-byte cache memory, eight asynchronous ports and a 48M-byte hard disk drive.

Gurrieri says Olivetti plans to manufacture the 3B machines when volumes are high enough and that Olivetti will maintain end users' hardware when required.

UNIX specialist Sphinx Ltd., Maidenhead, England, is one European software house readying packages for the 3B machines. Sphinx's software catalog should be available by September, says Sphinx managing director Dr. Pamela Geisler. It will include database-management, spreadsheet, word-processing and accounting software. Geisler says some of Sphinx's packages, written in C or a high-level language such as COBOL, run under System V on other manufacturers' machines.

Olivetti owns a minority share in Sphinx, but Geisler stresses that the link between the two companies did not inspire Sphinx to become interested in the 3B. "The AT&T machines were always a prime target for us," Geisler declares.

AT&T Technologies and Digital Research Inc., Pacific Grove, Calif., are jointly preparing the UNIX System V Certified Library of Programs (MMS, March, Page 33). The library will support programs for the WE32000, says a spokeswoman for AT&T Technologies, as well as



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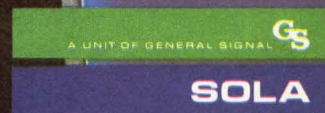
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# Mini-Micro World

## INTERNATIONAL

for the MC68000 processor family from Motorola Inc. and the 80286 chip set from Intel Corp.

Paul Bailey, vice president of Digital Research European Operations, Newbury, England, says machines configured around the MC68000 and 80286 will be the most popular hosts for UNIX System V. "All of the major European computer companies are working with the MC68000, and there will be a significant num-

ber of 80286 machines by the end of 1984," he claims.

Bailey says the library will include packages from both European and U.S. software houses. A Digital Research team in Palo Alto, Calif., which is compiling the library, is evaluating the packages. Bailey hopes the first European titles will be available by the beginning of 1985; the first 30 U.S. packages are expected by the end of 1984. Digital

Research will offer the programs on 8-inch floppy disks, but, Bailey notes, value-added resellers can change the disk format.

Logica UK Ltd., London, which distributes Microsoft Corp.'s UNIX-based operating system, XENIX, in Europe, does not plan to port XENIX to the WE32000, according to Hector Hart, commercial manager of the software products group of Logica. □

## OVERHEARD OVERSEAS

### Honeywell takes a bold step toward helping start-ups

Tim Palmer, European Contributor

U.S. and European companies wishing to break into foreign markets, but afraid of the high investment, have a new vehicle to consider. Honeywell Inc. is opening its entire marketing operation, including premises, people, distribution facilities and stores, to third-party products.

Major U.S. manufacturers, led by NCR Corp., Xerox Corp. and Control Data Corp. (CDC), already offer their maintenance networks and personnel to a host of small new businesses with limited resources. But the Honeywell venture is a bold initiative that could prove to be of great benefit to system integrators.

Last September, Honeywell announced plans to establish Honeywell High-Tech Trading Inc. Although the company was officially born on Jan. 1 and is now 250 people strong, little has been heard of it. Its first two contracts in Europe were negotiated quietly.

High-Tech is looking for appropriate products from small- and medium-sized U.S., European and Japanese companies and is offering to market, distribute and—importantly—service the products worldwide. The full range of services offered by the new company start with product

evaluation. High-Tech president and general manager Bjorn Bjornstad reckons that even aggressive Japanese traders who are clamoring for new electronic products to distribute do not have the same ability to assess a product's potential that Honeywell does.

Evaluation will be followed by market research, arrangement of export financing and worldwide distribution and service. If the client wants its products manufactured abroad, Honeywell is prepared to offer space in its own plants if it has one in the right location with the capability. High-Tech will also repackage European products for the U.S. market.

But High-Tech does not have a hard-and-fast rule about the services offered to a company; each case will be handled separately. Honeywell will arrange, rather than provide, financing; unlike CDC and Xerox, Honeywell does not have a strong financial-services arm. Agreements will vary. In some cases, Honeywell will share the risk of product failure; in other cases, it will guarantee a certain revenue over a given number of years.

Ideally, High-Tech's products should complement Honeywell's own. High-Tech has outlets in 50 countries but plans to sell Honeywell products

to markets in which they are not already sold. And, since it is ready to sell competitive products such as those from Future Technology, it seems that "complementary" will be loosely interpreted.

The European offices of High-Tech in Brussels, Belgium; Milan, Italy; Athens, Greece; and Vienna, Austria, are two-way operations; they take in new European products for marketing within the rest of the network, and they sell products from the rest of the world. The U.S. offices are in New York and San Francisco. There are also offices in Singapore and Tokyo.

People who know only the computer side of Honeywell's business may be surprised at the Continental cities chosen for High-Tech's operation, since they appear to compete with operations of Groupe Bull of France. (Groupe Bull represents Honeywell Information Systems Inc.'s computer operations throughout the Continent, except Italy.) But, since High-Tech is not part of Honeywell Information Systems, Honeywell has opened a back door into all the markets currently within Bull's province. This makes the move by Honeywell not only bold but also beneficial to third parties needing access to foreign markets. □



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Single capstan motor.

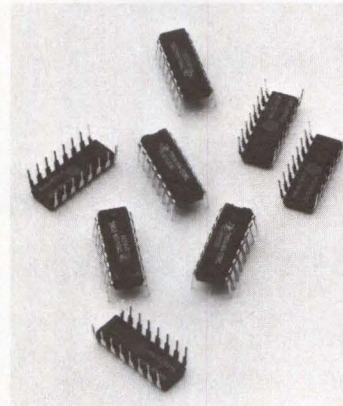
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64 KB cache memory in its interface makes it look like a start/stop drive.

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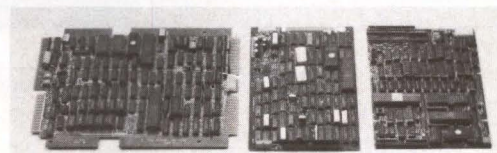
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Tilt Screen	YES	NO	YES	NO
Quiet Operation	YES (NO FAN)	NO	YES	NO
Memory	128K	128K OPTION	256K	256K OPTION
Graphics Display (640 x 200 resolution)	YES	OPTIONAL	YES	OPTIONAL
Printer Port	YES	OPTIONAL	YES	OPTIONAL
Communications Port	YES	OPTIONAL	YES	YES
MS™DOS/BASIC®	YES	OPTIONAL	YES	OPTIONAL
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Quiet Operation	YES (NO FAN)	NO
Display	YELLOW	AMBER
Memory	256K	256K
Graphics	YES	YES
Communications Port	YES	OPTIONAL
Printer Port	YES	OPTIONAL
MS™ DOS 2.11	YES	OPTIONAL

IBM hardware options without modification.

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# The Interpreter

An analysis of news, issues and trends affecting the computer industry

## Software vendors zero in on marketing

*It takes more than product quality to score a hit in the crowded microcomputer software field*

**Marjorie Stenzler-Centonze**, Associate Editor

In the early days of selling microcomputer software, suppliers could count on product quality alone to produce a hit. Now, they must solve a jigsaw puzzle with pieces as diverse as customer needs, technological expertise, distribution channels, support and—to a growing extent—marketing strategy.

As the base of microcomputer users grows, the software field is blossoming. Sales of microcomputer business software should reach \$2.2 billion this year and swell to \$8.1 billion by 1989, predicts market research company Future Computing Inc., Richardson, Texas. But high-quality software is also easier to find, making competition fiercer.

"Today, having a good product is not enough," says Rod Turner, vice president of sales for Ashton-Tate, Culver City, Calif., a leading supplier of application packages. "There's no way that a product is going to be successful in 1984 without a strong marketing campaign behind it."

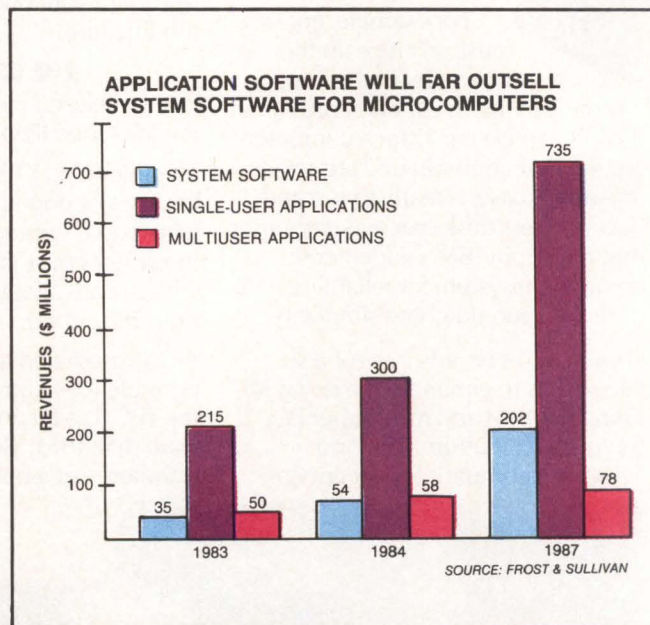
With even successful companies under pressure and rethinking their strategies, some look toward diversifying as a path to long-term survival. Two of the best-known suppliers of operating systems—Microsoft Corp. and Digital Research Inc. (DRI)—are making a strong push into the application software domain. Microsoft, Bellevue, Wash., is the developer of MS-DOS, and DRI, Pacific Grove, Calif., is the developer of CP/M.

DRI views system software as a narrow segment of its business but one that the company will continue to address, says Mark Duchesne, director of marketing. DRI plans to release a major addition to its operating software line this summer. The company claims the addition, Concurrent PC-DOS, will support concurrent CP/M and PC-DOS applications, offer built-in windowing capability and run as many as four tasks simultaneously.

In an effort to diversify further, the company is making major moves into applications this year. DRI is stressing presentation graphics with its DRI Graph and DRI Draw programs. In addition, the company an-

nounced a joint venture with AT&T Co. to publish a UNIX System V application library comprising packages licensed from independent software vendors. The first 10 of 30 applications due out this year will be licensed to OEMs starting in September, Duchesne says.

Similarly, Microsoft plans to make significant strides in applications this year while maintaining its strength in system software. Supplying system software is a high-risk, high-return business in which companies have either a large share of the market or almost no share, contends Steven A. Ballmer, vice president of marketing at Microsoft. "Although competition is intense in the applications side, it's still a lot easier to have, say, a 20 percent market share," Ballmer says. "In the operating-system business, it seems your market share is under 4 percent or over 90 percent." In an effort to leapfrog the competition, Ballmer says, Micro-



**Software vendors look toward applications for the biggest growth opportunities, even though microcomputer system software remains a viable and growing market. Application packages for single-user micros will make up the fastest-growing market segment, predicts research company Frost and Sullivan Inc.**

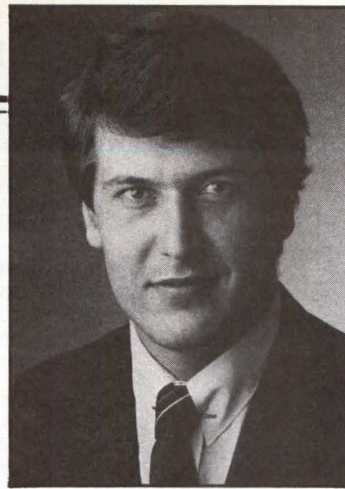


soft is directing significant application-development resources toward Apple Computer Inc.'s Macintosh computer. These packages will take advantage of the advanced graphics the machine incorporates in its user interface.

### Diversifying may hold dangers

The software community greets the diversification efforts of its competitors with mixed reactions. Companies throughout the industry are desperately trying to broaden their product lines, says Burt Bralliar, director of strategic marketing for Peachtree Software, Atlanta, a leading supplier of microcomputer application software. But, he warns, companies moving from system software into applications may have to watch out for new obstacles.

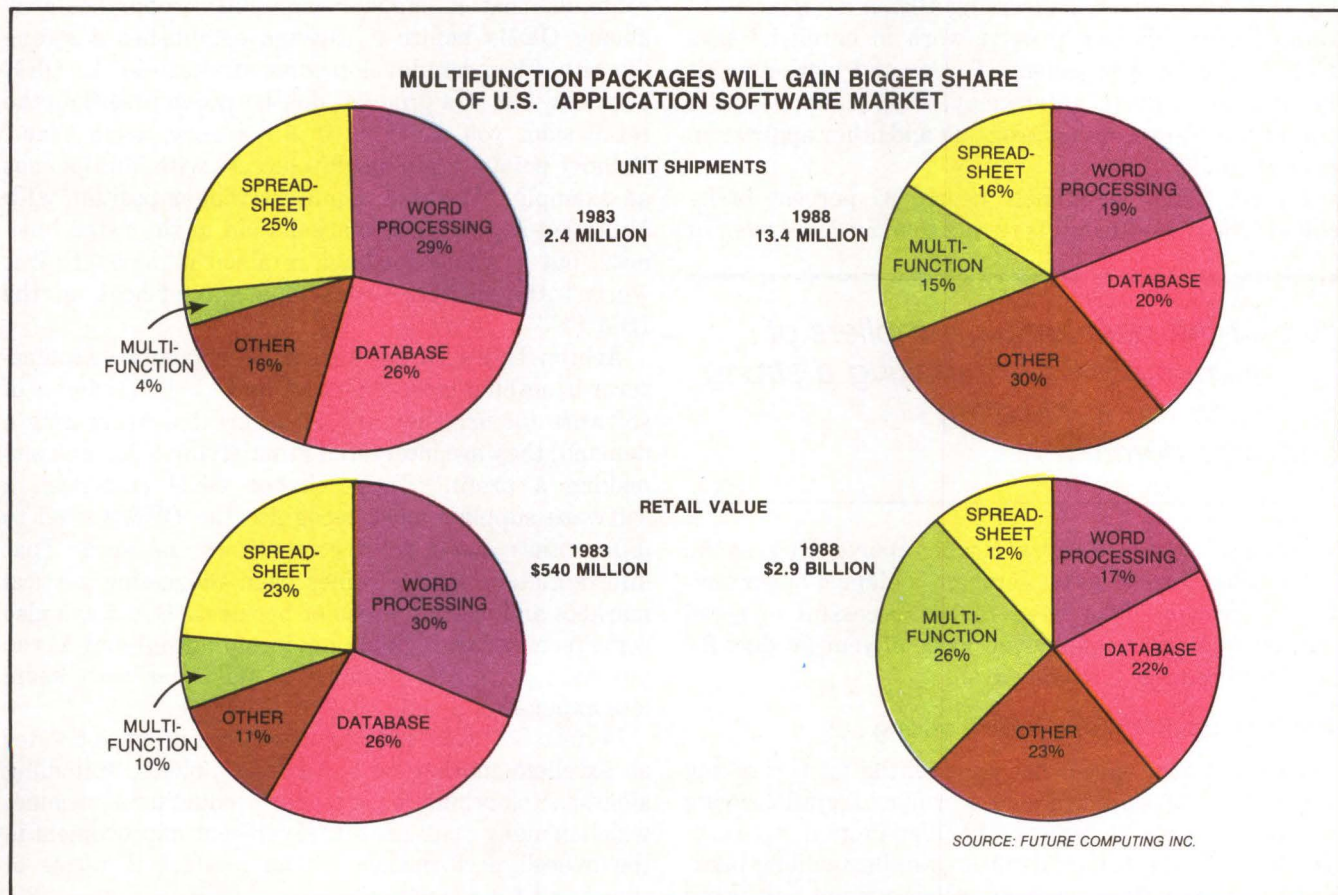
In moving from system software into applications, a company such as Microsoft may face a backlash from application suppliers, Bralliar explains. "Now, these [application] companies are going to have to re-evaluate their incestuous relations with Microsoft because the



"Today, having a good product is not enough," says Rod Turner of Ashton-Tate. He speculates that a software supplier might sell 5,000 units a year without a good marketing campaign but emphasizes, "to be successful today, you have to have a much higher unit volume than that."

company is starting to produce packages that are in direct competition with their own applications," Bralliar asserts.

Ashton-Tate's Turner points to another problem. While the market may have room for a company that develops only system or utility software, such a narrow focus might limit a company's growth to the point that it becomes uncompetitive. Ashton-Tate is expanding into productivity software with its introduction of Framework, an integrated package that includes word-processing, spreadsheet, file-management and graphics functions. However, Turner cautions, over-diversifying can put a company in a precarious position. "It's unwise to

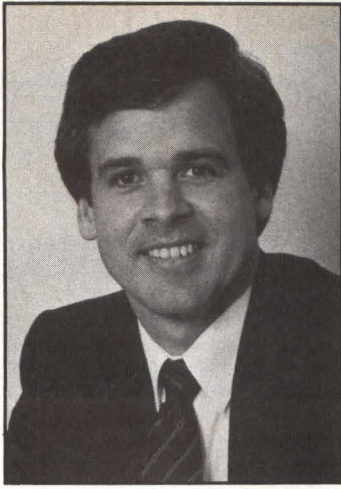


Users will turn increasingly toward multifunction software by 1988, predicts research company Future Computing. In the past,

users had to purchase separate packages to perform functions such as spreadsheet and word processing.

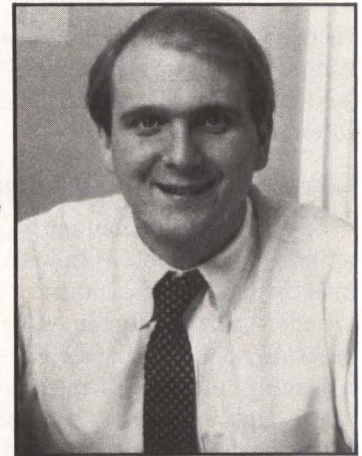


# The Interpreter



**"It's very important to make strategic alliances with companies like IBM and AT&T,"** says DRI's Mark Duchesne of marketing systems software. "Small companies like DRI and Microsoft don't create standards."

**"We need to emphasize the design of products that people want,"** stresses Microsoft's Steven Ballmer. "It's easy to spend a lot of money advertising, but it's hard to design the kinds of products that people really need."



diversify too far because the main line of the company can become secondary to other less important lines," he says. "It's difficult to be a winner in everything."

With diversification, companies must re-define distribution channels and realign marketing strategy. Suppliers that once sold most of their software to OEM customers are now expanding into the retail area by adding application packages to their offerings.

Successfully selling software to OEMs, value-added resellers and retail dealers involves developing marketing tools that include support, demonstrations and advertising, vendors say. "There are different marketing considerations in addressing OEMs as opposed to retail dealers, but they must work in parallel," says Nick Roche, vice president of sales and marketing at Perfect Software, the Berkeley, Calif., supplier of a popular word-processing program and other application packages.

Perfect Software funnels nearly 85 percent of its sales through OEMs but is trying to move 50 percent of

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***Two of the best-known suppliers of operating systems are making a strong push into the application software domain.***

---

its sales into the retail area, Roche reports. He sees the retail sales channel as his company's biggest opportunity for growth. "You have to be successful in retail marketing to give a perceived value of your product for the OEM market," Roche says.

## **Product identity must remain strong**

Most vendors agree that an essential part of selling application software is creating product identity among end users and throughout the distribution network. DRI's Duchesne maintains that even best-selling packages had to build their reputations among end users before they became popular with OEMs. "If Lotus had gone out to sell its 1-2-3 product to OEMs without first

having created an identity, there would not have been a very high demand for the product," he argues. "After it becomes a known brand, which is done through the retail channel, it becomes a highly desirable product for the OEMs."

Microsoft's Ballmer supports this view, although he contends that a supplier can make some headway among OEMs before a package establishes a strong identity. "You can develop some strength in the OEM business, but if [a product] doesn't prove [itself] on the retail side, you could be in for a very tough time." Ballmer points to Microsoft's success with Multiplan as an example. "We have a much stronger position with Multiplan in the OEM market than in the retail business, but it would not have retained its strength if it weren't the number-two selling spreadsheet on the IBM PC."

Ashton-Tate's Turner agrees: "A computer manufacturer is nothing more than a value-added distributor of software for us. They are not interested in creating a demand, they are interested in satisfying a demand and making a profit." To reach the OEM customer, a software supplier must recognize the OEM's need to differentiate itself from competitors, he says. That differentiation usually comes from addressing vertical markets and specific areas of business. But it can also come from software bundling: including software in the purchase price of a machine to make hardware seem less expensive.

Perfect Software's Roche thinks the practice creates an excellent market for software suppliers: "Bundling allows us to optimize a particular product for a machine, which in many cases enables significant improvement in the overall performance of the product in terms of speed and functionality."

Peachtree's Bralliar believes the software-bundling market will continue to grow because manufacturers





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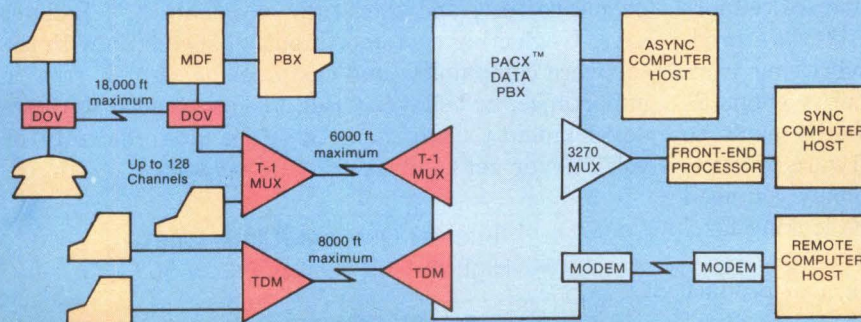
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# The Interpreter

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are clamoring for it. But, he reasons, as software becomes the computer industry's driving force, bundling will become less attractive to software suppliers. "Software companies are going to feel they don't have to offer the extortionate discounts to sell through this channel when they go out and sell through distributors and dealers," he explains.

Ashton-Tate's Turner views the bundling market as risky, cautioning that it could snuff out demand for a product at the retail level. "If we were to focus too heavily on hardware manufacturers for bundling, we would quench retail demand, and OEMs would no longer find our products exciting," he says.

Bundling presents risks for hardware manufacturers, too, points out Microsoft's Ballmer. Other software vendors may lose interest in supporting and selling

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*'In the operating system business, it seems your market share is under 4 percent or over 90 percent.'*

---

software for the machines, afraid their market will be taken away. "I don't see bundling as a particularly viable long-term approach," he says. "Take Apple, for example. Early on, they said they would bundle the Macintosh with MacPaint and MacWrite [software packages], but they intend to unbundle later on because they want to get other quality word processors on their machine."

One area in which bundling may remain viable in the future is in bulk sales of standalone personal computers. Dan McGee, director of marketing for Lotus Development Corp., Cambridge, Mass., points out, "Hardware manufacturers are now getting serious about the bulk selling of microcomputers. As you see more massive purchases in the multiple-thousand-unit range, companies are trying to standardize by having everyone work on a similar package."

## Marketing becomes sophisticated

Whatever the marketing approach, software vendors agree that launching and maintaining a software product today is expensive. Expensive advertising campaigns are becoming the rule since Lotus spent \$1 million to launch its 1-2-3 program. Lotus plans to spend even more launching its latest software product, Symphony, than it did for 1-2-3. "The money you need is a function of the market share you are looking for," comments McGee.

An important part of such a campaign is product

positioning. "If people cannot understand in common terms what the product is and what benefits it delivers, they will not try the product," McGee says. Peachtree Software's Bralliar underlines the importance of positioning, especially for an intangible product such as software: "You have to define for the potential customer what the package is and what it is supposed to do. Many technically sound products have not succeeded simply because of bad marketing."

Many other software companies agree that customers don't buy what they don't know—and that it takes big money to lift a product above the noise in the market today. In many cases, companies must prepare to accept early losses and to defer profits. And the ante is constantly rising: vendors say launching an integrated productivity package today can cost \$2 million to \$5 million.

Ray Boggs, a consultant with the research company Venture Development Corp., Wellesley, Mass., sees a hefty advertising budget as essential for software success today. "It's a function of what it takes to sit at the grown-ups' table. You need to invest at the same level at which other major companies are spending," Boggs says.

But the more money it takes to market and support a product, the more smaller software companies are overshadowed by major competitors. There are concerns in the market about whether small companies with sound software offerings can succeed. Perfect Software's Roche believes there is room for new companies and that ongoing opportunities still exist: "I think the retail market is still very open. As it matures, it will be more and more competitive, but if a company does a lot of things right and has a good product, they will find their niche."

Microsoft's Ballmer expects effective marketing to give companies the ability to focus on customer needs rather than on technology alone. He emphasizes the importance of introducing a product, letting customers use it and then refining and improving it repeatedly based on customer feedback. "Designers too often have a concept in mind, and they code it up, give it to a few people to test, and then they say, 'ship it,'" Ballmer says. Neglecting customer input will catch up with the software community, and customer needs will grow in importance, he believes. "But it requires good software development tools to make these changes efficiently, or you'll never get to market," he concludes. □

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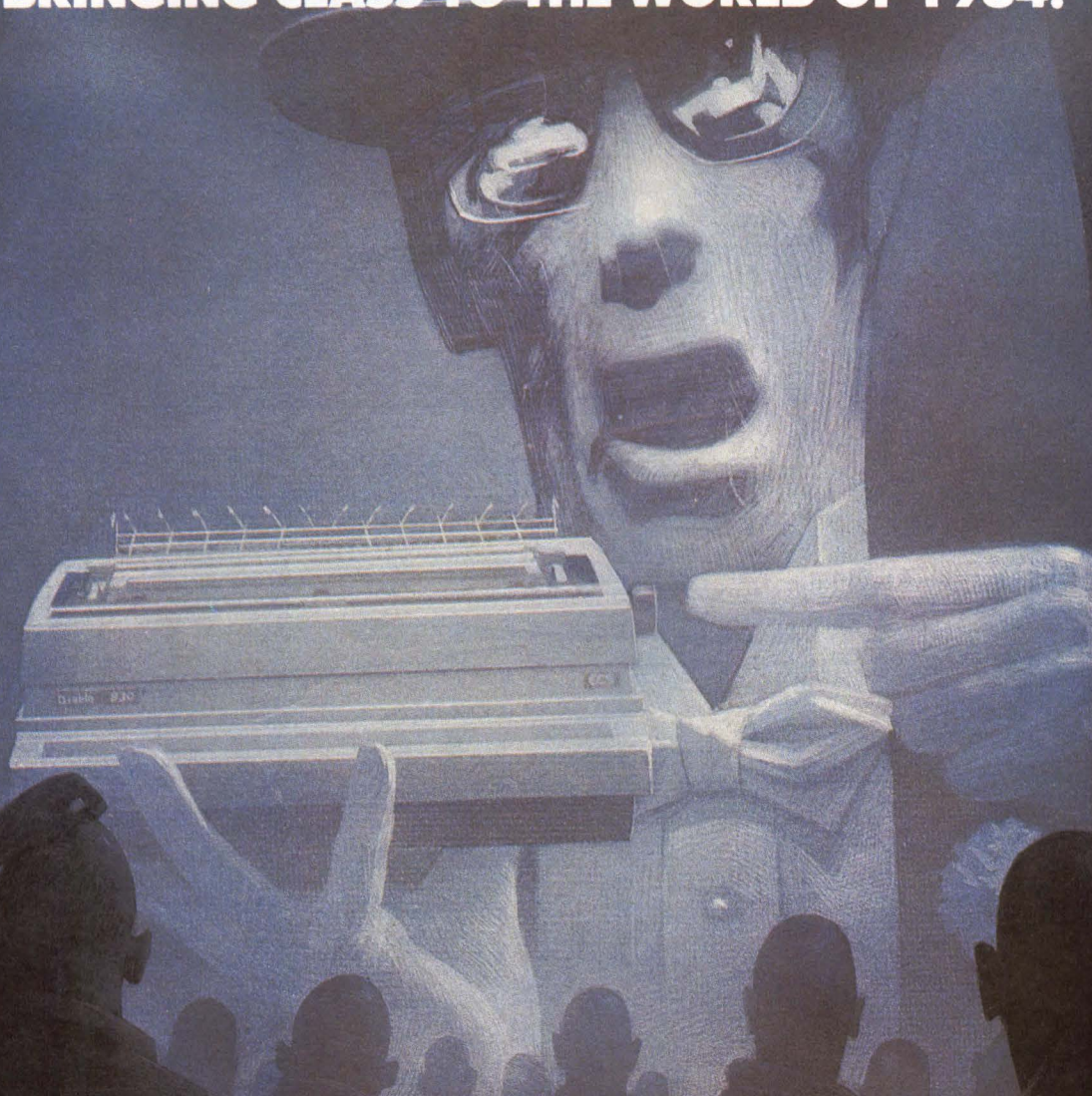
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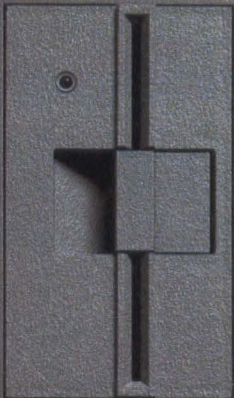
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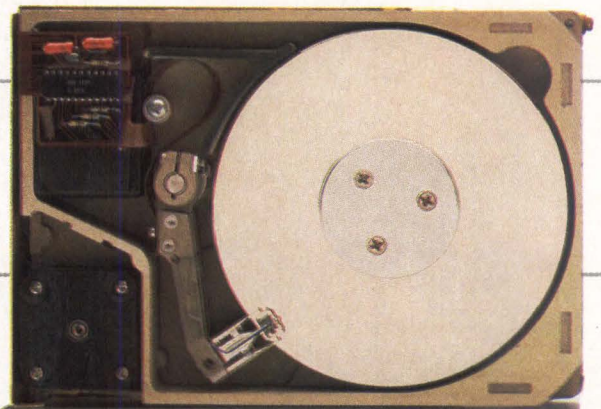
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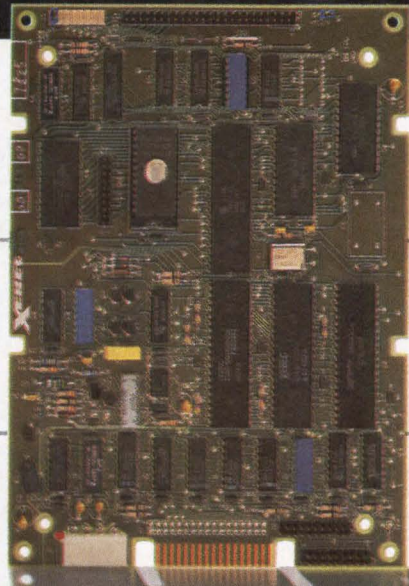
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# The Interpreter

## IBM's LAN: To wait is the question

*Should system integrators wait years for IBM's LAN  
or take the plunge with solutions from other suppliers?  
Opinion is divided*

**Marjorie Stenzler-Centonze**, Associate Editor

IBM Corp. recently broke its silence on plans for local-area networks (LANs). It introduced a star-wired LAN cabling system, which connects wall outlets in offices to wiring closets, and announced its intention to implement a token-passing ring LAN based on that system—but not for two to three years.

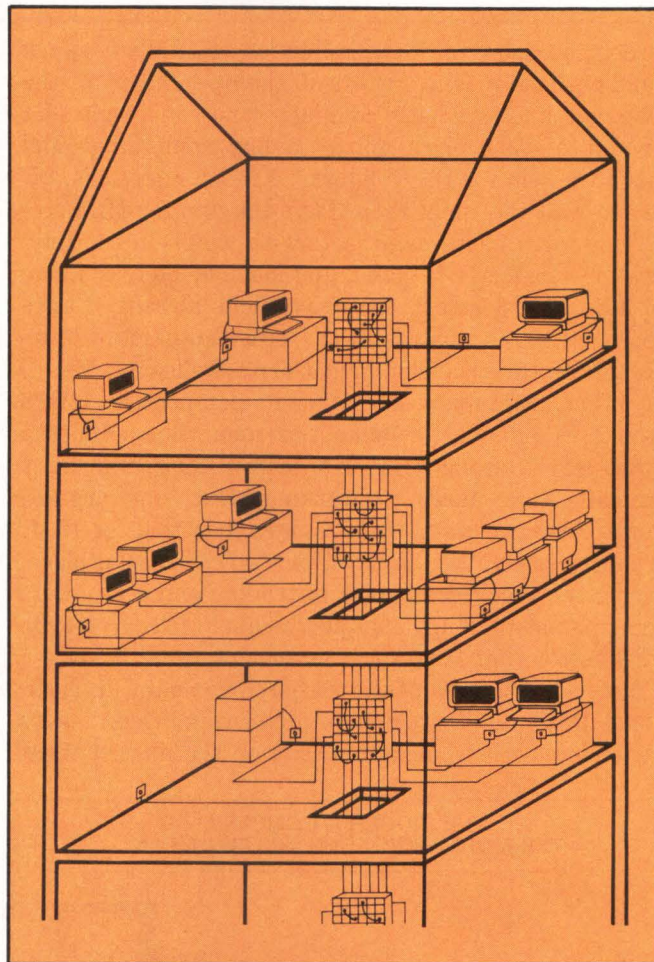
Industry observers greeted the token-ring aspect, tucked into a press release on the cabling scheme, with mixed reactions. Some insiders weren't surprised, having anticipated IBM's commitment to token-ring technology as a natural extension of its work on LAN standards (MMS, January, Page 31). Others claim the announcement is premature.

Some see the announcement as an attempt to stymie sales by LAN vendors over the next few years. Still others see it as an impetus for customers to buy sooner, since they now know how long they'll have to wait for IBM's version. IBM watchers agree, however, that companies considering networking will have to evaluate their plans seriously before deciding whether to wait for IBM or go with an alternative LAN scheme such as Ethernet.

Despite the uncertainty, most feel IBM's announcement adds credibility to this fast-growing market. Nonetheless, many expressed disappointment that the long-awaited announcement contained no new technical details about IBM's projected LAN.

Randall L. Sherman, vice president of telecommunications and office automation for Creative Strategies International, San Jose, Calif., echoes the disappointment. He notes that IBM announcements are usually more exciting. "This was sort of a Band-Aid to what we'd like to see." He contends that IBM needs a LAN for its System 34, System 36 and System 38 equipment that integrates a controller for a PC network, not just a pipeline between the different classes of equipment.

"Wang [Laboratories Inc.], Xerox [Corp.] and Hewlett-Packard [Co.] are moving right ahead," Sherman says, "and IBM is left with a little dust on them." He argues that, rather than basing its strategy on innovation, IBM has a predatory philosophy: "It prefers



**The IBM cabling system is installed permanently, just like telephone lines. The company claims that such a system will eliminate most of the expense of moving workstations within a building.**

that markets mature and show some potential; then it learns from others' mistakes, so it doesn't have to make the mistakes itself."

Ethernet vendors applaud IBM's announcement, according to Bill Krause, president and chief executive officer of 3Com Corp., Mountain View, Calif. He views IBM's announcement as a triple win: "It's a win for IBM, it's a win for the customer, and it's a win for the independent local network vendors."

3Com and other Ethernet vendors believe the two- or



# The Interpreter

## A close look at the cabling system

IBM Corp.'s cabling system, available this fall, is permanently wired and connects to outlet plates in office walls. The single cabling system can be used instead of coaxial or twin-axial cable, existing twisted-pair wiring or other special cabling, according to IBM. The system enables connec-

tions to be made between devices with a common cable consisting of twisted pairs of copper conductors.

The system connects wall outlets to distribution panels in wiring closets, with cables fanning out from each closet in a star-shaped pattern. Each distribution panel can accept as many

as 64 cables from different devices.

Most currently available IBM workstations and small- and intermediate-sized computers can be connected to the cabling system, claims IBM. It announced that customers could begin ordering cables and accessories this month.

three-year delay in the introduction of IBM's network could push many fence sitters off their perch. "Now, the customer knows what's coming. If he can't wait that amount of time, he's going to buy something—and that's the win for the vendors," Krause maintains. "If he can wait the time, then that's the win for IBM."

Customers have many factors to weigh in the buy-now-or-wait-for-IBM game, and much is likely to hinge on how much legwork they have done already. Leone Pease, research analyst in the office-automation division of Venture Development Corp., Wellesley, Mass., says that, from many an end user's perspective, IBM's intentions have come none too soon. She admits a three-year wait for IBM can seem a long time for a company that needs networking. But, she argues, companies have waited a lot longer than that for IBM. "Unfortunately," Pease says, "in today's marketplace, people see many companies in trouble and still others going bankrupt. They may just be likely to say, 'Maybe we'd better wait for IBM.'"

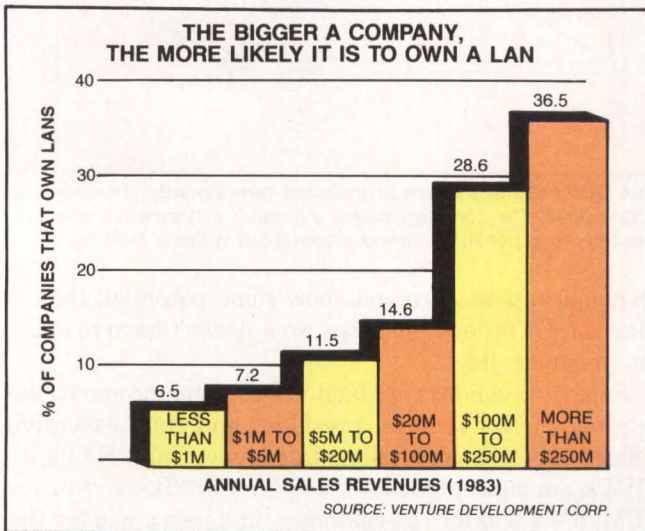
Maureen Fleming of the research company International Resource Development, Norwalk, Conn., says customers need to look at what's on the market right

now, rather than at what they imagine is coming. "After the PCjr bomb, with its keyboard problems, performance limitations and disappointing sales, IBM has to be careful too," she says. "Two blows, one after the other, wouldn't be too smart either." Fleming feels that delaying its LAN may affect other IBM products as well—particularly the expected supermicrocomputer dubbed "Popcorn," which she thinks will be a LAN-based system. She speculates that the LAN delay will in turn hold up the Popcorn's introduction.

3Com's Krause says his company already is seeing more interest by customers who cannot wait—or choose not to wait—for IBM. He doubts that today's Ethernet buyers are necessarily making the decision to cast aside IBM. Instead, Krause predicts that many companies are likely to end up with both Ethernet and IBM installations. "We have felt for some time that there would be more than one standard," he says. "There are at least two companies that have the marketing muscle to set de facto standards; those two companies are AT&T and IBM."

Krause believes that IBM's choice of the token-ring architecture will establish that technology as a de facto standard, but making it standard is proving harder than the company would like. Indeed, he says, IBM has received a strong message from customers that its token-ring network must be accepted as an industry standard to be successful. "It appears that customers have said to IBM that it's not enough just to be IBM," says Krause.

Creative Strategies' Sherman says of IBM that an announcement is simply not enough to establish a token-ring LAN as a standard. "It's a bit like chasing a shadow. The fact that they've said it does establish a kind of 'phantom' de facto standard, but I don't think it locks them into a particular type of architecture." He believes the company could still change course for any number of reasons: "Two years down the road, technology will evolve." □



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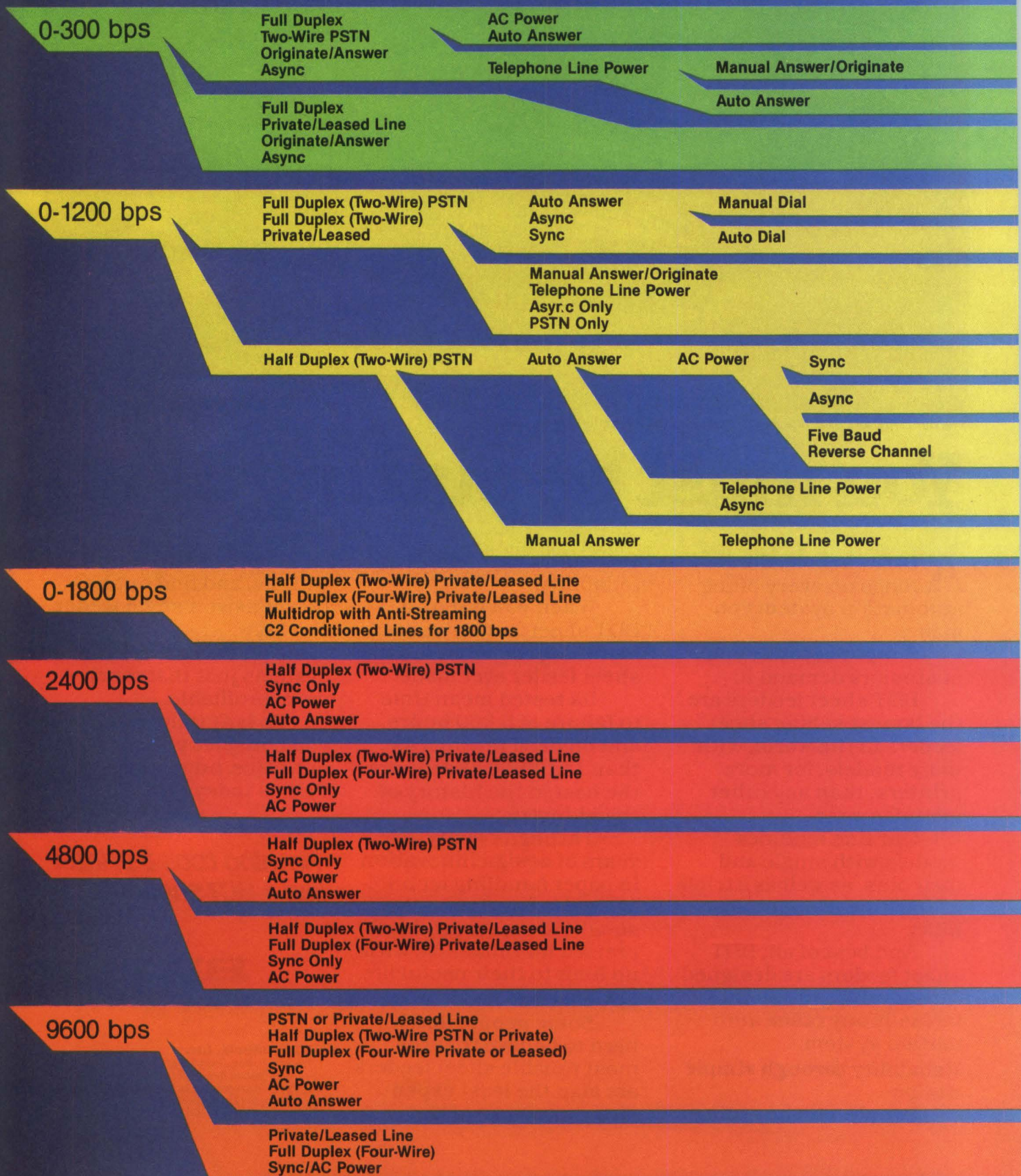
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108

212A

212A/D

212 LP

202S/SS

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## Technology continues to define leaders of CAD/CAM and CAE market

*Sales of computer-aided design, manufacturing and engineering systems rebounded from a slow start in 1983, may reach 40 percent growth in 1984*

Charles M. Foundyller, Daratech Inc.

Although 1983 began with only modest revenue gains for the computer-aided-design/computer-aided-manufacturing (CAD/CAM) and computer-aided-engineering (CAE) industry, it ended with a record-breaking final quarter for market leaders Computervision Corp., Bedford, Mass., IBM Corp., Intergraph Corp., Huntsville, Ala., and Calma Co., Santa Clara, Calif. Revenues topped \$1.7 billion in 1983, representing a 32 percent annual growth rate—up from the 28 percent growth rate recorded in 1983 but still below 1981's phenomenal 40 percent growth rate.

A buying surge in the last two months of 1983 increased estimated 1983 industry revenues by \$100 million and raised predictions of this year's growth to a bullish 40 percent annual rate. Supporting this optimism are forecasts from economists, who estimate that 1984 corporate earnings will rise more than 22 percent, spurring investment in plants and equipment.

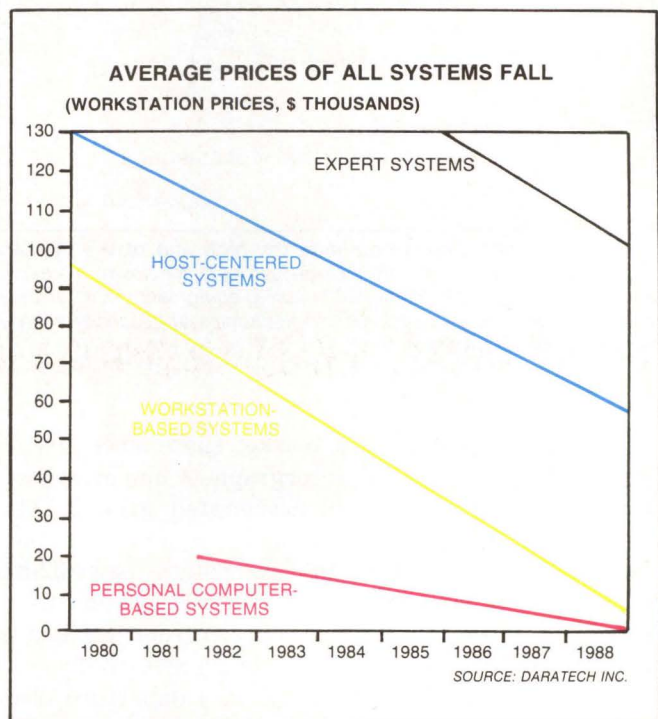
Vendors continue to enter the CAD/CAM and CAE market in record numbers. By Daratech Inc.'s count, the number of vendors selling CAD/CAM and CAE systems in the United States has increased fivefold, from about 20 at the end of 1980 to more than 100 in 1983. The shakeout of weaker companies, predicted by many observers in 1983, never materialized.

In the battle for market share, IBM, Intergraph, McDonnell Douglas Automation Co. (McAuto) and Control Data Corp. (CDC) all gained ground last year. Intergraph, the fastest-growing vendor in 1982, was again the growth leader in 1983. With 1983 revenues projected at \$252 million, Intergraph grew 62 percent to capture 14.6 percent of the market. Its growth places Intergraph only 8.5 percentage points behind Computervision and 4.6 points behind IBM. Intergraph continues to benefit from being the first to market systems with 32-bit superminicomputer power and advanced, high-performance raster displays, while

competitors Computervision, IBM, Calma and Applicon were unable to offer comparable systems until the second half of 1983.

Computervision, the industry sales leader, increased its revenues by 23 percent to an estimated total of \$400 million in 1983, giving it a 23.1 percent market share. Computervision's release last September of the CDS 4000 system, which incorporates the company's long-delayed proprietary 32-bit processor, rallied sales after a slow first six months. Almost 74 percent of Computervision's 1983 growth took place in the second half of the year.

Also contributing to Computervision's 1983 revenue

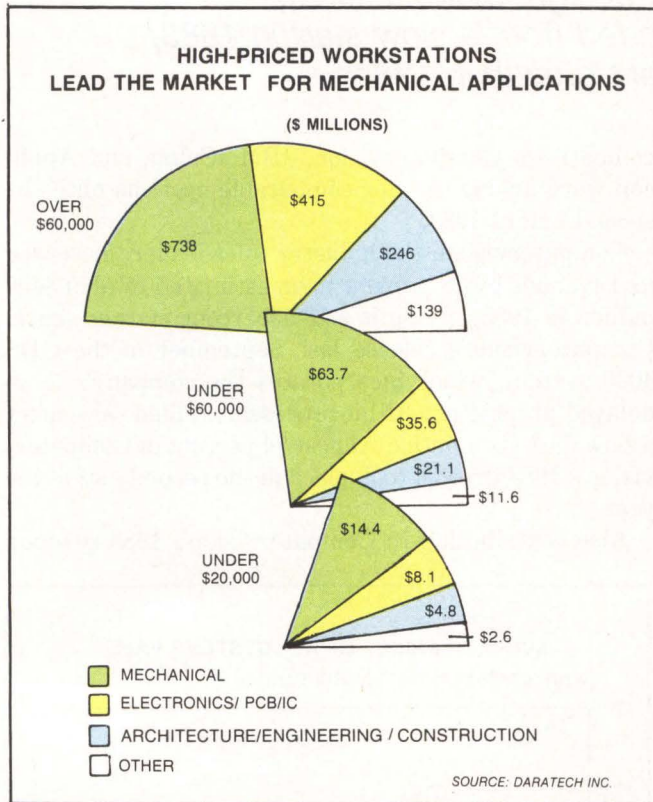


Prices of CAD/CAM and CAE systems should continue to fall, reflecting a trend established by most computer-based equipment. Although price reductions were most dramatic in the early 1980s, they should continue to decline steadily until the end of the decade.



# The Integrator

growth was its first-quarter acquisition of Cambridge Interactive Systems (CIS) Ltd., Cambridge, England, developer of Medusa, a CAD/CAM software system marketed in the United States by Prime Computer Inc. With sales of \$20 million, CIS accounted for 26 percent of Computervision's 1983 revenue increase.



**Mechanical applications dominate the high end of the market.** Such applications frequently include software for solids modeling and interfaces to automated manufacturing equipment. Although they can be quite complex, systems for electronics applications usually include only 2-D graphics.

Having consistently lost market share since 1981—principally to IBM and Intergraph—Computervision might be on the verge of accelerated growth. The company has had problems bringing products to market on time; for example, the company's new 32-bit computers, which power the CDS 4000 system, were more than a year late. Now, Computervision insists it is determined to step up R&D and bring new products to market more quickly. Recently, in a departure from past practices, Computervision began looking outside the company for hardware, software and expertise to speed new systems to market.

Two examples of the new direction are new Comput-

ervision systems based on IBM 4300 computers and the high-performance workstations to be developed jointly by Computervision and Sun Microsystems Inc. If completed on time, they promise to give Computervision competitive, up-to-date systems at the high- and low-priced ends of the market. Once the company starts shipping these advanced systems in volume, its revenues will grow. But Computervision may not gain market share until 1985 because of strong competition and because it lost customers while it lacked a leading-edge product.

IBM, with 1983 sales of CAD/CAM and CAE systems to end users that grew a little faster than the industry norm, will probably pass Computervision to become the industry's leading supplier in 1984. IBM's growth was slow for most of 1983 because its model 3250 workstations had shortcomings that limited applications in areas such as solids modeling and electronic design. Nevertheless, IBM's CAD/CAM and CAE sales reached an estimated total of \$332 million, giving the company a 19.2 percent market share. This year, innovative products such as the newly announced model 5080 high-performance raster workstation, scheduled to be shipped in the second quarter of 1984, should improve IBM's position. With its aggressive pricing, attractive leasing options and well-known marketing skills, IBM should capture a dominant share of the end-user CAD/CAM and CAE market.

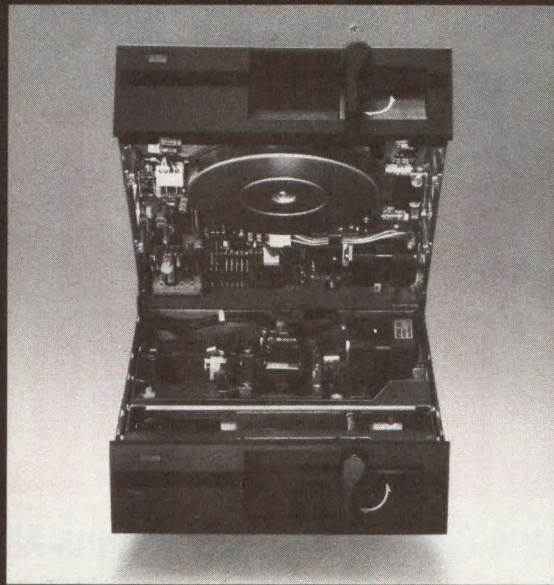
In addition to direct sales, IBM's Distribution Channels Unit is becoming a major OEM supplier of computers and workstations for CAD/CAM and CAE. Moving into a market long dominated by Digital Equipment Corp., Data General Corp. and Hewlett-Packard Co., IBM is re-establishing itself as a supplier of computers to the engineering community—a role it gave up in the late 1960s. So far, Computervision and Matra Datavision have announced plans to become IBM value-added remarketers (VARs). Computervision systems will incorporate the IBM model 4300 series of superminicomputers for database management; Matra's Euclid software will run on model 4300s using IBM's model 5080 workstations.

## Other contenders fill market niches

McAuto, St. Louis, the sixth-largest CAD/CAM and CAE vendor, made impressive gains in 1983. In spite of increasingly strong competition from IBM and Computervision, McAuto's sales grew 48.2 percent to reach \$70 million, giving the company a 4 percent market share. McAuto owes much of its market strength to the depth and range of its CAM software. Although sales of its highly regarded solids-modeling package have been



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# The Integrator

slow, McAuto remains a leader in CAM. This position and an increased emphasis on the architecture, engineering and construction (AEC) market, should help McAuto continue to gain overall market share in 1984.

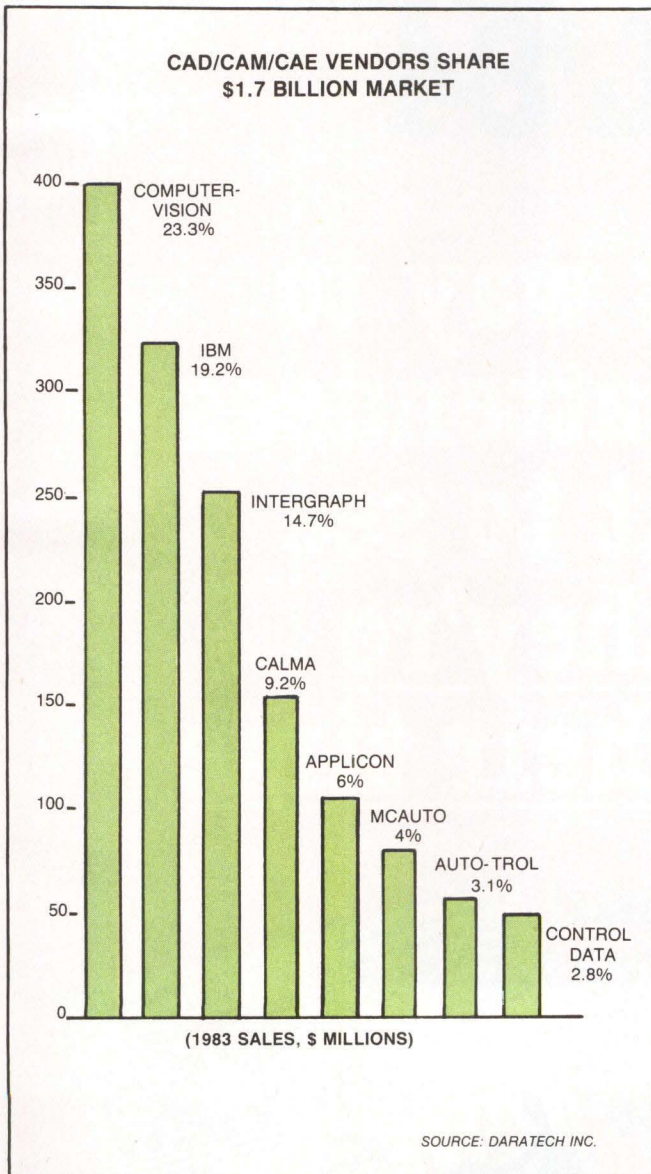
After losing ground for two years, Auto-trol Technology Corp., Denver, rebounded in 1983 and may finish the year with two consecutive profitable quarters—its first since 1980. Although the company is still far from regaining the 8 percent market share it commanded

four years ago, its revenues grew an estimated total of 20.5 percent to \$53 million, topping the 1980 high of \$51 million.

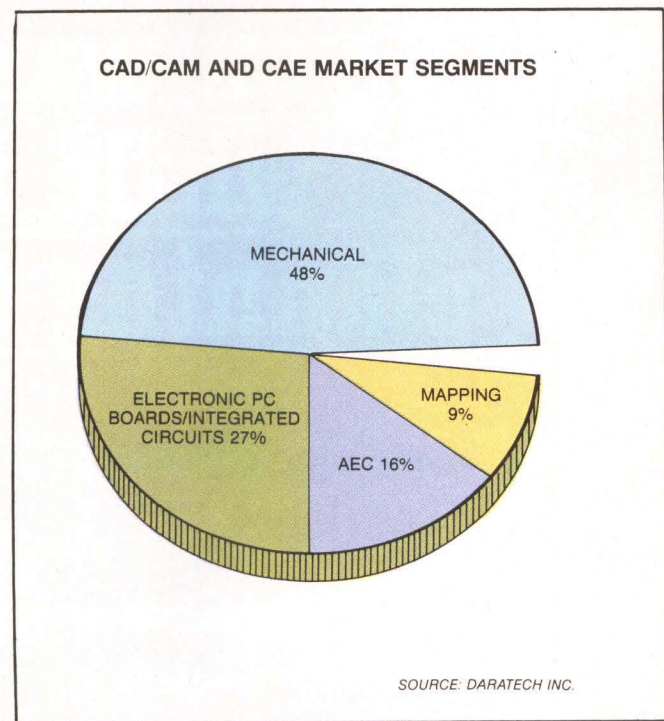
Auto-trol's turnaround was mainly due to the success of its AGW line of systems for mechanical and AEC applications, which are based on workstations from Apollo Computer Inc. The mechanical system, released in mid-1982, and the AEC system, released in the first quarter of 1983, account for 80 percent of Auto-trol's system sales. Indications are that the company will continue to do well in 1984.

CDC, Minneapolis, is making considerable progress establishing itself in the CAD/CAM and CAE industry. In 1983, the company posted revenues of \$82 million from all CAD/CAM- and CAE-related sources. An estimated total of \$49.2 million from the sale of systems and related services represented a 46.4 percent increase over the previous year's sales. The company's good performance came mainly from stronger-than-anticipated acceptance of its low-cost ICEM/120 series of design/drafting systems introduced in late 1982.

CDC appears committed to expanding its CAD/CAM and CAE operations. In November 1983, the company



Computervision is the CAD/CAM and CAE industry leader, although it has lost the dominance it held just a few years ago. IBM and Intergraph, second and third, respectively, now account for a third of industry revenues.



Mechanical applications account for nearly half of the CAD/CAM and CAE market, partly because the mechanical and industrial engineers comprise a majority of engineers and partly because the value of systems tends to be higher than that of systems in the other market segments.



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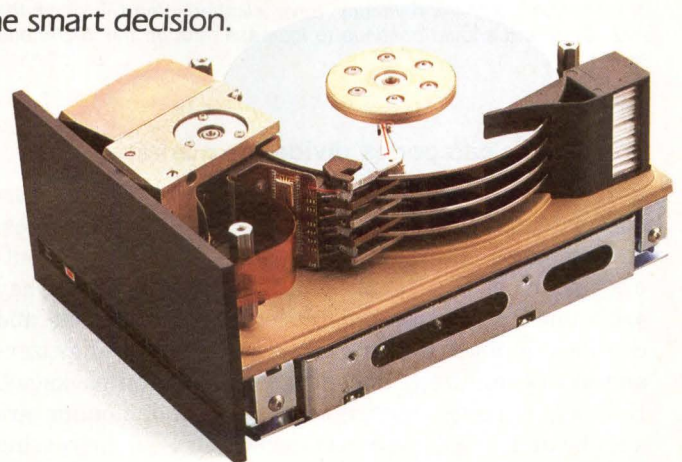
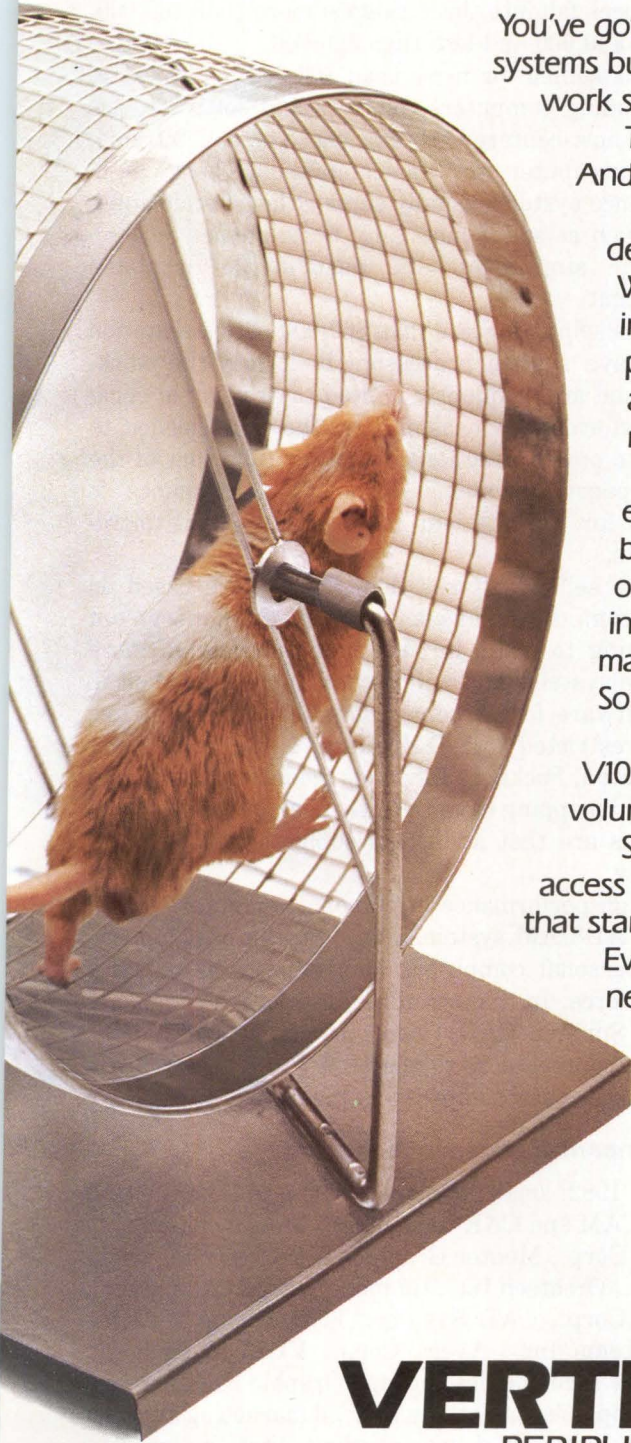
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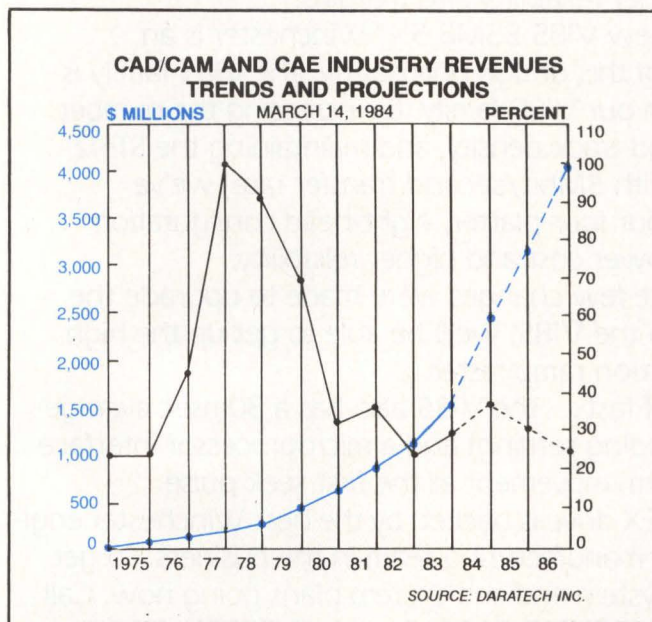
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# The Integrator

formed a division to integrate its CAD/CAM and CAE and manufacturing-support activities. Called the Computer-Integrated Manufacturing (CIM) Division, the unit will help CDC coordinate its CAD/CAM and CAE development, marketing and support efforts. Citing product introductions scheduled for this year, a spokesman for the CIM Division estimates that CDC's 1984 revenues from CAD/CAM and CAE system sales and related services would reach \$75 million. If this projection proves accurate, the company will probably pass Auto-trol to become the industry's seventh-largest vendor with a 3.3 percent share of the 1984 CAD/CAM and CAE market.



Revenue growth in 1984 should equal and may even surpass the recent high of 40 percent experienced in 1981. Despite a fluctuating growth rate, industry revenues have climbed steadily since the mid-1970s and should continue to increase through the 1980s and early 1990s.

## Three price categories divide the market

Today's CAD/CAM and CAE products are a confusing patchwork of systems based on mainframes, superminicomputers, minicomputers and microcomputers that have 16-, 16-/32- and 32-bit processors. They are sometimes connected by local-area networks and can include high- or low-resolution displays, digitizers and any of hundreds of software application packages. But beginning to emerge from this pandemonium are applications and price ranges to suit an increasing number of industry needs. Applications address me-

chanical and electronics design and manufacturing and AEC. Prices fall into three ranges: more than \$60,000, less than \$60,000 and less than \$20,000.

Systems selling for more than \$60,000 per workstation, including computers, plotters and software, are generally host-centered systems based on a mainframe, superminicomputer or minicomputer. These high-performance systems usually support large-scale applications such as solids modeling, finite-element modeling, logic simulation and associative database management.

Systems selling for less than \$60,000 per workstation usually have system processors built into the workstations and are frequently limited to drafting applications. Performance, measured by the time needed to respond to operator actions, is poorer than that of the more expensive systems, although performance is improved for workstations based on 16-/32-bit microprocessors.

Systems selling for less than \$20,000 are based on personal computers. This fast-growing market segment is beginning to make inroads into the sales of more expensive systems and will become more important in 1984. Software for personal computer-based systems, initially restricted to 2-D drafting, is becoming more sophisticated. Packages for solids modeling, electronics design and mapping have recently been introduced, and indications are that additional sophisticated software will follow.

Although performance of personal computers is still limited CAD/CAM systems based on the next generation of personal computers may emerge as a major industry force. In the meantime, innovative companies such as Summit CAD Corp., Houston, which adds 16-/32-bit coprocessors to the IBM PC XT to improve performance, obtain impressive results.

## New companies advance technology

In late 1982, small companies began to take the lead in CAD/CAM and CAE technology. They include Daisy Systems Corp., Mentor Graphics Corp., Apollo, Meth-eus Corp., Orcatech Inc., Cadnetix Corp., Cadline Inc., Cadtrak Corp., CAE Systems, Engineering Automation Systems Inc., Avera Corp., VLSI Technology, Formative Technologies Inc. and Graphic Horizons Inc. These companies and others started marketing systems based on networked workstations that incorporate 32-bit microprocessors with multiple coprocessors, very large memory and disk capacities and high-resolution color displays with picture memory sizes measured in megabytes. These systems deliver a lot of performance at far lower prices than the high-end



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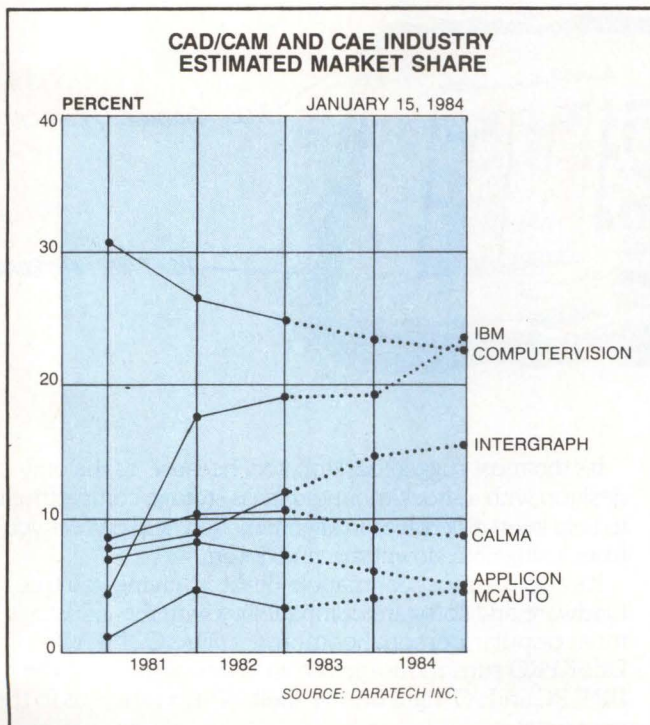
systems. Software for these workstations is usually based on the UNIX operating system and includes extended engineering-analysis functions that are impractical to run on 16-bit, minicomputer-based systems.

Leading the pack in graphics workstation technology is Silicon Graphics Inc., Mountain View, Calif., which in mid-1983, introduced a workstation capable of computing shaded images fast enough to display complex, shaded models of solids moving in real time. To do this, the workstation performs 7 million floating-point operations per second—five to 10 times as many as a VAX-11/780 can perform. With a top-of-the-line model priced at \$59,500, these workstations promise to make today's solids-modeling software substantially more useful and to open a wealth of CAD/CAM and CAE applications.

Although only one or two vendors were selling IBM PC- or PC XT-based CAD/CAM and CAE systems at the end of 1982, 13 companies have entered this market segment, and more are on the way. The systems they offer range from simple 2-D drafting packages for AEC applications to printed-circuit-board design systems and a solids-modeling system capable of producing complex shaded images.

Suppliers of PC-based systems are marketing the systems in three principal ways: directly from software developers to end users, indirectly through manufacturers' representatives and through system integrators. System integrators purchase software from developers, buy hardware directly from hardware manufacturers or from dealers and sell the entire package—hardware, software, training and maintenance—to end users. System integrators tend to have an affinity for their market niches. Integrators selling to the AEC market, for example, are often spin-offs from architectural and professional engineering companies.

Prices in the low-end market segment start at about \$1,000 for simple 2-D drafting software. Price of a solids-modeling package installed on a 19-inch, 4,096-color (from a palette of 16.8 million), 512-by-512-pixel, 30-Hz interlaced graphics display with 1M byte of pixel memory is \$16,000. A 2-D mechanical design/drafting system with numerical-control capability can be priced as high as \$25,000. Revenues from the sale of IBM PC-based systems will probably grow 400 percent this year—from \$5 million in 1983 to more than \$25 million in 1984—representing a 1 percent market share. Companies marketing IBM PC-based systems include Autodesk Inc., CadCal Products Inc., Carrier Corp., FutureNet Corp., Integrated Computer Technologies Inc., Micro Control Systems Inc., Personal CAD Systems Inc., Summit CAD, T&W Systems Inc. and Cubicomp Corp. □



**IBM should pass industry leader Computervision to capture the largest market share in the CAD/CAM and CAE market by the end of 1984. Among other leaders, Intergraph and McAuto should increase their market shares, while Computervision, Calma and Applicon should each lose share.**

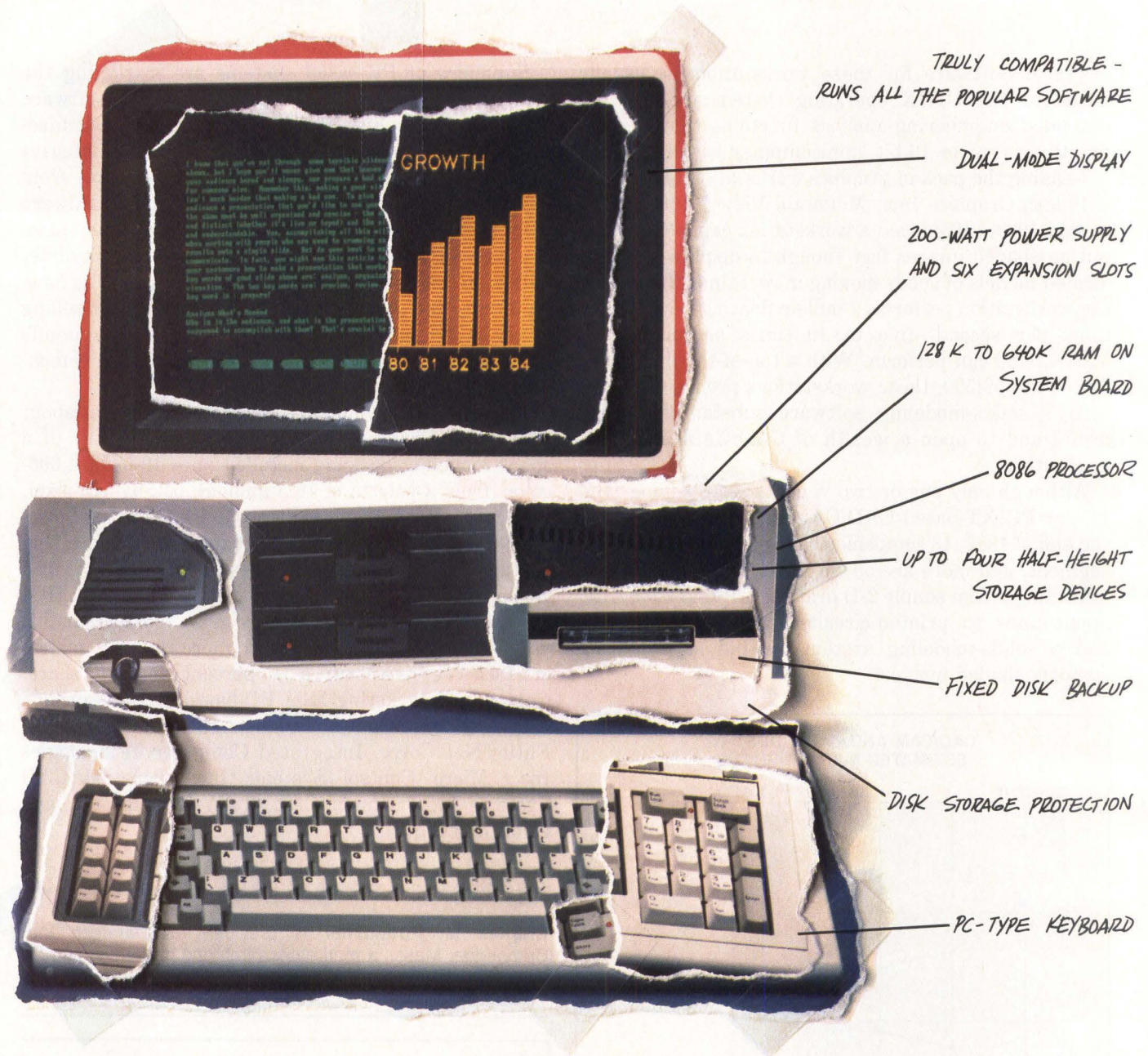
**Charles M. Foundyler** is president of Daratech Inc., Cambridge, Mass., a market research and publishing company specializing in the CAD/CAM and CAE industry.

This article is based on material contained in Daratech Inc.'s publication, *CAD/CAM, CAE: Survey, Review and Buyer's Guide*. The \$199 survey contains detailed information on 209 CAD/CAM systems and 105 vendors. For more information on this publication, contact Daratech, 16 Myrtle Ave., P.O. Box 410, Cambridge, Mass. 02238, (617) 354-2339.

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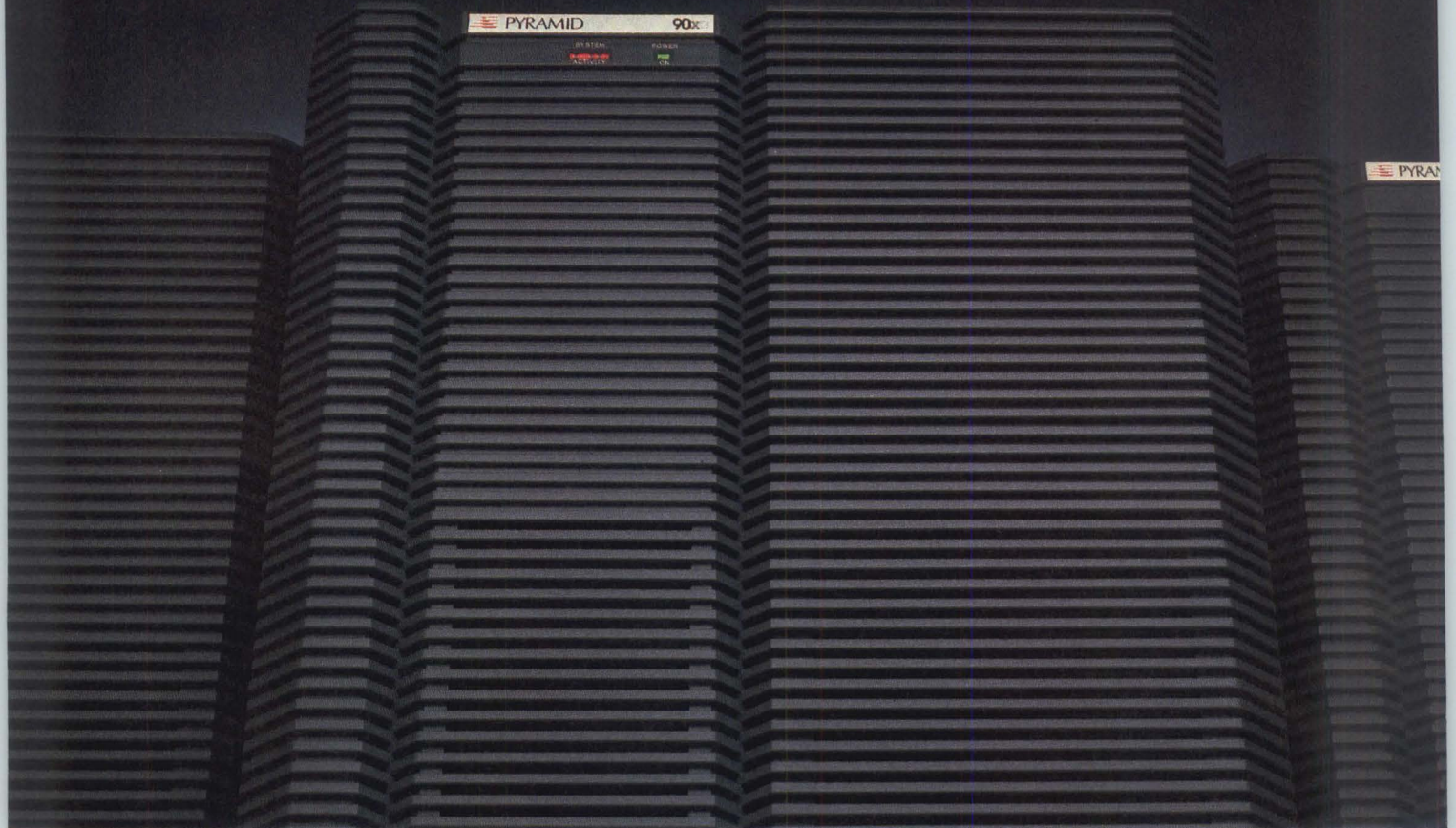
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# The Integrator

## Automated testing and material handling streamline production and raise yields

*Faced with choice between moving overseas or automating, disk drive maker opts to automate*

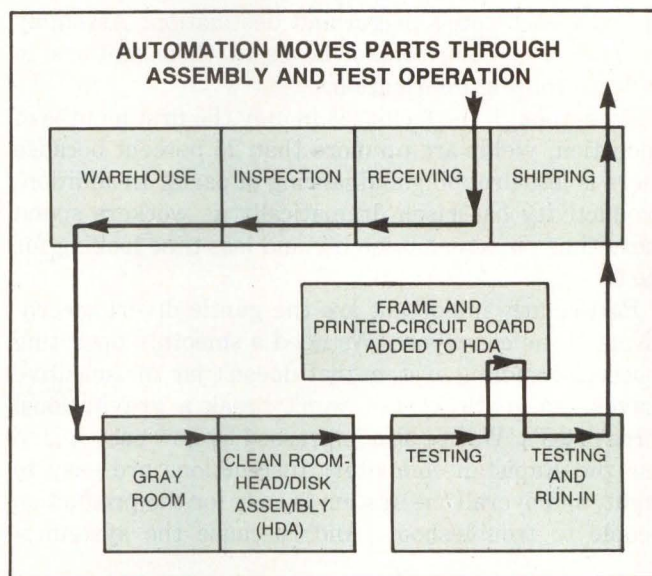
Joseph Smith, Priam Corp.

Early in 1982, Priam Corp., a San Jose, Calif., manufacturer of high-capacity Winchester disk drives, recognized the need to increase productivity and achieve lower manufacturing costs. With sales doubling annually, we realized that limited production capacity was keeping us from growing. The goal was to increase manufacturing capacity fivefold—from 250 to 1,200 drives per day—without sacrificing quality standards.

We considered moving production overseas but determined that the drawbacks, including substantial management and support costs, training of foreign workers and lack of contact between technical and production groups, outweighed the benefits of lower labor costs. By carefully studying and implementing automation, we have achieved production goals while maintaining tighter control over manufacturing processes.

Priam's manufacturing operation consists of assembling and testing 5¼-, 8- and 14-inch Winchester disk drives. To achieve the production volume initially targeted, the logical first step was automating material handling and testing. For material handling, we presumed that decreasing human contact with components during assembly would help eliminate contamination and lead to higher yields. We also presumed that workers would be more productive if parts were continually available. Automating the testing of disk drives also offered more than increased efficiency. Because testing amounts to 60 percent of Priam's manufacturing process, we looked to automation as a means of collecting additional data about the drives.

After a year of investigating equipment for the new facility, Priam settled on three main suppliers: Litton Unit Handling Systems, Florence, Ky.; Rapistan Co., Grand Rapids, Mich., a division of Lear Siegler Inc.; and Dreyden Engineering Co., Santa Clara, Calif., a supplier of modular clean tunnels from Integrated Air Systems (IAS) Inc. The reputation of each supplier—its track record and overall expertise—and the support each supplier offered were critical considerations. Once we chose the equipment, a new building was designed. Ground-breaking for the 142,000-square-foot facility



Starting in the receiving area, parts travel on automated material-handling equipment. Ultrasonic cleaning takes place in the gray room, and assembly of delicate components takes place in four clean rooms. In the final stages, both testing and material handling is automated.

was in May 1983, and, by December, disk drives were traveling along the newly installed conveyor system.

### Material moves efficiently but gently

Automated material handling begins when components arrive in the receiving area and continues through assembly, testing and shipping. Currently, warehousing is not automated, although delivery of parts to and from the warehouse is automated. Components, including printed-circuit boards assembled at another Priam facility, motors, media and heads, move on conveyors to and from inspection stations and the warehouse. Workers then move parts manually from storage to "gray rooms," where components for the head/disk assembly (HDA) are initially assembled and cleaned. An HDA consists of magnetic heads and disks for writing, storing and reading data, a spindle and spindle motor for spinning disks and a linear voice-coil actuator for positioning heads.



# The Integrator

Once workers assemble the parts kits, Rapistan's production-management system routes material to and from assembly workstations within four clean tunnels. Workers place parts such as drive spindles and disk platters into totes designed to transport these delicate assemblies. The Rapistan conveyors move material in a predetermined sequence from one set of stations to the next as assembly progresses. Sensors tell the system which stations are open and able to receive parts and, by keeping a 6½-foot "window" between totes, allows it to track each tote's origin and destination. Assembly workers also have control boxes at their stations to indicate routing information.

Even though the facility is in only the first months of operation, yields are up more than 25 percent because there is less dropping and jarring of parts. In addition, productivity has risen dramatically as workers spend more time on actual assembly and less time looking for parts.

Particularly important are the gentle divert mechanisms of the conveyors. We need a smoothly operating material-handling system that doesn't jar the sensitive drives—so gentle that it won't break a gravitational force of 2G's. We are also impressed by how easy it is to use the Rapistan computer. Instructions are easy to input, and overall the system is easy for the production people to troubleshoot. And, because the system is

modular, it can be re-configured to meet changing production needs.

We also plan to take advantage of features that allow us to collect information about the assembly process itself. The material-handling system has distributed process-control/communication functions that offer a real-time window on the assembly process, providing information such as the number of units in assembly, assembly completion times and pass/fail rates. Local devices plug in at various workstations and are linked to a supervisory-level microprocessor, the tote director controller (TDC).

Supporting the TDC is a combination Winchester/floppy disk subsystem that stores basic parameters, operating programs and operation data. Once operators are comfortable with the material-handling system, we plan to use it to collect data and will eventually tie it into a mainframe to allow more fully integrated computerized manufacturing.

Priam chose clean tunnels from IAS because of the company's reputation for high-quality air systems and because of the support IAS offered. Our deadline for getting the facility up and running was a major consideration, and Dreyden Engineering, the supplier of the IAS system, was able to meet it.

In addition to guaranteeing that 1 square foot of air has no more than 100 particles that measure 0.5 μm. or



**Inside the clean room, a worker completes a head/disk assembly.** Delicate parts move from station to station on conveyors, minimizing accidental dropping and jarring.





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 Price: \$28.00  
 Allocation: Autos 24-924-952-907  
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 CHIEF ENGINEER: J. SANDOZ  
 CHIEF DESIGNER: W. OSBY  
 SUPERVISOR: S. MITCHELL  
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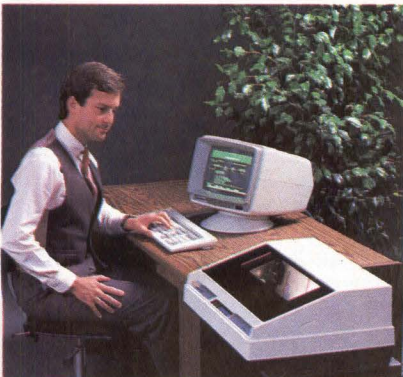
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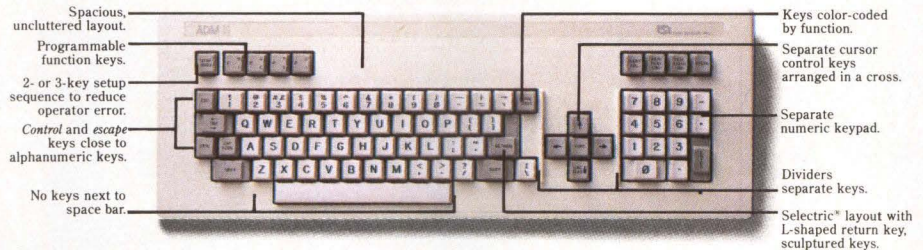
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	<b>ADM 11</b>	<b>ADM 12</b>	<b>ADM 24E</b>
	Conversational	Editing	Host Programmable
Programmable Function Keys	4 (Shiftable to 8)	16 (Shiftable to 32)	16 (Shiftable to 32)
Non-Volatile Function Keys	Optional	Standard	Standard
Function Key Legends on 25th Line	From Host	From Host	Standard Non-Volatile
No. of Pages of Display Memory	1	2	4
Display Memory Configurations (Plus 25th Message/Status Line)	24 Lines by 80 Characters	(2) 24 x 80 or (1) 48 x 80 or (1) 24 x 158	User Definable up to 96 x 80
Scrolling	Standard Scrolling	Smooth, Jump or Horizontal Scrolling Split Screen	Smooth or Jump Scroll Split Screen
Transmission Mode	Conversation Mode	Conversation or Block Mode	Conversation or Block Mode
Editing	Limited	Full Editing & Protected Fields	Full Editing & Protected Fields
Visual Attributes: Reduced Intensity, Blink, Blank and Reverse Video. Underline also on ADM 12 and ADM 24E	3 Embedded 1 Non-Embedded	4 Embedded, 1 Non-Embedded or All Non-Embedded, plus Full Screen Reverse Video	5 Embedded, 1 Non-Embedded or All Non-Embedded, plus Full Screen Reverse Video and Highlight
OEM Flexibility	Modifiable Set-Up Characteristics	Modifiable Set-Up Characteristics & Personality	Modifiable Set-Up Characteristics. Add to Program in ROM or Down-Line Load in RAM (56K ROM or RAM. Up to 22K Display Available) Room for additional Logic Boards.
Terminal Compatibility	ADM 3A, ADM 5, ADDS Viewpoint & Regent 25, Hazeltine 1400, 1420 & 1500, DEC VT-52	ADM 3A, ADM 5, ADM 31, ADM 32	ADM 3A, ADM 5, ADM 31, ADM, 32, ADM 42

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# The Integrator

more in diameter, these Class-100 clean tunnels provide laminar airflow at 100 feet per minute through wall-to-wall ceiling filters. Air travels downward and is recirculated through return air walls in which it is filtered again. The improvement in yields is largely due to the conditions of the clean tunnels. Because temperature and humidity can be controlled, working conditions have also improved for assembly workers, who must don nylon outerwear to work in the clean tunnels. Greater humidity control has also added to the increase in yields.

## Drives move through automated test setup

After an HDA is assembled and just before it leaves the clean room, it is placed in a "hot pallet," a plastic carrier designed for use in the Litton test system. An elevator then moves the pallet onto the conveyor that takes it to the Litton ToteStacker, a computerized storage-and-retrieval area. An automated crane, similar to a forklift, moves in the aisles between rows of shelves. Two storage-and-retrieval systems handle each of the four clean tunnels. The front end of each tunnel is dedicated to initial testing, and the back end is used for run-in and final testing.

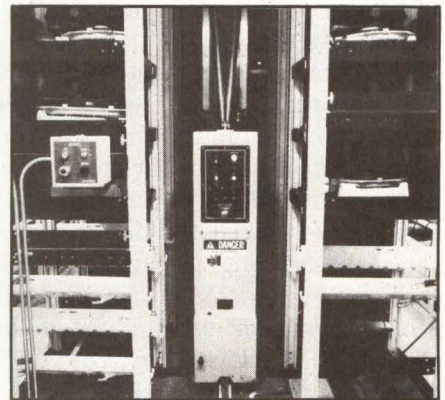
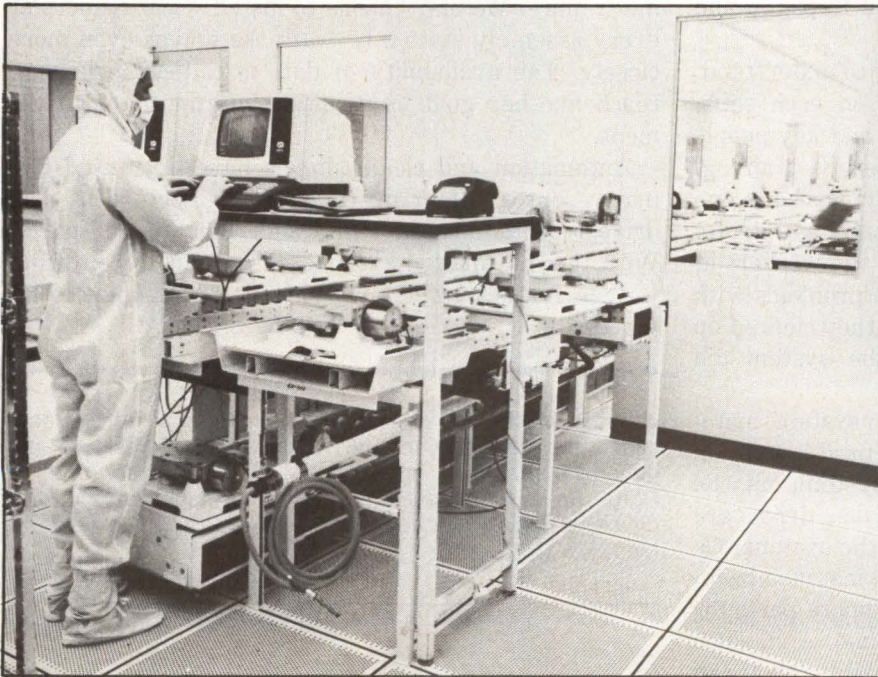
The pallets' bar-code labels are an important part of the tracking and test procedures. Once an HDA is placed in a pallet, a worker uses a bar-code reader to enter the pallet identification number and the drive's part number into the Litton system. This procedure tells the system whether the pallet contains a 14-inch,

8-inch or 5¼-inch drive and allows it to track the drive and compile a history of its test results. The pallet also serves as part of the test system and was designed and wired to Priam's specifications.

We evaluated equipment from a number of vendors before automating our testing process, and we liked the fact that Litton already had a prototype burn-in scheme similar to the procedure we wanted to implement. Litton also offers a light crane that can move pallets quickly. We also like Litton's hardware and software support. Both Rapistan and Litton have installed modems at the facility to help us troubleshoot software used in their systems.

The front end of the Litton system stores HDAs and delivers them to test stations, where workers perform initial functional tests such as contamination testing and surface analysis. As an HDA passes a test, it is sent back into the storage-and-retrieval equipment, in which it remains until the pallet can be delivered to the next test station. If a drive fails, it's sent to an HDA debugging station.

The back end of the Litton system is used for run-in and final testing. After the HDA passes its initial tests, the crane delivers it to a drive-assembly station. There, an assembly worker puts the HDA and disk drive electronics into a frame. From framing, the assembled drive is sent into the second stage of the storage-and-retrieval system for run-in and final testing. The storage compartments in the second ToteStacker are fitted with fans and extensive wiring so that run-in and final



**At the heart of the automated test area is a computerized crane that stores and retrieves disk drive assemblies from racks. The pallets on which the assemblies rest contain cables for automated testing procedures.**

**At the automatic material-induction station, part of the computerized conveyor system, an operator enters information used by the system to route components through the clean room for assembly.**



# The Integrator

testing can be performed automatically.

When the pallets leave the framing area, they contain the completed drive and a power supply along with a standalone test (SAT) card developed by Priam that contains instructions for run-in and final test. Each drive is plugged into a hot pallet and sent back into the system, which brings it to an open test slot. There, they plug themselves in and begin run-in and testing.

The SAT card can send messages about the status of a drive to the Litton system or to a mainframe computer, as well as record data on the disk itself about the drive's performance. A network of communication loops lets test equipment share data and report results to a mainframe. Once the drive completes final testing, it receives a last quality check and travels by conveyor to shipping.

---

*Since testing is 60 percent of Priam's manufacturing process, we looked to automation as a means of collecting additional data about the drives.*

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## Learning to use the systems

In designing the facility, we tried to simplify overall manufacturing by making it unnecessary for employees to move heavy, bulky materials. We kept workers informed from the beginning and showed them slides and a videotape that explained both the Rapistan and Litton systems.

The Rapistan equipment is fairly easy to understand. An industrial engineer spent a week on each shift, training workers to use the conveyors, and key people who operate the computer got more extensive training. Litton provided all operators and key workers one month of extended training in areas such as maintenance and test engineering and trained the workers at each workstation. We initially had a few problems with people working around the system, but they cleared up quickly as employees realized that the system did indeed do what it was designed to do.

Should problems occur in the Rapistan system, materials can be moved manually so that production can continue. Malfunction of the Litton system, on the other hand, could affect production because drives are difficult to retrieve once they're inside the system. We don't anticipate problems because we've installed back-up computer systems and have stocked spare parts for both systems, which should limit downtime. And, since we designed production lines to be flexible, they can



Workers perform contamination tests on the head/disk assembly before putting it into a frame with the printed-circuit board assembly and sending it into the automated test system for run-in and final testing.

handle production of any size drive if a line goes down.

Both the Rapistan and Litton systems provide extensive data-collection capability that will determine where a drive failed in the manufacturing process, how many drives of a given size are available at any time and much more. We may choose to install wand readers at every assembly station to track the drives even more closely. The availability of data is critical in helping reach another goal: centralized information management.

Automation and clean tunnels have decreased two major sources of errors in the manufacture of disk drives: contamination and rough handling of parts. With the information automated systems can provide, we can further refine and control the manufacturing process. □

---

**Joseph Smith**, vice president of operations at Priam Corp., joined the company in 1981. Former vice president and general manager of rigid disk drive operation for Shugart Corp., Smith has spent 17 years in the manufacture of disk drives, including five years at IBM Corp. and five years at Memorex Corp.

---





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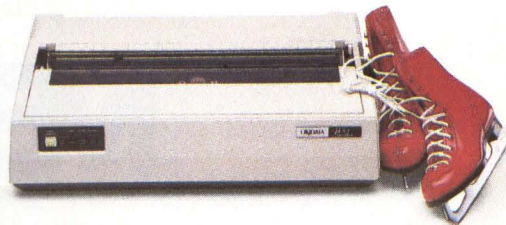
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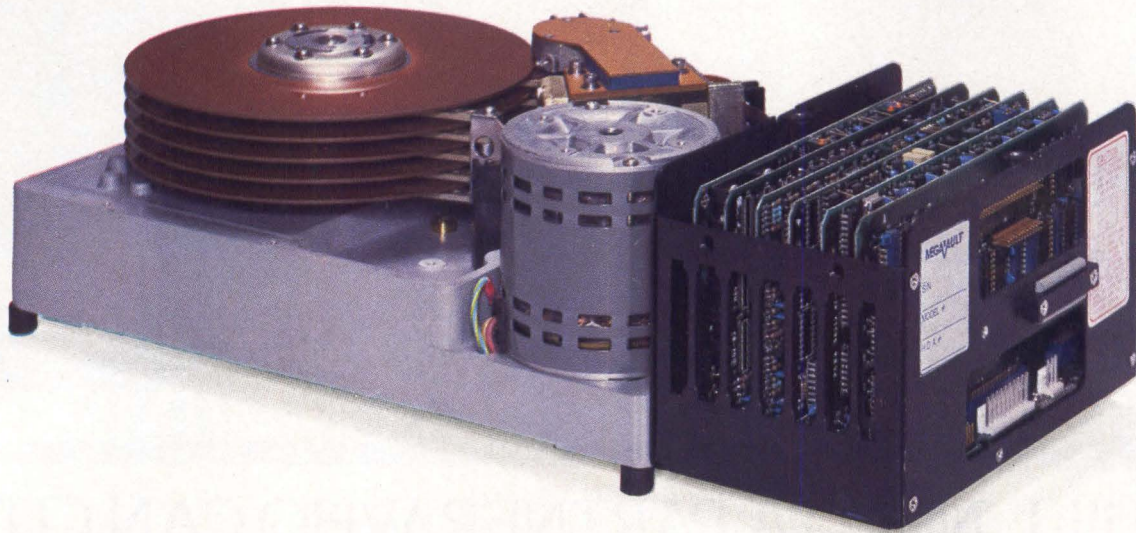


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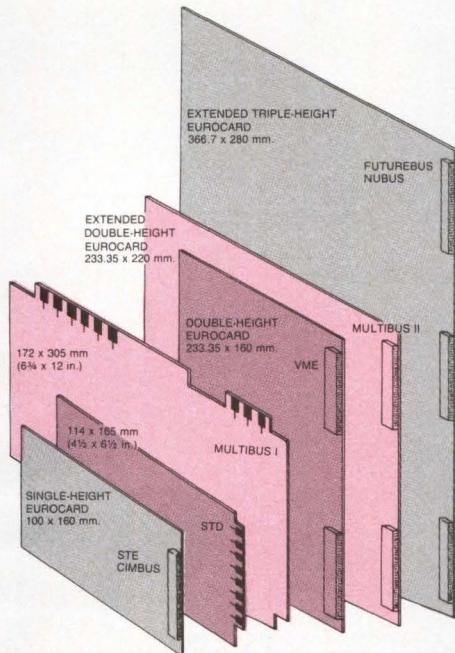
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# FEATURE HIGHLIGHTS



**SINGLE-BOARD COMPUTERS:** Although microcomputer manufacturers have said incompatibility is necessary to achieve high performance levels, a new single-board computer from Advanced Computing Technologies Inc. incorporates a 16-bit processor that is faster than the 8086 and 68000, yet is 100 percent object-code-compatible with the industry-standard Intel 8080. For a closer look, turn to **p. 159**.

**EUROCARDS:** In the first of a two-part series on microcomputer bus standards, Senior Editor Rick Dalrymple explores 8- and 16-bit buses, with a close examination of the Eurocard/DIN-based STE-bus and CIMbus and the edge-connector-based Multibus, Q-bus and STD-bus. For more details, see **p. 171**.

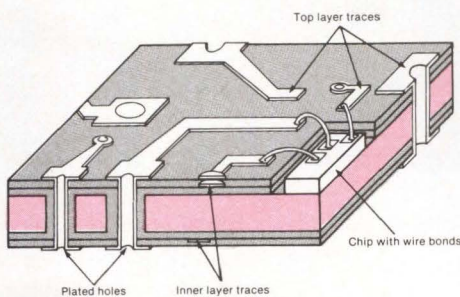
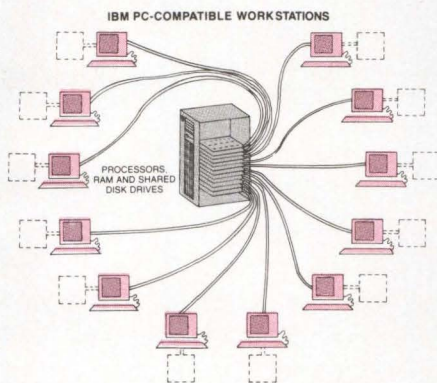
**DEVELOPMENT SOFTWARE:** Software developers find their job much easier these days with the variety of tools available to them—tools that includes optimized language compilers, operating system environments and sophisticated fault finders, and which can even help to create other tools for more complex applications. See **p. 183** for more details.

**MICROCOMPUTERS:** System integrators are incorporating single-user micros into networks that allow multiple users to pool programs, data and peripheral devices. North Star Computer Inc.'s Dimension includes multiple processors that communicate through shared memory using an architecture that incorporates aspects of both loosely- and closely-coupled networks. More information appears on **p. 195**.

**PERSONAL COMPUTERS:** A significant and growing market for personal computers in applications normally served by system integrators and OEMs has emerged. This market is catching the eye of almost all of the major participants in the personal-computer arena. If it's caught yours as well, turn to **p. 205**.

**WORKSTATIONS:** Designing a 32-bit desktop computer with 1-MIPS power requires innovations spanning component chips, physical packaging and even a temperature-control system. A close look at Hewlett-Packard's top-end model 9000, starting on **p. 217**, reveals why it's billed as the machine that can compete with superminis at a fraction of their price.

**TERMINALS:** Because the major advantage of a computer-integrated-design (CID) terminal is the virtual elimination of communications delays, internal throughput is a primary design consideration. Megatek Corp.'s Merlin 9200 achieves that goal at an affordable price. See **p. 233**.







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However it's defined, quality has a way of being recognized.

For some of our customers, it might be product versatility. Two years ago we began making a 68000-based 16/32 bit CPU board that could operate with or without the popular UNIX operating system, depending on whether the customer had system- or real-time needs.

For others, performance is important. We designed a memory management unit that protects multiuser programs with no wait states. That's when we discovered that performance and versatility become interconnected.

For instance, Congress needed some method of debugging the networking system currently used by the Members'

staffs. We packaged our CPU board with the necessary peripherals, and from this computer system we discovered even more applications. Our board now helps the U.S. Geological Survey analyze minor quakes from the Atlantic seafloor, while across the ocean the Prime Minister's Office uses the same product to edit correspondence.

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# Single-board computer merges 8-, 16-bit performance

*Minicomputer strategy packs power on a single board:  
3 million instructions per second,  
8080 object-code compatibility  
and supermicrocomputer operation*

**Robin Fosheim and Douglas R. Grundman**  
Advanced Computing Technologies Inc.

In the race to get to market with higher-performance processors, microcomputer manufacturers have frequently neglected to make their new processors object-code-compatible with earlier machines. The result for OEMs and system integrators has been costly delays in new product introductions as software is translated from the current processor to a new one. Attempts to sidestep the compatibility problem have met with various degrees of success. High-level languages ease the transition from one computer to another, but, in practice, few languages are totally portable across machines. Some companies offer dual-processor systems that typically include an 8-bit processor for continued access to 8-bit software, and a 16-bit processor for the use of new products. This strategy, however, does not allow system integrators to port their 8-bit code to the higher-performance 16-bit processor without substantial modification.

Though microcomputer manufacturers have justified incompatibility as necessary to achieve current performance levels, a new single-board computer (SBC) from Advanced Computing Technologies Inc. (ACTI) incorporates a 16-bit processor that is faster than the 8086 and 68000, yet is 100 percent object-code-compatible with the industry-standard Intel 8080. By providing an integrated 16-bit extension, the processor solves the problem of merging 8-bit compatibility with 16-bit performance, without the drawbacks of dual-

processor architecture. The extended instruction set, ability to address as much as 16M bytes of memory and a hardware-supported Zilog Z80 emulation scheme make this processor a logical 16-bit upgrade consideration for 8-bit users.

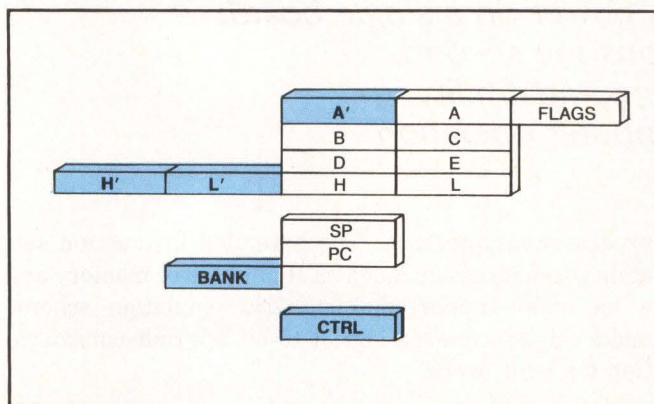
## **Three key goals were met**

The ACT-3 processor was designed with three main goals in mind. First, it had to be fast enough to qualify as a supermicrocomputer in order to compete with other high-performance 16- and 32-bit machines (Table 1); the specific design goal was an average throughput of 3 million instructions per second (MIPS). Second, it had to be upwardly object-code-compatible with a popular 8-bit microprocessor family to ensure immediate (and continued) access to a large base of field-proven code. The Intel 8080 family was chosen because of the impressive amount of development and application software written for it. And, third, the ACT-3 processor had to have true 16-bit functionality to provide a growth path for future applications.

The performance goal of 3 MIPS was accomplished with superminicomputer design strategies, including use of the latest high-speed logic. The ACT-3 is implemented entirely in Fairchild Space and Electronics Co.'s FAST family of transistor-to-transistor logic (TTL) chips, the same technology chosen for Digital Equipment Corp.'s recently announced VAX-11/785. The processor is clocked at 15 MHz, achieving a microcycle time of 67 nsec. This extremely short microcycle time (the VAX-11/780's is more than 200 nsec.) is made



possible in part by use of multilayered printed-circuit boards. These boards permit shorter lead lengths and thus minimize trace propagation delays and capacitive loading. The ACT-3 processor is horizontally micro-coded with a microword width of 96 bits. This micro-code organization requires less decoding circuitry than vertically microcoded machines, thereby minimizing attendant gate delays. The microcode is pipelined to allow parallel control of certain overlapped functions. While one microinstruction is being executed, the next microinstruction is fetched. On-board memory consists of 64K bytes of RAM incorporated directly into the processor (see "Mini on a board," Page 162), enabling the ACT-3 to access on-board memory for both 8- and 16-bit instructions in only two microcycles (134 nsec.).



**Fig. 1** The ACT-3 register set is a straight-forward enhancement of the 8080. Five new registers (shown in color) support the ACT-3's 16-bit instructions and 24-bit addressing scheme. Register A' serves as the high byte of a 16-bit accumulator for double-precision instructions. Byte-sized instructions do not affect register A'. Register L' is used in tandem with registers H and L to perform an indirect access to data stored at a 24-bit address. Programs that do not require more than 64K bytes of memory can use H'L' as a second pointer register. The BANK register determines the default high-address byte for original 8080 instructions. It therefore supports bank-oriented and multiuser operating systems. The CTRL (control) register contains bits that activate or deactivate several special features such as Multibus arbitration override, Multibus LOCK, interrupt-processing mode selection and Z80 compatibility mode.

**Sample execution times** (in nanoseconds) show the ACT-3's performance advantage over other processors.

Complete 8080 compatibility, the second design goal, was achieved by adding the entire set of 8080 instructions to the ACT-3's instruction set. This approach distinguishes the ACT-3 from the Intel 8086. Although the 8086 can perform operations that the 8080 performs, it does not offer instruction-set compatibility.

Therefore, the software must be modified—sometimes extensively—to be executed on the 8086. The ACT-3 also differs from machines like the 80286 and the VAX, which use a "mode bit" to indicate whether the processor should run compatibly with its predecessor or run in an extended mode. The advantage of an integrated instruction set, such as those provided by Data General Corp.'s Eagle or ACTI's ACT-3, is that the machine is always compatible with its predecessor—even when the extended features of the processor are exploited.

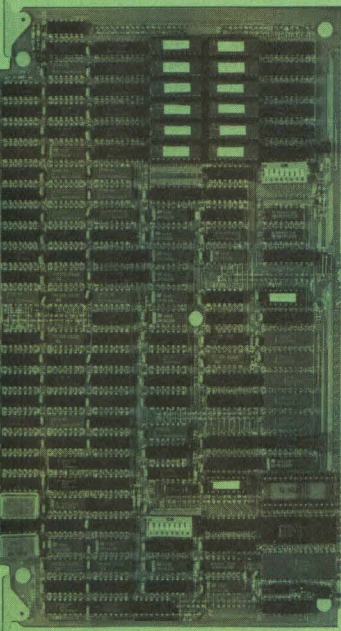
The ACT-3 processor is a full 16-bit machine in all aspects. New instructions support this architectural extension to the 8080 to provide true 16-bit functionality. It is worth noting, however, that the 16-bit nature of the machine improves the performance of the basic 8080 instruction set as well. Widened 16-bit data paths allow the ACT-3 to fetch 2 bytes at once, cutting the number of clock cycles for each instruction to half that of the 8080. To store the accumulator, for example, the 8080 requires 13 states, whereas the ACT-3 requires seven; the instruction "exchange top of stack with HL"

Operation	ACT-3 (nsec.)	8080A 2MHz (nsec.)	8085 5MHz (nsec.)	8086 10 MHz (nsec.)	68000 10 MHz (nsec.)
Add register byte to Accum	267		800	300	400
Add register word to Accum**	267	5,000	2,000	300	400
Add memory word to Accum**	400	15,000*	6,000*	1,400	800
Add immediate word to Accum**	333	10,000*	4,000*	400	800
Add register pair to HL	267		2,000	300	400
Load Accum direct with word**	467	8,000	3,200	1,400	1,200
Load Accum indirect with word**	333	12,000*	4,000*	1,300	800
Load HL direct	467	8,000	3,200	1,400	1,200
Load immediate register pair	333	5,000	2,000	1,000	800
Push register pair on stack	400	5,500	2,400	1,000	900
Pop register pair on stack	333	5,000	2,000	800	800
Branch	333	5,000	2,000	700	1,000
Branch on carry (avg.)	300	5,000	1,700	600	900
Jump to subroutine	533	8,500	3,600	1,100	2,000
Return	333	5,000	2,000	8,000	1,600
Return on carry		4,000			
Multiply (signed)** (max)	5,667	?	?	14,000	7,000
Multiply (unsigned)** (max)	5,800	?	?	12,400	7,000
Divide (signed)** (max)	9,400	?	?	17,700	15,800
Divide (unsigned)** (max)	9,467	?	?	15,500	14,400
Swap DE and HL	400	2,000	800	400	1,200*
Swap top of stack with HL	533	9,000	3,200	2,000*	2,100*

\*Requires multiple instructions. \*\*8085 uses HL. Source: Advanced Computing Technologies



## Spec summary



- **Name:** aSBC 80/300 single-board computer

- **Manufacturer:** Advanced Computing Technologies Inc. (ACTI), 1214 Eisenhower Place, Ann Arbor, Mich. 48104, (313) 973-2762

- **Price:** \$2,651 in 100-unit quantities

- **Main features:** 15-MHz ACT-3 CPU (3 million instructions per second, 8080-compatible, 8-/16-bit instruction set, 16M-byte addressing), 64K-byte RAM, 64K-byte electrically programmable read-only memory (EPROM)/electrically erasable PROM (EEPROM) space, one serial I/O port, eight levels of vectored interrupt control

- **Market:** OEMs and system integrators with installed base of 8080, 8085 or Z80 software and/or computation-intensive applications

- **Operating systems:** CP/M 3.0 (available from ACTI) and all other 8080 operating systems (CP/M 2.2, MP/M, OASIS, etc.)

- **Development tools:** ACTI relocatable macro assembler and linker, machine-level debugger in EPROM, ACTI Pascal and C compilers, real-time kernel for multitasking applications plus all existing 8080/8085 development tools.

## Programming the ACT-3

ACTI's ACT-3 instruction set contains 68 new instructions that ease the job of assembly-language programming and provide efficient support for high-level languages (see "Software tools ready for new product development," Page 163). Word-wide operations reduce the number of instructions needed to perform a task, and extended addressing instructions directly access large amounts of memory without worrying about bank switching or segment registers. The

ACT-3 mnemonics need little explanation: instructions appended with a "W" operate on words, mnemonics with an "F" indicate far-reaching addresses, and instructions with "WF" operate on words located anywhere in the 16M-byte address space.

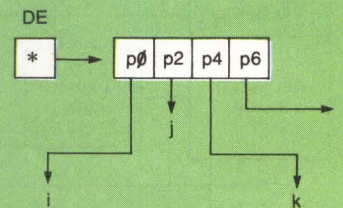
To demonstrate the power of the ACT-3 instructions, two program examples are given. The first program is a simple 16-bit subtraction of two words in memory, symbolically illustrated by "X := Y - Z":

ACT-3		bytes/cycles	8080A		bytes/Tstates
lrpi	h,2	3/5 ; HL : = offset of p2	lxi	h,2	3/10
add	d	1/4 ; add DE to HL	dad	d	1/10
movw	h,m	2/5 ; HL : = p2	mov	a,m	1/7
movw	a,m	2/5 ; A'A : = j	inx	h	1/5
stw	LOCAL	4/7 ; store A'A into LOCAL	mov	h,m	1/7
		12/26 = 1.7 $\mu$ sec.	mov	l,a	1/5
			mov	a,m	1/7
			inx	h	1/5
			mov	h,m	1/7
			mov	l,a	1/5
			shld	LOCAL	3/16
					15/84 = 42 $\mu$ sec.

The ACT-3 code is easier to understand, primarily because it handles the task in a straightforward manner and contains fewer instructions. The main benefit of concise code is that it is less likely to contain bugs and is more likely to be easily modifiable in the future. Note that the 8080 code on the right runs on the ACT-3 in 2.9  $\mu$ sec. but takes nearly 13 times longer or 38  $\mu$ sec. when run on an 8080A.

The second program example comes from a common method of passing parameters, especially in

FORTRAN. Register DE, in this case, holds the address of a memory region that contains pointers to actual data objects. Pictorially,



Assuming the p0, p2, p4 and p6 are 16-bit pointers with respective offsets

of 0, 2, 4 and 6 from DE, the assignment "LOCAL = j" is coded:

ACT-3		bytes/cycles	8080A		bytes/Tstates
ldw	Y	4/7 ; load Y into A'A	lhld	Y	3/16
idd	Z	3/7 ; load Z into HL	lda	Z	3/13
subw	h	2/4 ; subtract HL from A'A	sub	l	1/4
stw	X	4/7 ; store A'A into X	sta	X	3/13
		13/25 = 1.7 $\mu$ sec	lda	Z+1	3/13
			sbb	h	1/4
			sta	X+1	1/5
					17/76 = 38 $\mu$ sec

The 8080 code executes in 3.5  $\mu$ sec. on the ACT-3, or more than 10

times faster than on the 8080A running at 2 MHz.



(XTHL) takes 18 states on the 8080 but only six on the ACT-3. The ACT-3 is also able to fetch odd words in a single memory cycle, saving clock cycles on all 3-byte 8080 instructions that contain 16 bits of address or data on an odd boundary.

**Instructions simplify software development**

Taking advantage of the opcode space not used by the 8080, ACTI created a comprehensive superset of instructions that allows straightforward access to and manipulation of 16-bit data. Each 8-bit instruction of the 8080 has a 16-bit analog on the ACT-3. The instruc-

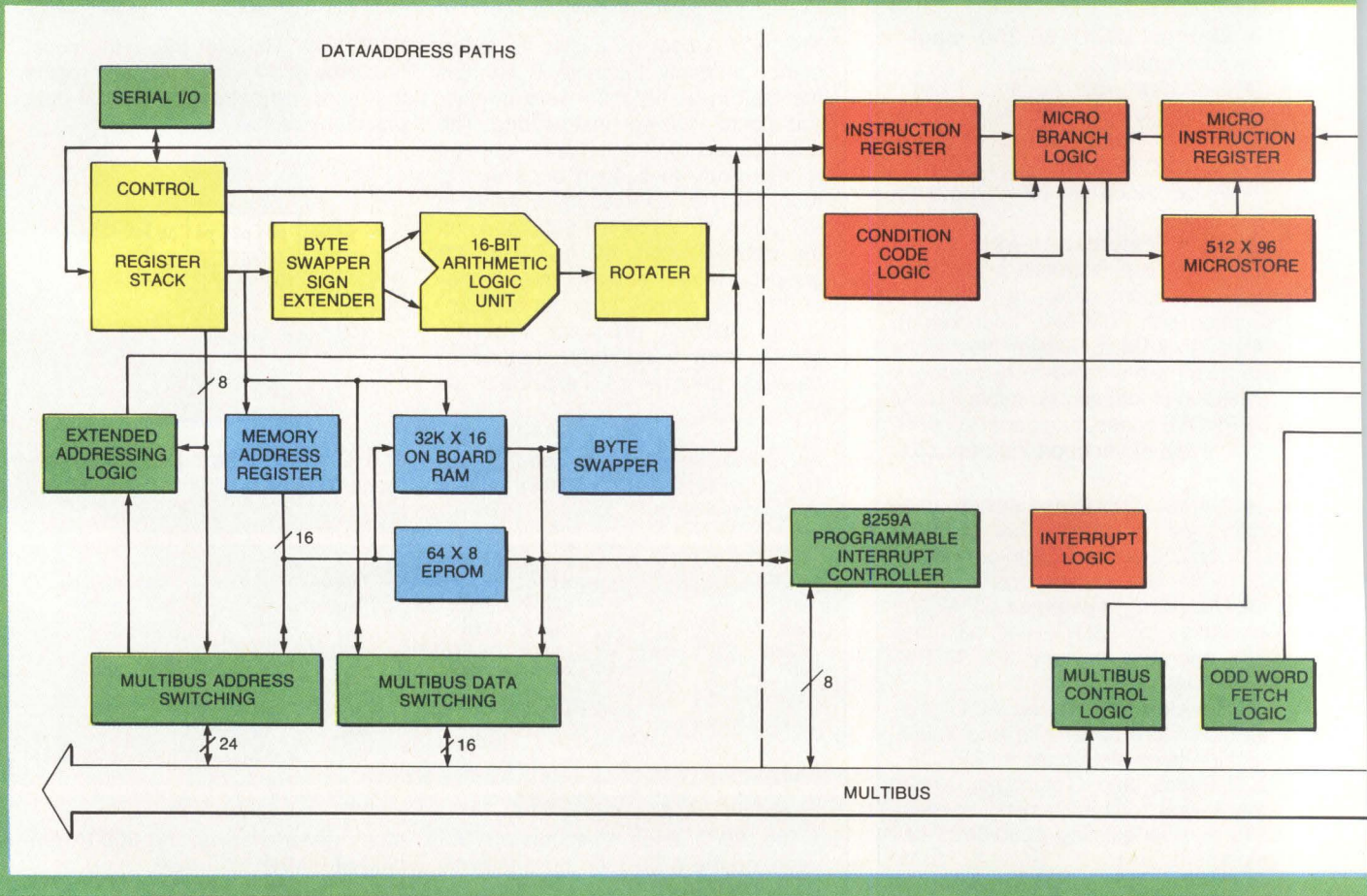
tion CMP, for example, compares a byte to the accumulator; the instruction CMPW compares a word. The 16-bit register and register-indirect instructions take the same amount of time as their 8-bit counterparts; (instructions SUB and SUBW, for instance, both take 267 nsec.). In addition to extending all the 8080 instructions, several entirely new instructions have been added. Most notably, the 16-bit multiply and divide instructions were implemented to ensure maximum support for computation-intensive applications. The ACT-3 register set (Fig. 1) supports these extensions in a logical way: the accumulator was widened to 16 bits

**Mini on a board**

Dominating ACTI's aSBC 80/300 single-board computer is the ACT-3 processor built from advanced Schottky transistor-to-transistor logic (TTL). The arithmetic-logic unit (ALU) path (yellow) comprises four main modules: a register stack containing all the CPU registers, a byte-swapper/sign-extend

er that converts bytes to words, the 16-bit-wide ALU and a rotator. The ALU path can perform a byte-swap/sign-extend 16-bit arithmetic operation and bit-rotate all in one microcycle. The processor is controlled by a pipelined microprogram control unit (orange) that has a basic microcycle time of 67 nsec. Wait states are generated only during accesses to slow external devices. Blue represents the 64K bytes of

on-board erasable programmable read-only memory (EPROM) space and the 64K bytes of on-board high-speed RAM. Because the RAM is integrated directly into the processor, memory accesses occur with zero wait states. The byte swapper performs word-wide fetches from even or odd boundaries with no performance penalty.





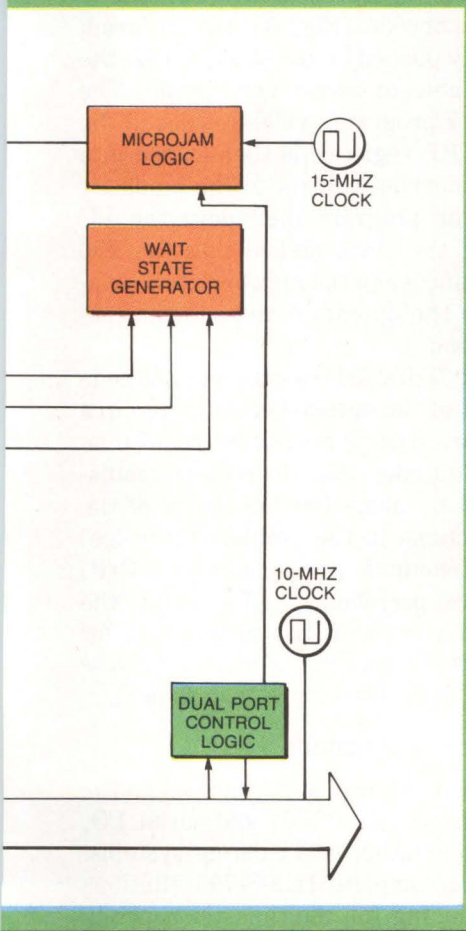
for word-wide manipulations on data, and the HL register was doubled in width to allow large-scale memory addressing.

Using the ACT-3's 16-bit instructions, software can be written that averages more than 20 times the speed of ordinary 8080 code running on a 2-MHz 8080 (see "Programming the ACT-3," Page 161). Note, however, that unmodified 8080 code already runs as much as 13 times faster on the ACT-3, depending on the clock rate of the current processor. In many cases, this improvement in performance is sufficient. However, system integrators with more stringent speed requirements

need only modify a critical portion of code—for instance, an often-used subroutine—to realize further substantial gains in performance.

The ACT-3's extended instructions improve code density as well, primarily because fewer instructions are needed to perform a given task. On the average, a program coded in ACT-3 assembler takes 80 percent of the space it would occupy if coded in 8080 assembler. Thus, programs that employ the ACT-3's extended instructions can include more features (than pure 8080 programs) and still be accommodated in a 64K-byte memory space.

The "real-world" interface circuitry is in green and includes interrupt control, an RS232 channel, a second path into on-board RAM from the Multibus, multimaster Multibus interfacing and circuitry for extended memory addressing. In combination, these components represent the technology and performance of a large-scale mini-computer.



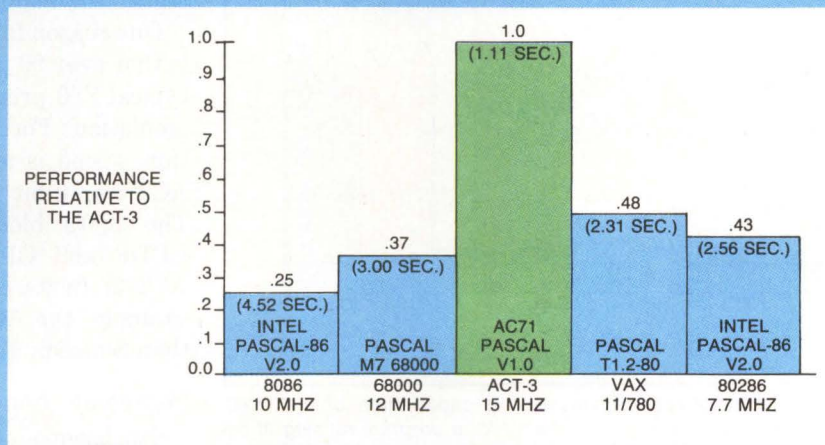
### Software tools ready for new product development

Because ACTI's ACT-3 is 100 percent compatible with the 8080, all development tools written for the 8080 run on the ACT-3 without modification. Executed without change, these programs average more than 13 times their former speed on a standard 8080A. To pull still more performance out of the ACT-3, a full line of development tools take advantage of the ACT-3's extensions to the 8080. Among the software packages available is the ACTI Pascal compiler, which makes full use of the ACT-3's 16-bit capabilities and also transparently exploits the processor's ability to address more than 64K bytes of memory. In other words, it allows programs in memory to be much larger than can be accommodated on the 8080 without requiring fancy programming tricks.

The ACTI Pascal compiler is also

user-friendly. Advanced error-recovery techniques ensure that compile-time errors are reported succinctly and informatively. The most important feature of the compiler, however, is its output quality. The accompanying bar chart compares the performance of this compiler with offerings by other manufacturers in a popular Pascal benchmark. Using ACTI Pascal under the CP/M 3.0 operating system, the ACT-3's 80/300 outperforms the 8086, 68000, 80286 and the VAX-11/780—all by at least a factor of two.

Other support software now available includes a relocatable macro assembler and linker, a machine-level debugger, and CP/M 3.0, already configured for the ACT-3. Upcoming software tools include a C compiler (fall '84 delivery), a real-time kernel for multitasking applications and data-communications software.



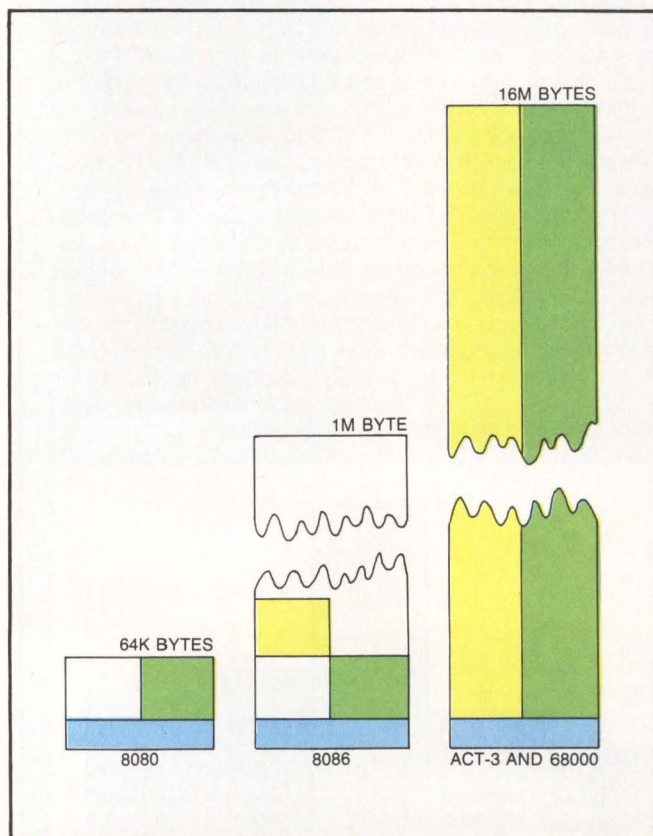
The Eratosthenes Sieve benchmark program computes prime numbers from 3 to 8,190. Performance figures reflect compiler efficiency, CPU memory organization and processing power. Object-code lengths for this program are Intel Pascal-86: 274 bytes; ACTI Pascal: 184 bytes; Pascal MT 68000: 410 bytes.



### More memory is accessible

Larger programs, increasingly sophisticated application and growing databases make memory addressability a critical issue for system integrators. Another design goal for the ACT-3, therefore, was to extend its addressing beyond the 64K-byte limit of the 8080. In doing so, the main criterion was to provide a straightforward means of accessing large amounts of memory. Segmented addressing schemes increase the total amount of memory space available, but only 64K bytes of data can be directly addressed at a time. And memory-management hardware is required to move the 64K-byte window around within the larger memory space. To avoid these restrictions, the ACT-3 was designed with a linear addressing scheme much like the 68000's. Figure 2 illustrates the implications of this design for programming.

The ACT-3's scheme is implemented with instructions that allow programmers in a single step to move data or transfer control to or from any location in a 16M-byte memory space. For instance, the instruction



**Fig. 2. Single-instruction addressing capabilities of the 8080, 8086, ACT-3 and 68000 are illustrated for a program running at the bottom of memory (blue). Green regions are accessible via flow-of-control instructions (jumps, calls, etc.); yellow regions are accessible via data-access instructions (loads, stores, etc.) Note that the segmented approach allows access to only 64K bytes of data at a time, whereas a linear addressing scheme (employed by the 68000 and the ACT-3) gives direct access to the full 16M-byte address space.**

BRF branches "far" to any 24-bit physical address, and the instruction LDWF loads the widened accumulator (A'A) with a 16-bit word from anywhere in the extended memory space. Large-scale indirect addressing is facilitated by the ACT-3's L' register, which is used with registers H and L to form a 24-bit indirect address. Instruction STINF, for example, indirects through the L'HL registers to store the accumulator.

Even with this 16M-byte addressing scheme, 8080 programs run compatibly on the ACT-3 due to the BANK register, which forms the default upper 8 bits of a 24-bit physical address. Two new instructions specifically alter the BANK register to select the 64K-byte boundaries on which the 8080 programs should reside. The BANK register also supports multiuser and bank-oriented operating systems.

### Hardware supports Z80 emulation

The ACT-3's compatibility with 8-bit software goes one step further to include emulation of Z80 code. A bit in the ACT-3's CTRL register determines whether the processor is in the ACT-3's extended mode or in the Z80 compatibility mode. Both modes run the standard 8080 instruction set as a matter of course. When the machine detects a Z80-specific opcode (Fig. 3), the program counter is automatically pushed on the stack so that the emulator program is able to access the opcode. The address of the emulator program, which resides in the upper 8 bits of the CTRL register, is then loaded into the PC register, transferring control to the emulator program. The emulator program then pops the PC register's contents off the stack and fetches the Z80 instruction. It then branches to the appropriate emulation routine, performs the operation and returns control to the main program.

One reason for the ACT-3's fast execution of Z80 code is that over 90 percent of the opcodes encountered in a typical Z80 program are 8080 opcodes that require no emulation. For those opcodes that do require emulation, speed is attained by using the full power of the ACT-3's 16-bit instructions in the emulation routine. The Z80's block instructions (for example, LDIR, LDDR and CPIR) are particularly efficient on the ACT-3. In its emulation of the LDIR instruction, for example, the ACT-3 moves 1K byte of memory in less than 3 msec.; a 4-MHz Z80 takes more than 5 msec.

### Immediate benefits for applications

The ACT-3 processor is already at board level on the aSBC 80/300 SBC with RAM, PROM and serial I/O, allowing immediate integration into existing systems. The SBC supports the complete IEEE-796 Multibus interface protocol, including full multimaster capabili-



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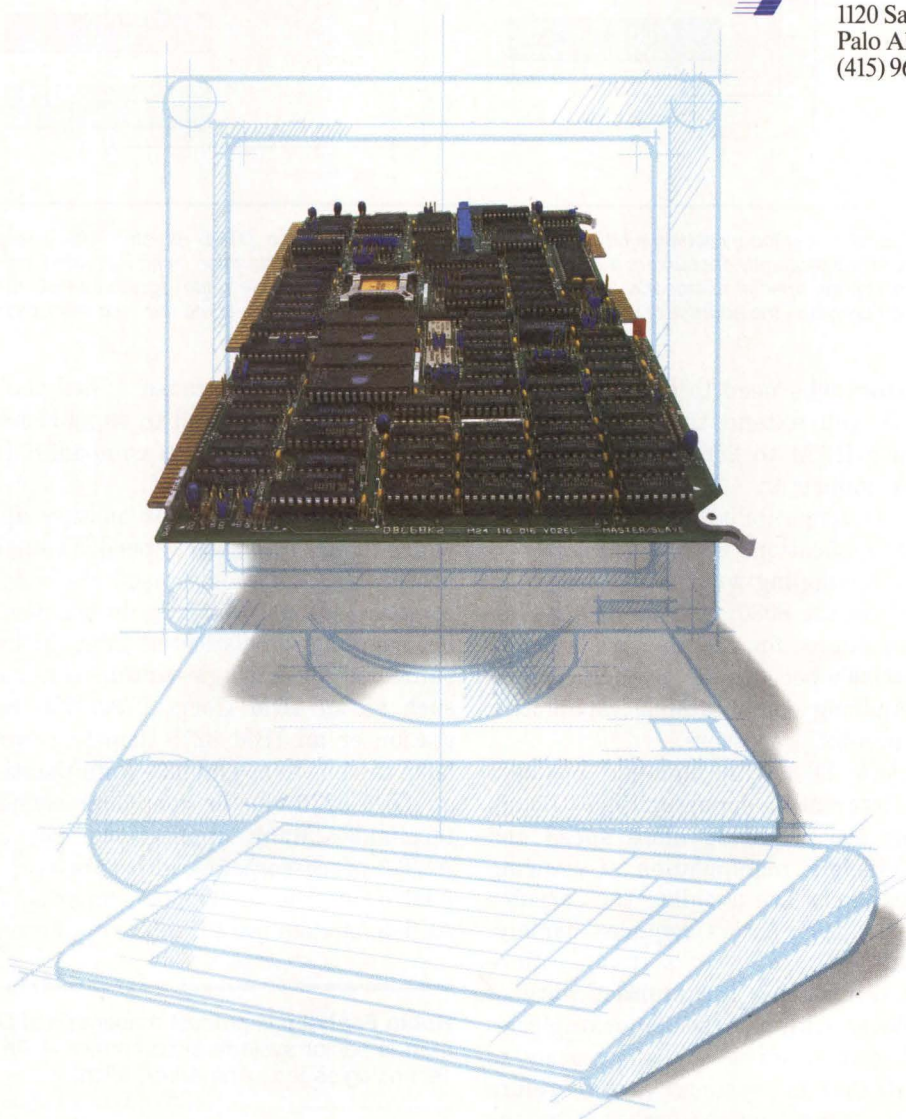
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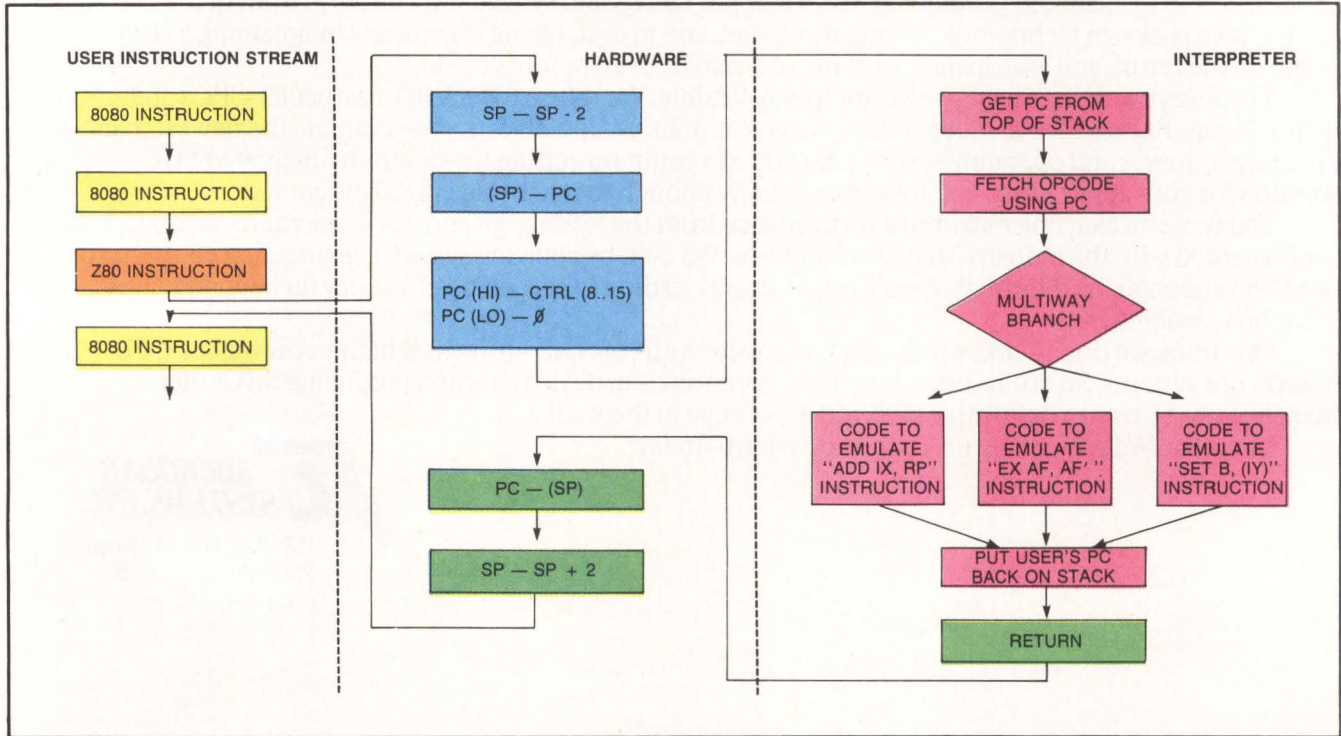


Fig. 3. The ACT-3's Z80 mode is enabled by setting a bit in the CTRL register. When the processor subsequently encounters a Z80 opcode (orange) in the instruction stream, special microcode (blue) is executed to trap to the emulator program, the address of which lies in the

upper 8 bits of the CTRL register. The emulation software (red) performs the Z80 instruction using extended instructions to maximize performance. A simple return (green) sends the processor back to the main program to execute the next instruction.

ties. System integrators who need to minimize Multi-bus memory accesses can extend the 64K bytes of on-board no-wait-state RAM to 256K bytes, using a high-speed expansion connector.

Because of its 8-bit compatibility and high rate of throughput, the best applications for the aSBC 80/300 are by those who are struggling with the memory and processing constraints of the 8080, 8085 or Z80. Industrial-automation applications, for example, are a prime target for the aSBC 80/300 because increasingly sophisticated tasks are requiring computational capabilities beyond the abilities of 8-bit processors.

Exploiting the aSBC 80/300 in high-end business systems provides an interesting opportunity. Although business applications are requiring more speed and memory space for efficient manipulation of growing databases, many companies are avoiding the sacrifice that higher-performance processors require—namely, losing access to their installed 8-bit software. More businesses are also confronting the impracticality of equipping each employee with a personal desktop computer, because such computers do not allow users to share files easily. Multiuser systems are therefore regaining popularity, though processors such as the Z80 and 8080 are not fast enough to support multiple workstations. The aSBC 80/300 thus fills a niche in

business systems because it has the throughput and memory space required to support multiple users and at the same time allows companies to maintain their 8-bit software investment.

Data communications is another application area in which the aSBC 80/300's speed is valuable. Today's 8-bit processors, commonly used for implementing data-communications products, do not have the throughput for handling sophisticated jobs. Although the 8080 is sufficient for a single-station communications device such as an IBM Corp. 2780/3780 remote-data-entry station or an IBM 3275 display terminal, it does not have the power to emulate a multistation device such as an IBM 3276 cluster controller connected to multiple terminals. Many applications can also employ the ACT-3 processor's fast interrupt-response time. In the EDN/Carnegie Mellon benchmarks, for example, the ACT-3 handles the I/O interrupt kernel in just 28 µsec. □

Robin Fosheim is product manager and Douglas R. Grundman is senior systems programmer at Advanced Computing Technologies Inc., Ann Arbor, Mich.

Interest Quotient (Circle One)  
High 813 Medium 814 Low 815



# CREATIVE EXORbus\* ARCHITECTURE

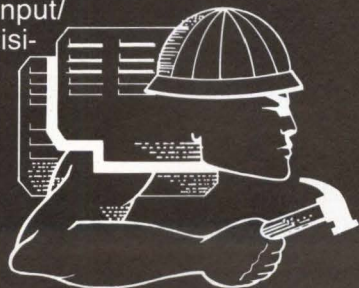


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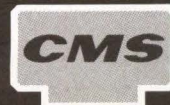
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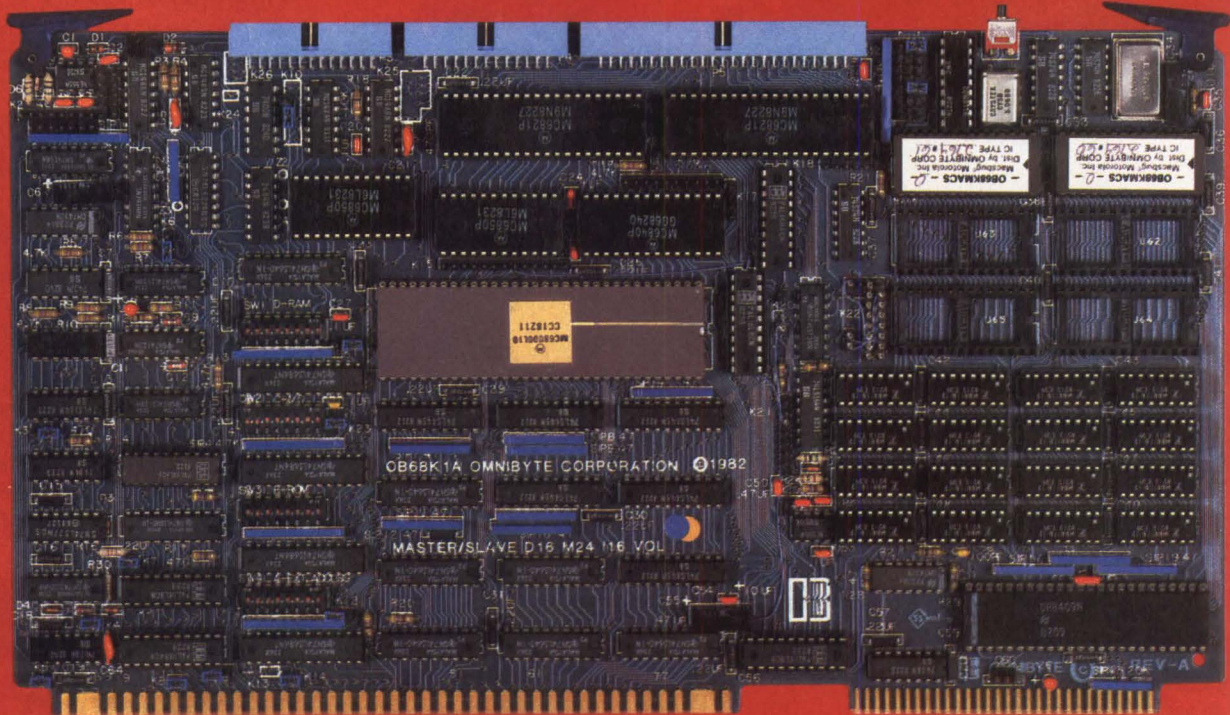
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# Eurocard/DIN single-board computers signal era of international standards

*Debate surrounding interface bus standards highlights trends in system integration*

**Rick Dalrymple, Senior Editor**

Although the Eurocard/DIN-based VMEbus is now one of the four dominant board-level buses in the U.S. market, it may be several years before it and other Eurocard/DIN buses gain a domestic market share rivaling the edge-connector-based Multibus, Q-bus and STD-bus. These three popular U.S. standards have a track record of adapting to current application requirements. This fact, coupled with the wide variety and availability of tried-and-true support boards, leads many system integrators to conclude that these "old" standards deserve their continued loyalty.

In this article, the first of two, the emphasis is on those three popular 8- and 16-bit buses and two new 8-bit buses, the STE-bus and the CIMbus. Both the STE-bus and CIMbus incorporate the Eurocard/DIN mechanical specifications. The reason for this packaging standard's popularity goes beyond its reliability. As a family of boards and connectors, it offers the flexibility to keep pace with new architectures and performance requirements for many years to come (see "Eurocard's two families," Page 172). That is why all bus standards now in the proposal stage have incorporated the Eurocard/DIN specification.

The Multibus, Q-bus and STD-bus date to the mid-1970s, when 8-bit, single-processor systems with 64K-byte addressing represented the state of the art. Over the years, each of those buses has taken advantage of available technology to meet market demand. That process continues today as innovative board-level manufacturers find new ways to extend the capability of these old buses.

*This is the first installment of a two-part series on microcomputer bus standards. The second article will focus on 32-bit buses, such as the VMEbus, the Multibus II, the NUBus and the Futurebus.*

## STD VS. STE

	STD	STE
IEEE no.	P961	P1000
Board size	6.5x4.5 in.	100x160mm Eurocard
Connector/pins	edge/56	DIN 41612/64
Data transfer	synchronous	asynchronous
Data lines	8	8
Address lines	16 (24 by multiplexing)	20
Multiple processor architecture	unspecified	master/slave
Interrupts	2	4
Daisy chain	1	2

Perhaps the most limited of the three popular buses, the STD-bus, was conceived for control applications using 8-bit microprocessors. The STD-bus now has the capacity to compete in high-performance applications such as image and speech processing. It is found in fast-Fourier-transform (FFT) machines and flight simulators—all a far cry from the simple process-control tasks usually associated with the STD-bus.

## Extending STD-bus performance

The STD-bus' new-found computational power comes from 16-bit microprocessors with 8-bit I/O, such as the 8088, 68008 and Z800. By coupling these devices with math coprocessors, number-crunching applications are improved as much as 100 to 1 in calculation speed. Also, new STD-bus, single-board computers overcome 64K-byte addressing limitations by sharing four lines between memory address and data. This scheme creates the necessary 20 lines to address 1M byte of memory.

Jim Eckford, marketing manager at Ziatech Corp., San Luis Obispo, Calif., considers his company's 8088/8087 board as a product that can compete with the Multibus in certain applications. "What we offer the



**Eurocard's two families**

The key difference between Eurocards and the mechanical specifications of other buses is that Eurocards are a family of cards coupled with a family of connectors. This system allows system integrators to take advantage of several different card sizes and connector configurations without leaving the Eurocard family. This results in a mechanical specification that has the flexibility to keep pace with new architectures and performance requirements for many years.

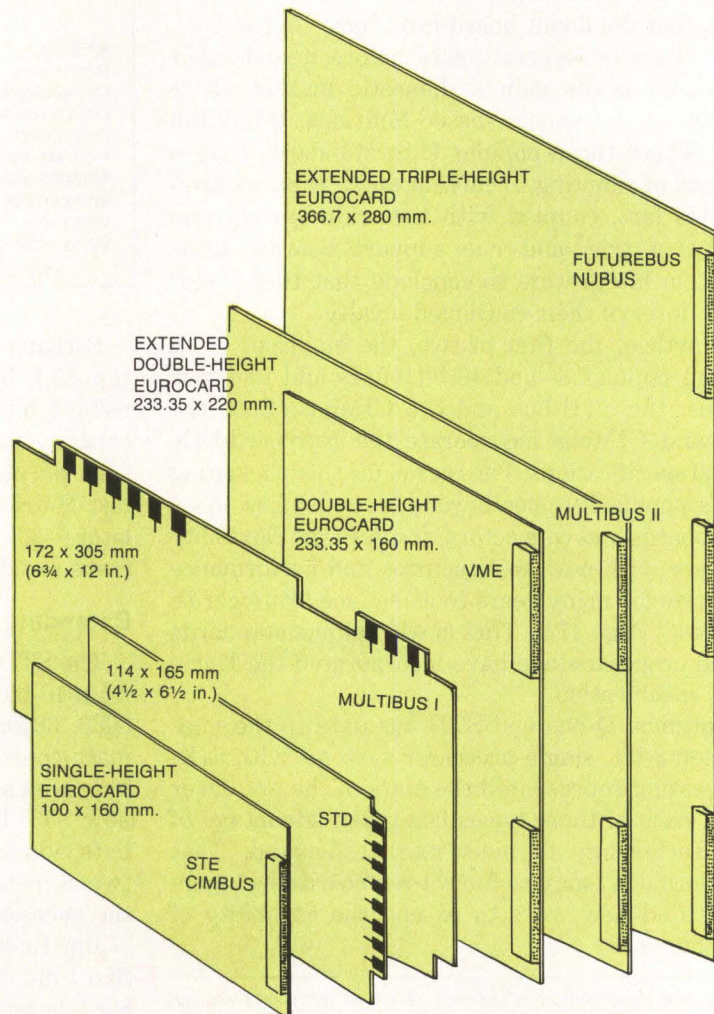
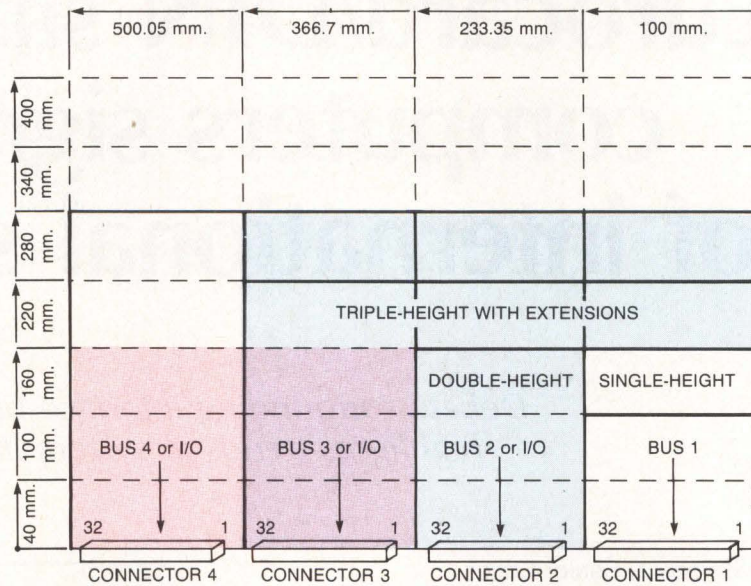
Within the Eurocard family, system integrators can use single-height (100 by 160 mm.) cards as compact modules or take advantage of the maximum board area accommodated by the Eurocard system by using the four-connector cards (500 by 400 mm.). This family of compatible card sizes allows system integrators to mix cards in the rack. For instance, they could use a combination of double-height, high-performance processor cards and lower-cost, single-height I/O modules.

Although the two-piece, pin-in-socket DIN 41612 connector offers a gas-tight, environmentally secure seal, reliability is just one facet of its appeal. Again a family, it offers compatible units with a range of accessories that includes ribbon and coaxial cable connections. The DIN connector's 96 pins provide the high pin density required to place all bus lines on a single connector. So, as technology allows a card to shrink from, say, double height to single height, no connector modifications are necessary.

Because the Eurocard is an open international standard, plenty of Eurocard hardware is on the market. And, because all new bus standards are adopting the Eurocard system, Eurocard hardware volume will increase and competition will keep prices down.

**Eurocard sizes range from 100 by 160 mm. to 500.05 by 400 mm., based on a grid system that allows card sizes to be configured in standard increments. Stacking cards from several bus standards side by side demonstrates the flexibility of the Eurocard specification and how STD's and Multibus' card sizes compare to Eurocards.**

**EUROCARD CONFIGURATION GRID**





customer," states Eckford, "is a 16-bit product that is half Multibus' size and half Multibus' typical price." He therefore sees the STD-bus' small form factor—4½ by 6½ inches—and the availability of many low-cost boards well-suited to test and measurement functions as his company's edge over Multibus boards. "Where we can do well," notes Eckford, "is in compact, dedicated, computation-intensive applications such as blood analyzers, oil-well loggers and spectrum-analysis systems."

Users shouldn't confuse processing power with I/O capability. The STD-bus is an 8-bit bus that does not perform well in I/O-intensive operations. Both the 16-bit Multibus and the 32-bit VMEbus are better suited to I/O-intensive applications. Therefore, the STD-bus continues to pose no threat to buses used on commercial data-processing systems.

### Distributed processing on STD-bus

Another trend benefiting all board-level products is the ever-increasing amount of function that will fit on a single card. With each new generation of integrated circuits (ICs), board manufacturers can place more processing power on peripheral cards. At the system level, this means that peripheral processing tasks can be offloaded from the CPU card and that operations on several different peripheral boards can run concurrently.

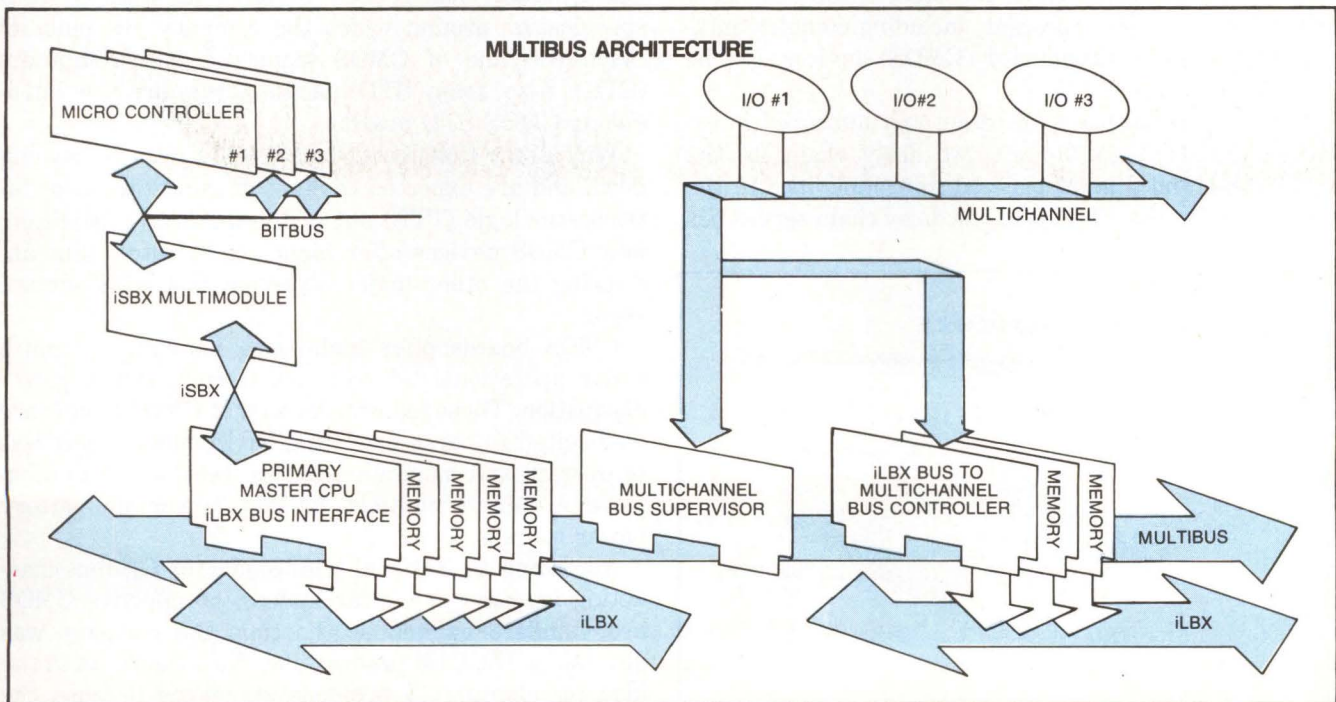
In the case of the STD-bus, this concept has been applied to peripheral cards that could be called "intelligent slaves." These modules are single-board computers that function as intelligent I/O cards acting as slaves

to one master CPU card. Ziatech offers STD single-board computers with a second connector that interfaces to the Multibus' iSBX Multimodules, thus allowing each slave processor to have dedicated memory or I/O. These cards suit the one master/multiple-slave configuration because they allow the slave to address its own memory or other I/O card without using the STD-bus.

Smart I/O cards also help alleviate the STD-bus' I/O limitations. As Matt Biewer, vice president of research and development at Prolog Corp., Monterey, Calif., points out, "The concept of distributed processing uses hardware to achieve the multitask environment in a parallel, rather than serial, mode of operation. The use of smart I/O cards eliminates the need for a more sophisticated multitasking operating system because the host processor is relieved of most of the peripherals' task." Shifting the software load onto the peripheral card means that adding I/O functions does not add significantly to the CPU's load. This approach allows performance features to be added without seriously impacting the operating system software.

The STD-bus has yet to be adopted as an IEEE standard, but it carries a working group number, P961. In moving toward a standard, the STD Manufacturers Group has developed an arbitration scheme that allows a two-master/two-slave configuration. The latest item, however, is a proposal from Ziatech, suggesting an additional surface connector on STD boards positioned so that iSBX Multimodules from the Multibus can be used in conjunction with the STD-bus.

Despite its improvements, the STD-bus is missing several features found in the newer bus standards.





Another IEEE working group, the P1000 committee, has formulated a bus specification dubbed the STE-bus. While it retains STD's simple, low-cost interfacing, it is a fundamentally different 8-bit bus. The STE-bus offers system integrators an asynchronous, multimaster scheme on standard single-height or optional double-height Eurocards.

**STE-bus committee circulates spec**

According to committee chairman Bill Shields, president of Seaport Computers Inc., San Diego, committee members and other interested parties are now reviewing version 3.1 of the STE specification. Following this comment stage, the committee will print and submit a final specification document to the IEEE for approval.

The STE-bus' Eurocard standardization allows cards designed around it to function in Eurocard-based dual-bus systems. In such a system, a high-end 32-bit bus, such as the VMEbus, uses STE cards as low-cost I/O. An STE board interfaces neatly with the two-connector VME scheme because the STE scheme uses only the outside two rows of the P2 DIN connector.

The STE-bus offers six improvements over the STD-bus, including:

- processor independence,
- asynchronous operation,
- master/slave daisy-chained bus arbitration,
- improved interrupt structure,
- extended addressing range,
- higher system integrity.

These improvements, along with the lines to address 1M byte of memory, accommodate the latest generation of 16-bit processors such as the 8088, 68008 and Z800. However, any 8-bit processor, including complementary-metal-oxide-semiconductor (CMOS) devices, can be used on the bus.

With regard to bus arbitration and improved interrupts, the STE-bus defines two daisy chains to the STD's one, and four prioritized interrupt lines to the STD's two. In the STE spec, one daisy chain serves bus

arbitration, and the other assigns priority to interrupt-slaves. The STD's single daisy chain can be used for bus arbitration or interrupts—but not for both.

The items that provide the STE-bus with greater system integrity are the more reliable DIN connectors, careful provision of grounds and the added safety of using a bus-error line to monitor data transfers and arbitration. In addition, extra 0V lines around the data-transfer strobes provide greater data-transfer integrity and the possibility of ribbon-cable connection for remote I/O.

The big problem now facing the STE-bus is the lack of support from major board manufacturers. The STE-bus needs a champion with the marketing clout to rally board manufacturers and system integrators to the STE standard. Without this support, the STE-bus may languish until enough products come onto the market to make it a real alternative to other 8-bit buses.

The first STE products are coming from the United Kingdom. Several British manufacturers have planned products, but only one—GMT Electronic Systems, Wimbledon, England—is shipping STE boards. Several small U.S. companies are interested in the STE-bus, but none has announced products.

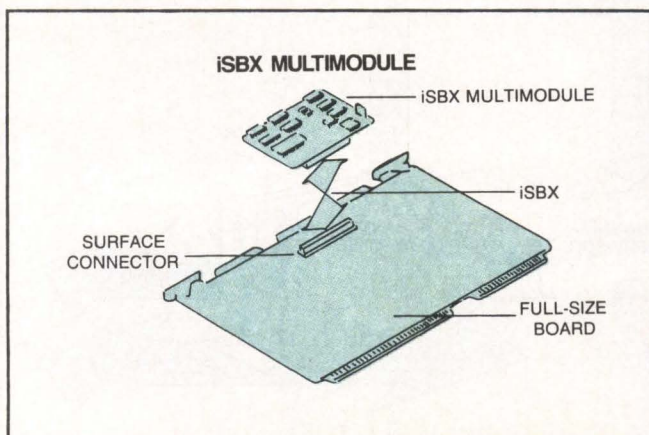
**Enthusiasm runs high for CMOS**

One technology that may boost the STE-bus is CMOS. The STE specification takes the interfacing requirements of CMOS devices into account, and board manufacturers incorporating CMOS devices into their products may find the STE-bus attractive. But a big CMOS promoter, National Semiconductor Corp., Santa Clara, Calif., has chosen to offer its own CIMbus specification around which the company has built its Series/800 line of CMOS industrial microcomputers (CIM). Also, many STD manufacturers are now introducing CMOS STD boards.

Why all the CMOS activity? CMOS prices are coming down and are expected to start pushing transistor-to-transistor logic (TTL) out of the market. In addition, new CMOS devices offer higher clock rates, thus answering the other major objection to CMOS—device speed.

CMOS boards offer high noise immunity, a much wider operational temperature range and low power dissipation. These features mean that CMOS boards are well-suited to harsh operating environments, cost less to operate and maintain and lend themselves to inexpensive, uninterruptible backup power or battery power sources.

According to National Semiconductor CIMbus marketing manager Steve McGinness, no effective CMOS bus standard existed at the time the company was developing the CIM product line. National rejected the idea of adapting to previous standards because the



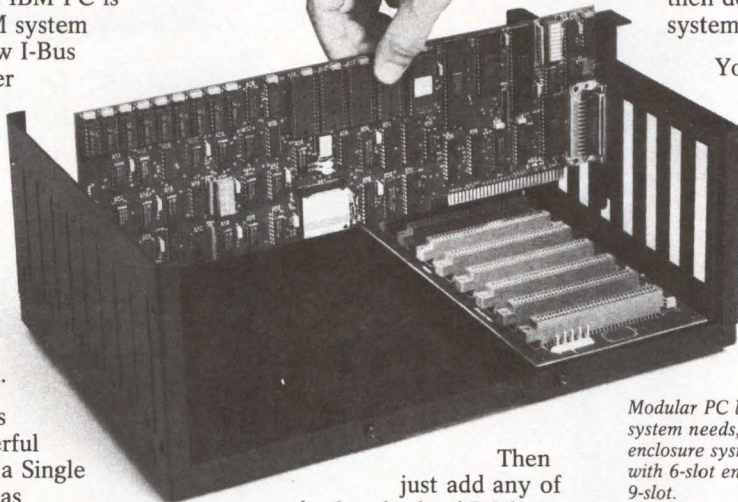


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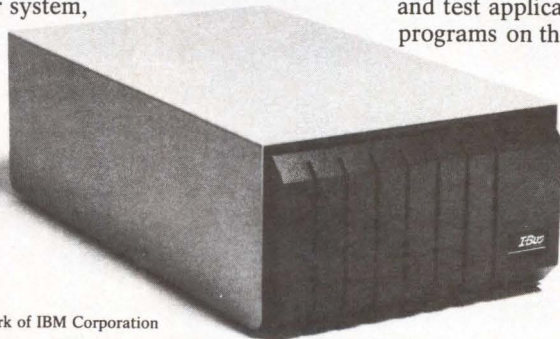
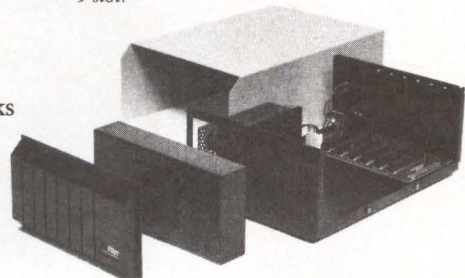
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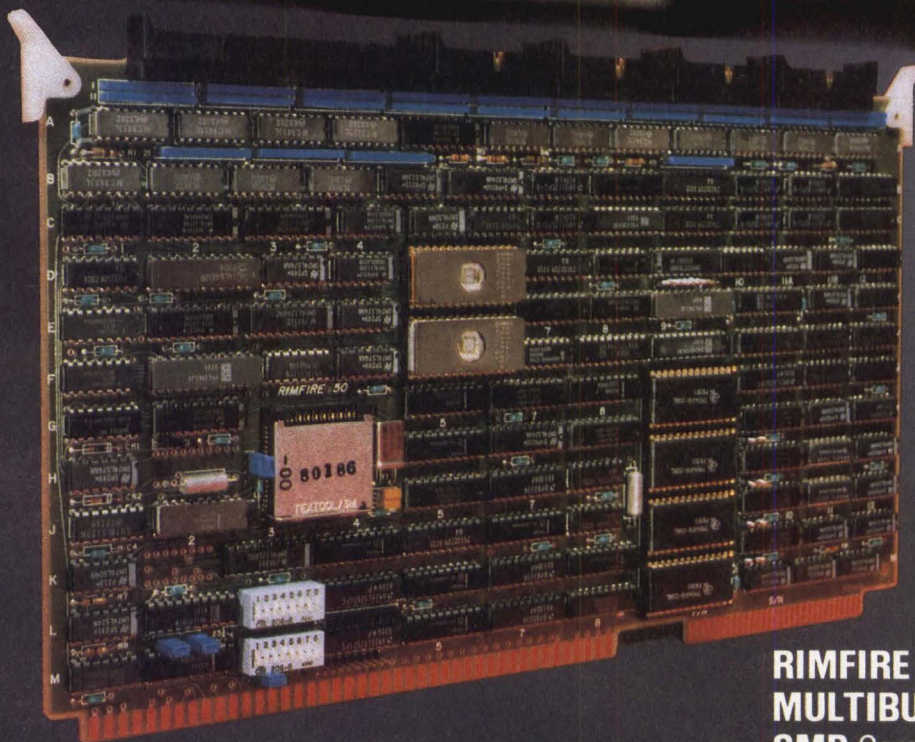
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## CMOS CIMBUS COMPARISON

	CIMbus	STD-bus	Multibus
IC technology	CMOS	NMOS	NMOS
Board size	100x160mm Eurocards	4.5x6.5 in.	6.75x12 in.
Connector	DIN 41612	edge	edge
Data transfer	synchronous	synchronous	asynchronous
Temperature range	-40°C to 85°C (-40°F to 185°F)	0°C to 55°C (32°F to 131°F)	0°C to 55°C (32°F to 131°F)
Power supply voltage	10VDC to 17VDC (unregulated)	+5VDC, ±12VDC (regulated)	+5VDC, ±12VDC (regulated)
Power dissipation (watts)	.3	7.5	20
Bus speed	1MHz to 4MHz	2MHz to 5MHz	2MHz to 5MHz

*Source: National Semiconductor Corp.*

drive/sink translation logic would take up valuable board space and power. Therefore, the company designed a new bus—a synchronous bus based on single-height Eurocards with DIN 41612 connectors. No efforts are under way to make the CIMbus an IEEE standard. If a CMOS bus evolves, it's a safe bet that it will adhere to the Eurocard/DIN mechanical standards. As to a CMOS bus itself, it remains to be seen whether STE, a derivative of the CIMbus or a new effort altogether will result in an effective CMOS bus standard.

Meanwhile, system integrators can choose from CIMbus, STD-bus and Multibus products. The Multibus CMOS board manufacturer is Diversified Technology Inc., Rigland, Miss. Notes board products manager Bill Long, "Part of our success has been based on retrofitting old Multibus designs to make them more reliable." CMOS boards work well in sealed enclosures, allowing system integrators to move computers out of protected areas onto the factory floor or to other harsh environments.

### Q-bus products pace market demand

The Q-bus, oldest of the U.S. bus standards, and Multibus, the standard now holding the largest U.S. market share, have been head-to-head competitors since the mid-1970s. During the last couple of years, the Q-bus has lost market share. However, recent Q-bus product introductions are stemming the flow of Q-bus customers to the Multibus. A key product is Digital Equipment Corp.'s 11/73, a higher-performance single-board computer offering a fully compatible upgrade path for DEC 11/23 users. Alcyon Corp., San Diego, was the first to offer DEC 11/23 users an upgrade replacement board; DEC followed with the LSI-11/73. Either product slips neatly into the DEC PDP-11/23 CPU slot.

According to Gene Banman, director of marketing at Data Systems Design Inc., San Jose, Calif., a disk drive supplier to both Q-bus and Multibus integrators, "Be-

fore the LSI-11/73, design wins for the Multibus included Q-bus customers. Now, Multibus design wins continue at a rapid pace, but Q-bus integrators are not among them." Banman observes that products like DEC's MicroVAX I superminicomputer and JFEP11 board from MDB Systems Inc., Orange, Calif. (MMS, June, Page 269), are providing the performance improvements and upgrade paths that are keeping the Q-bus integrators happy.

The strength of the Q-bus lies in the large volume of developed software. As Q-bus integrators move to the MicroVAX I, a two-board product with prices starting at less than \$10,000, they must also move up to VAX software to take advantage of features such as a 4G-byte virtual-address space, a 32-bit word size and full memory management. Once again a large library of VAX programs is available to system integrators, many of whom have programming experience on VAX systems.

The battle for market share in the single-board computer market pits DEC against semiconductor giants Intel Corp., Santa Clara, Calif., and Motorola Inc., Phoenix, Ariz. Each comes to the market championing different bus standards: DEC, the Q-bus; Intel, the Multibus; and Motorola, the VMEbus. Historically, DEC has been the leading single-board vendor. Intel has been second, and other single-board computer vendors lag far behind. But there is movement in this horse race. When 1984 sales figures are tallied, the leader could be Intel.

According to Dataquest Inc., a Cupertino, Calif., market research concern, 16-bit single-board computers will continue to dominate the market. The most popular 16-bit bus is the Multibus. A number of other high-performance 16-bit Multibus boards that promise to boost system performance well into the supermini-computer range are on the way.

### Multibus offers configuration wealth

By adding a bus here and tacking on another there, the Multibus has grown from one bus to five. More than 200 manufacturers produce Multibus products. Multibus integrators are confronted with a wealth of configuration possibilities.

The first addition to the Multibus was the iLBX execution bus. This architectural extension allows a processor board to access as much as 16M bytes of off-board memory as if it resided on the processor board. This effectively removes local memory traffic from the Multibus. The benefits of this scheme quickly become apparent in multiprocessor configurations. With each processor board using a separate bus for local memory, the Multibus is free for I/O operations or processor-to-processor communications.

Intelligent I/O cards also free the Multibus to handle



more processor and I/O ports. With a dedicated micro-processor and memory located on the I/O card, the need to hold a dialogue between host processor and peripheral is greatly reduced.

Among the single-board computer manufacturers exploiting the benefits of the iLBX extension is Central Data Corp., Champaign, Ill. The company is offering two high-performance processor boards—one based on the Z8000; the other, on the 68000. Neither board contains RAM or serial I/O devices. Instead, these boards feature full demand-paged, virtual-memory-management circuitry, an interface to both the Multibus and iLBX extension that includes bus-vectored interrupts and a powerful state sequence machine that handles all processor cycles on the board. It also leaves room for as much as 32K bytes of programmable read-only memory (PROM) for bootstrap and on-board diagnostics.

Both boards are intended for use with Central Data's cache memory board. By using the cache board, the effective memory access time totals 160 nsec. for an average cycle. Clearly, this powerful combination aids Multibus-based multiuser systems.

The next addition to the Multibus was the Multichannel I/O bus. This architectural expansion allows the

Multibus to accommodate high-speed I/O transfers—as fast as 8M bytes per second—at distances as long as 15m. Typical applications include I/O bus communications with graphics processors, data-acquisition modules and Multibus system-to-system links. The bus provides block transfers across an 8- or 16-bit-wide data path using a simple asynchronous IEEE-488-like protocol.

The Multichannel is an alternative to the IEEE-488 bus, which is limited by a 1M-byte-per-second transfer rate. However, the 488 bus does stretch to 20m. and has the advantage of ready-made links to peripherals and instruments with ports for the 488.

### Small items offer large benefits

The most recent Multibus additions include the iSBX modular I/O bus and associated Multimodule. These, in turn, connect to Intel's Bitbus and new distributed-control modules (iDCMs). Each of these small items could offer large benefits.

The iSBX bus and Multimodules allow the addition of a small, low-cost board that attaches directly above a full-sized Multibus processor board. This allows system integrators to configure each processor board to its application more precisely by adding functions such as high-speed math, memory management, voice synthesis and a board-level modem. Because each of these functions can be accomplished using smaller Multimodules, system integrators save the expense and space of full-sized Multibus boards. There are two other advantages: first, Multimodules can be accessed as quickly as on-board memory, and they free both the Multibus and iLBX bus for other tasks.

The Bitbus opens new vistas in control applications. The key item in the Bitbus is the microcontroller, an Intel term for a single-chip microcomputer on a small board that includes the necessary drive circuitry. Microcontrollers are dedicated to specific control devices such as temperature monitors, motor controllers, heating/air-conditioning system controllers, badge readers and door and window alarms. All these dedicated systems can be connected to a Multibus computer system via the Bitbus, a serial bus with a maximum data rate of 2.4M bits per second using the synchronous data-link-control (SDLC) protocol. The Bitbus extends to 2 km., compared with the RS232C at 50 feet and the RS422 at less than 1,000 feet.

To review single-board computers now on the market, refer to *Mini-Micro Systems' Computer Digest*, June 15, Page 23. □

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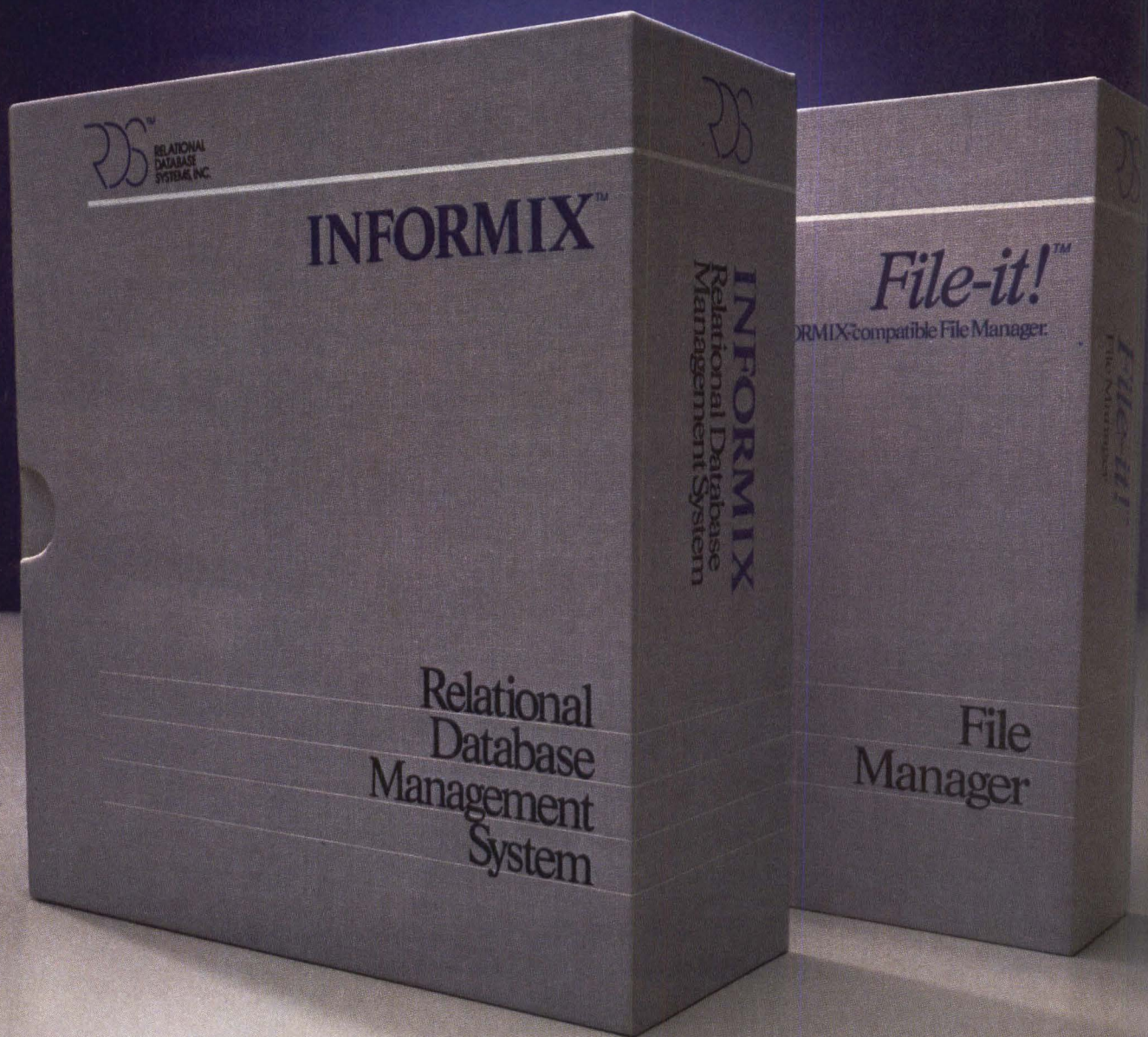
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AT&T Personal Computer	Intel System 86/330
BBN C machine (all models)	Masscomp NC 500
Bunker Ramo Aladdin 20	Momentum Hawk 32
Charles River Data Systems	NCR Tower
Universe 68	Onyx C8002, C8002A
Convergent Technologies	Perkin-Elmer 3210, 3220,
Miniframe and Megaframe	3240, 3250
Corvus Systems Uniplex	Pixel 100/AP, 80 Supermicro
Cromemco System 1	Plexus P/25, P/35, P/40, P/60
DEC 11/23, 11/34, 11/44, 11/60,	Pyramid Technologies 90x
11/70, VAX 11/730, 11/750,	Radio Shack Model 16
11/780	SCI Systems IN/ix
Dual Systems System 83	Wicat System 150WS, 160,
ERG Mini System (all models)	200
Fortune 32:16	Zentec 2020
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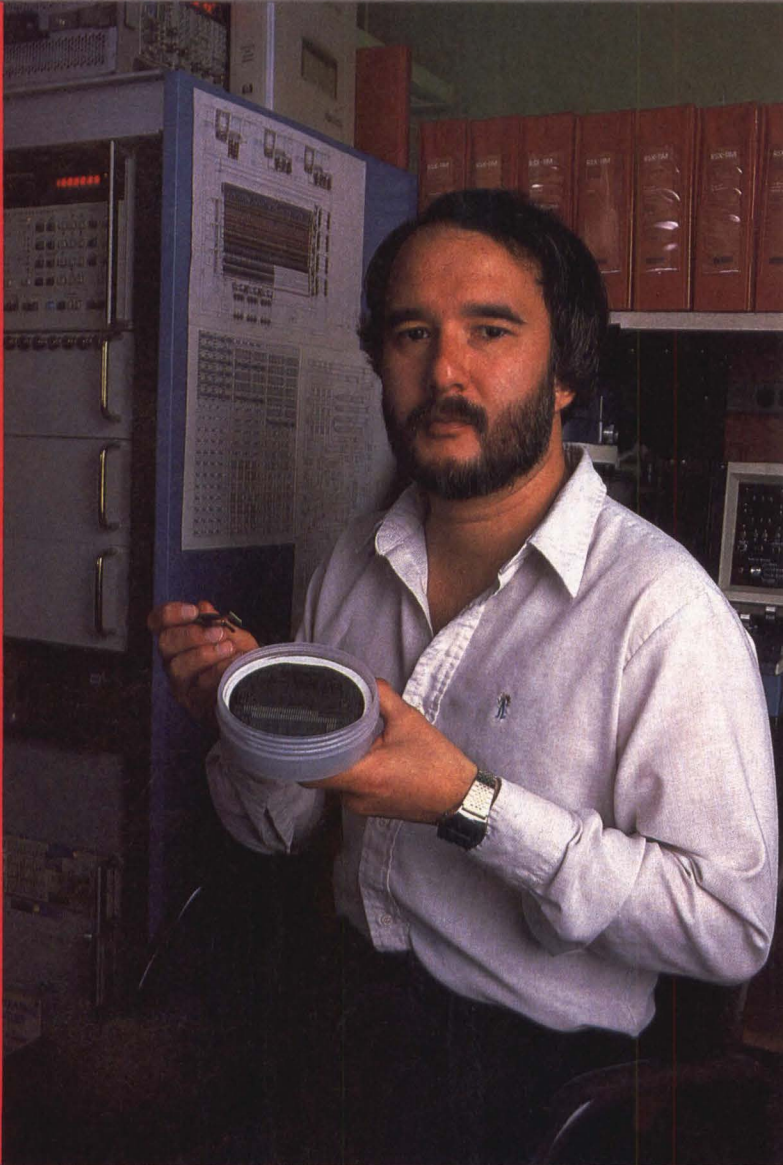
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**Glenn Jennings**

*Senior Engineer, Programming  
Jet Propulsion Laboratory  
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# Mature software tools speed development tasks

*The latest software tools provide a mature environment for the development of complex applications, allowing greater productivity*

**Carl Warren**, Western Editor

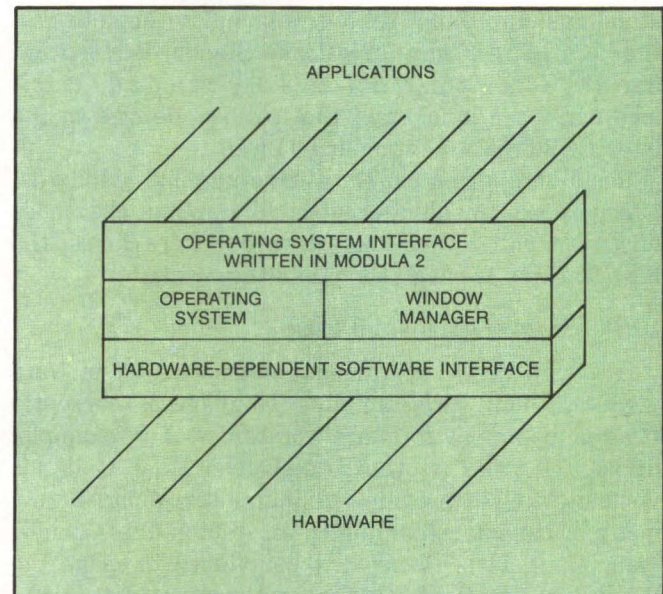
Software developers now have a robust set of tools. These include optimized language compilers, operating system environments that aid software development and sophisticated fault finders (debuggers).

With these tools, software writers can make a better product in less time. Although in most cases the tools are used to create application programs, they also lend themselves to the creation of still other development tools, or to the establishment of a fertile development ground.

One example of a tool used to create tools is Modula 2 for the 8086, developed by Logitech Corp., Redwood City, Calif. According to company president Pierluigi Zappacosta, Logitech's version of Modula 2 is a true compiler. It generates native code rather than p-code that must be interpreted. "We aren't pushing Modula 2," says Zappacosta. "Rather, we are more interested in creating a programming environment and providing tools to the software developer similar to those used by hardware designers."

Modula 2 is an extension or, more correctly, a robust version, of Pascal. Logitech believes Modula 2 offers the right environment because it is many tools within a tool. Moreover, it permits the creation of other tools by using modules that can be used to define operation-specific libraries. "We have essentially addressed the problem of real-time programming," says Zappacosta, "but we have no illusions about supplanting the C programming language."

Another company embracing Pascal is Intel Corp., Santa Clara, Calif., with its Pascal-286 compiler. It employs a version of Pascal conforming to the standards established by the International Standards Organization (ISO). The code produced is transportable to any



**Logitech's Modula 2** is designed to match applications with the operating environment by providing a software interface to the operating environment. Much like the hardware interface, the software link is written by the system integrator.

other ISO-standard Pascal environment.

By offering Pascal-286, Intel hopes that software writers and system integrators will develop a host of products around its powerful 80286 microprocessor. Pascal-286, sold as iMDX-324, is priced at \$3,900 and includes enhancements that take advantage of support chips such as the 80287 numeric coprocessor. Like Logitech's Modula 2, Pascal-286 also produces native object code.

Softech Microsystems Inc., San Diego, offers the UCSD Pascal and p-system. Softech has added a little extra in the form of a window manager called Insight



Window Designer. The entire package—with the window manager, UCSD Pascal and the p-system for IBM Corp.'s PC, Digital Equipment Corp.'s Rainbow and Apple Computer Inc.'s IIe—sells for less than \$500.

Prospero Software Ltd., London, may have taken the language extension further with Pro Pascal and Pro FORTRAN. Both of these products are for 16-bit microcomputers using the Intel 8086 or 8088 microprocessor and the CP/M-86 operating system from Digital Research Inc. (DRI), Pacific Grove, Calif. Support for the Intel 8087 matching coprocessor is built-in.

To relieve software writers of the tasks of cross-referencing modules and performing cumbersome linking operations, Prospero provides a full set of command files that handle these tasks dynamically. To ensure conformity of the source-level code, Pro Pascal conforms to the ISO 7185 standard and is certified by the British Standards Institution for meeting international standards. Pro FORTRAN is a complete implementation of the American National Standards Institute (ANSI) X3.9-1966 (FORTRAN 66) standard, but it incorporates a number of the features defined in the later FORTRAN 77 standard as well.

Besides adhering closely to international standards, Prospero has made provisions to combine the codes written in both compilers. Software writers can use the best features of each and couple the results.

**UNIX establishes a solid base**

Although Pascal provides an alternative to software writers, the C programming language is currently favored by many software companies. For example, dBase III, from Ashton-Tate, Culver City, Calif., is written in C to provide maximum portability across many machines. According to an Ashton-Tate spokesman, the goal is to use C's portability to make the product as beneficial to system integrators as possible.

Robert Anton Byers, an independent software consulting engineer in LaCrescenta, Calif., says system integrators can use C because UNIX provides a plush environment in which to build software. "In UNIX, you have literally rafts of libraries to choose from. Therefore, software writers have the tools at the touch of a button."

The C language lends itself well to producing other tools. One company, Digital Information Systems Corp., Sacramento, Calif., has used C to create Data Business Language (DBL). This "new" language is a superset of the DIBOL-11 business language from DEC, Maynard, Mass. As the name implies, the \$449 DBL-4 is written to support business applications. Existing applications can get easily transported due to compatibility with the DEC product. Furthermore, DBL-4 operates in a variety of operating-system envi-



Extending the operating environment of the IBM PC can be achieved using DRI's Concurrent CP/M-86 and a Starlink expansion add-on to support as many as five users.

ronments including MS-DOS; thus, source code can be created on the IBM PC or a compatible microcomputer and up-loaded to a DEC PDP/11.

**Tools locate data**

Byers contends that, in reality, what computers are used for is managing databases. "The trick is to figure out a method of getting to the data quickly. Sophisticated tools now provide the programmer with that ability."

One such tool that aids software writers in handling databases is Trio Systems' C-INDEX+. This package, priced at \$400, links into C language applications and provides variable-length data-storage and -indexing functions. Moreover, company president Alan Bartholomew says that indexed sequential access method (ISAM) techniques are used to keep track of the data and to provide quick access to it. Although Trio does sell the object-code version, it also makes available a source-code OEM version for system integrators.

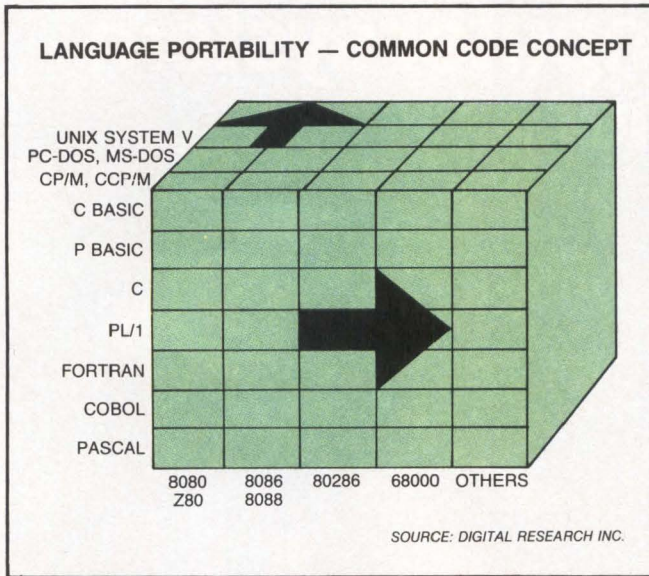
For developers who are creating applications for the IBM PC world, XOR Corp., Minnetonka, Minn., provides a tool kit of 50 C routines for \$99.95. "This is a superior set of extensions to the standard C library," says vice president of research and development Michael de St. Hippolyte. "The standard C library doesn't have built-in input/output commands but uses general functions. Our C Tools is a set of functions for I/O specifically optimized for the IBM PC; thus, a programmer can quickly have keyboard and sound routines by simply specifying a library call in the source code."

Taking a different approach to C compilers is Boston Systems Office, Waltham, Mass., with an optimized Motorola 68000 microprocessor BSO/C compiler. The compiler, priced at \$5,000, is designed to run on the DEC VAX to produce microprocessor target code, turning the powerful minicomputer into a microprocessor development system. BSO also plans versions for









The basic concepts of DRI's common code are to provide a common syntax on the front-end (languages), a link to the various processors and common links to the operating systems. This 3-D approach means that code generated on one machine type for a given operating system can be used in a completely different environment with little or no changes.

the Intel 8086/88 and 8087 microprocessors as well as Motorola's 6809 and Zilog's Z80 family of processors.

The BSO development series includes the necessary software interfaces to allow linking to a variety of microcomputer operating systems. In addition, a runtime math library is incorporated to institute floating-point capability.

**Tool makers are challenged**

Because computer systems, minicomputers and microcomputers and the attendant applications grow increasingly more sophisticated, software tool makers are continually challenged to provide better widgets. DRI, one of the mainstays of the operating system and tool business has recognized the need to bolster developers' tools. "The biggest challenge we see is to provide source-level portability across a number of processors," says Fred Langhorst, vice president of DRI's corporate planning and development. He admits that this isn't news. "It may be the single most important factor, however," he says.

According to Langhorst, because of the number of chips with 32-bit power being produced by the semiconductor industry, the software has to be available to take advantage of it.

Due to the diversity in the various chips, Langhorst says, the new generation of development tools are designed to remove "bit-twiddling," thus ensuring that they meet the portability demands of the industry. "We match the code to maximize the processor—and we may

be pushing the state-of-the-art with Concurrent CP/M-86—but it does open up a new environment for the software writer."

Even though DRI has traditionally skirted the UNIX issue, it is now aggressively developing a series of tools and applications in concert with AT&T Technology Systems, Summit, N.J. Specifically, under the aegis of AT&T, DRI is developing products in three distinct areas: professional programming library, which includes compilers and other development tools; office automation—spreadsheets, word processors and graphics; and engineering scientific, with statistics, finite analysis and surface representations. "The products are primarily for the AT&T B-series of minicomputers, but it is an open-architecture scheme to permit portability across a variety of devices and to allow developers to increase the value of the base product."

**Ease of creation sought**

To achieve portability and ease of creation, DRI uses the common code-compiler generator. This is a technique whereby the compiler has a front end and a back end. The front end always has the same syntax regardless of the CPU, and the back end makes it CPU-dependent. An intermediate translator from the source code to the chip-specific generator serves as the communications vehicle. "This doesn't mean multiple steps are required; we handle all the translation in a transparent manner at compile and link time," Langhorst says.

Still another company that is working with AT&T to provide developers with tools for the powerful computers is Feith Systems and Software Inc., Bala Cynwyd, Pa. Its contribution is UX-BASIC. "This is a product we distribute for UXSoftware Inc., Toronto, explains company president Don Feith. "This is a superset of BASIC and contains statements such as TRIM, DAY and DATE and even has Pascal-like constructs such as WHILE and WHEN. This language allows software writers to quickly create applications that will run on a host of UNIX-based machines."

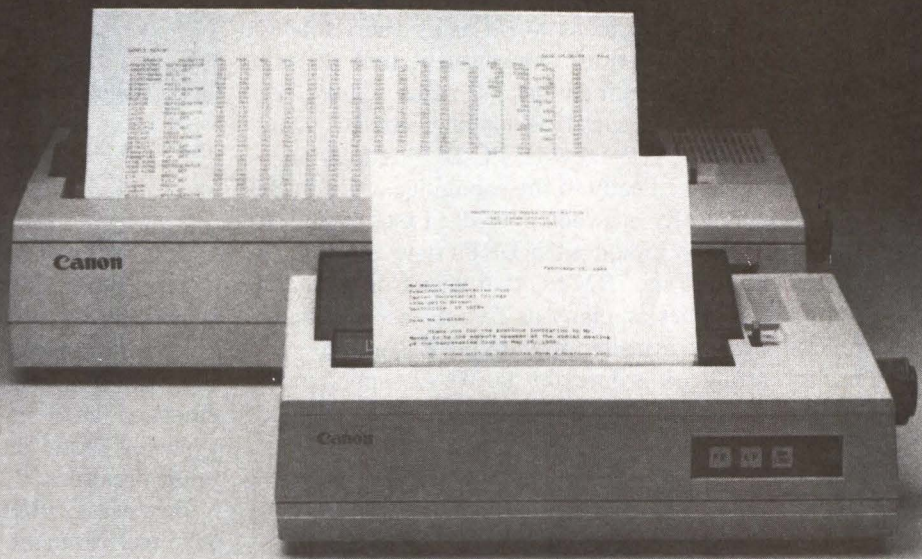
One company that has taken an aggressive posture in providing high-performance software, especially for the graphics industry, is Megatek Corp., San Diego, with the Template graphics package. "This is a powerful tool that lets you develop sophisticated graphics that are usable in a variety of environments, ranging from large-scale, computer-aided design workstations to the IBM PC," claims Template director of operations Robert W. Adams. The newest version of the package for the IBM PC, priced at \$300, aims at OEMs, system integrators and sophisticated end users.

Basically, Template is a library of FORTRAN programmer routines—a graphics development tool kit.



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Included are 21 font styles and device drivers to handle various input and output devices. As with the C libraries, Template's FORTRAN routines can be coupled into a total development environment.

**Operating environments important**

Because power, portability and ease of development are important to software writers, they are naturally looking for the most productive environment they can find. Craig S. Jelinek, president of Micro Business Applications Inc., Burnsville, Minn., runs one such company. "Because we have products that are aimed at being generic in the business world using the IBM-PC and look-alikes, we need an environment that doesn't restrict us to a predefined set of rules. Thus, we decided that we could satisfy a lot of needs by using DRI's Concurrent CP/M-86 with PC-DOS emulation."

Jelinek refers specifically to the capability of CP/M-86 to switch dynamically between operating modes (CP/M or PC-DOS). When linked with DRI's new Starlink, a multiport add-on to the IBM PC that uses Concurrent's capability to support as many as five users, multiuser capability is automatically provided. "Essentially, all the background work is done for us. We can spend most of our time developing the application."

```

002240 DATEFROM.
002250 MOVE 320 TO IO-LENGTH.
002260 MOVE 1601 TO SCREEN-OFFSET.
002270 MOVE 1 TO BUFFER-OFFSET.
002280 CALL SCREEN-TO USING WRITE-ATTR FORM-PARAMS DATEFROM-00-ATTR.
002290 DISPLAY DATEFROM-00 AT 2201.
002300 DISPLAY DATEFROM-01 AT 2201.

TEST-RESULTS.
IF UK
MOVE " date in UK format -" TO FORMAT-MSG
ELSE
MOVE " date in USA format " TO FORMAT-MSG.
MOVE "date is OK" TO RESULT-MSG.
IF DAY-NO = SPACE
MOVE "Day is invalid" TO RESULT-MSG
IF UK MOVE 0956 TO CURSOR-POSITION
ELSE MOVE 0959 TO CURSOR-POSITION
ELSE IF MONTH-NAME = SPACE
MOVE "Month is invalid" TO RESULT-MSG

DATECALL.
Level-02-Speed-0-
Am-Scroll
F1 F2-view F3-context F4-swap F5-where F6-line F9/F10-word-l/r Escape
S C Z := next-If Perform Reset Break Env Query Find Locate Text Do 0-9-speed
    
```

Micro Focus' Level II COBOL is designed for ease of application creation by providing structured mainline coding techniques.

**COBOL remains an important tool**

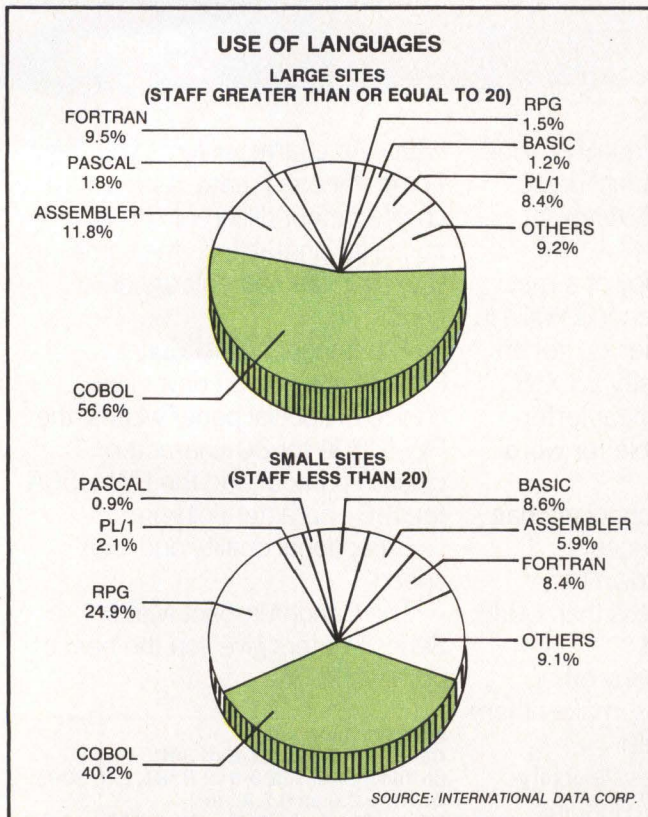
The Common Business-Oriented Language (COBOL) is proving to be a powerful mainstay for a variety of business applications. Developed in the early '50s as a tool to handle batch business applications, it has emerged as a useful tool in interactive applications typically found on most microcomputers and business minicomputers.

Because COBOL does offer software writers a mature environment to create applications, a number of companies are actively supporting the language. Among these are Ryan-McFarland Corp., Rolling Hills Estates, Calif.; Micro Focus Ltd., Palo Alto, Calif.; and Microsoft, to name a few. Micro Focus, however, is the only company that has built a complete development philosophy around the language and created a host of products to support the development process.

Among the products Micro Focus offers are: Level II COBOL, which conforms to ISO standards, ANIMATOR, a program that analyzes and debugs COBOL source-level code, and Personal COBOL, which is essentially a fast version of the large-scale COBOL.

Although Level II COBOL is priced at a hefty \$1,995, it does support code written in mainframe environments, thus easing the translation process. Moreover, users of smaller systems such as the IBM PC can use Personal COBOL, priced at \$395, and develop code that can be easily ported to the more robust Level II.

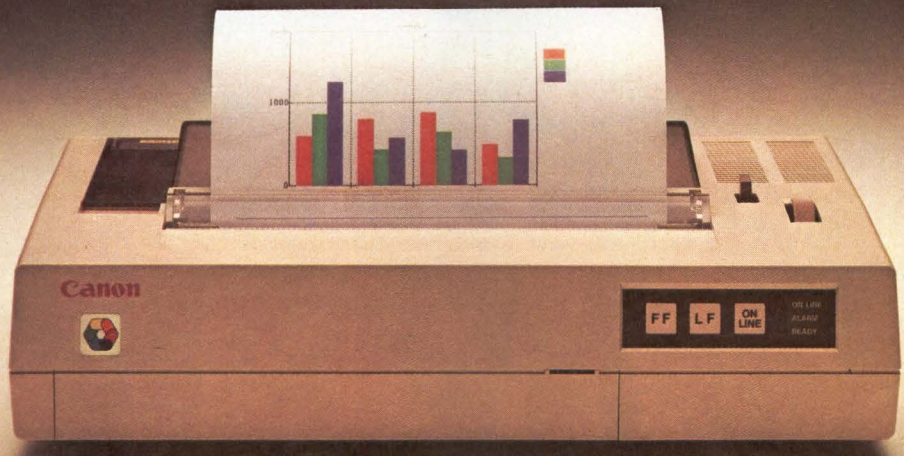
Even with most of the industry appearing to stress other languages, International Data Corp., Boston, sees COBOL as retaining the lion's share of the software market with an average of about 45 percent across large and small systems. This represents about \$100 billion in worldwide investment. Thus, the profitability of COBOL-oriented products is easily assessed.



Across large and small systems, COBOL still remains the most favored development language. (Source: International Data Corp.)



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To speed COBOL programming, Bytel Corp., Berkeley, Calif., has COGEN 6.0. This powerful front end to COBOL allows software writers to define COBOL code lines interactively by using screen definitions. Bytel's COGEN isn't limited to either micros or minis but is available for MS-DOS/PC-DOS systems as well as UNIX-based systems. An MS-DOS version is priced at \$950; the microcomputer UNIX version is \$1,250. Minicomputers supported include those from Texas Instruments Inc., NCR Corp., Prime Computer Inc. and DEC and range in price from \$2,900 to \$7,500 plus an annual maintenance fee.

Another company offering a 74 COBOL-compatible compiler is S&H Computer Systems Inc., Nashville, Tenn. The company's COBOL Plus, which ranges in price from \$2,000 to \$3,500, depending on licensing arrangements, is optimized to run under DEC's RT-11 and RT-11XM single-user operating systems, and S&H's TXX-Plus multitasking/multiuser operating system. Moreover, the package includes facilities to allow applications written under other versions of COBOL to be transported with minor modification.

#### Other tools emerge

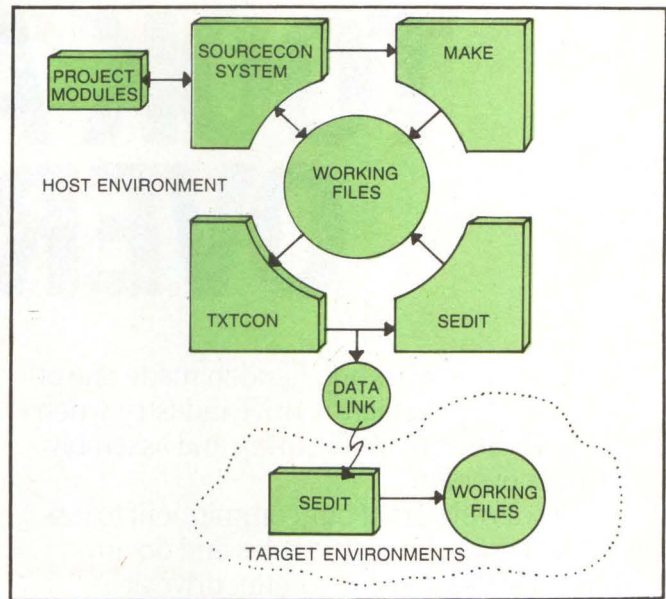
Not all development strategies involve just the software. Digital Datacom Inc., Laguna Niguel, Calif., for example, has developed a complete workstation concept for increasing programmer productivity. Called the WorkForce Development System, it comes with a custom COBOL code generator that matches ANSI requirements for the 74 COBOL standard. This generator, claims the company, permits the creation of structured, consistent code.

Working in concert with Nastec Corp., South Field, Mich., Spectrum International Inc., Culver City, Calif., has developed the LifeCycle Manager, which integrates standard development methods and design tools for software development on Nastec's CASE 2000 workstation.

The total system, including software and workstation, is priced at \$29,000. But the developers claim that it speeds software development and cuts costs by providing a fully automated tracking—auditing—system for the entire process.

Because software development can be cumbersome and the management difficult, Oregon Software Inc., Portland, Ore., has developed SourceTools. This series of programs, which runs on the DEC PDP-11 under RSX or RSTS operating systems, manages the development and maintenance of software projects.

The SourceTools system operates with any language and consists of three groups of programs that work together to create a development environment. The first group, Source Control (SOURCECON), is made



**A detailed view of Oregon Software's SourceTools components** in both the host and target operating environments shows a set of project-control modules from which the working files are called. Notice that each working file can share the control modules, so many applications can be looked at concurrently. MAKE accesses the modules only through the SOURCECON by executing description-file commands to retrieve the working files, which are text source files. The arrows depict the flow of operations.

up of four programs that control the creation and modification of source files. The second group is a single program called MAKE, which handles the rebuilding of programs from control modules. The third module is made up of two programs: TXTCOM, a file-comparison utility, and SEDIT, a stream editor that reads the TXTCOM script and applies changes to a parallel source file. This latter group serves as the management audit trail for keeping track of changes.

Basically, SourceTools ensure that proper testing and documentation are updated. Moreover, various versions of the code are kept and compiled as changes are made, thus eliminating time-consuming recompilation of the complete system.

Even with sophisticated tools becoming available for microcomputers, most of the powerful tools still reside on minicomputers and mainframes. Industry experts, such as DRI's Langhorst and independent consultant Byers, believe that it will still be another two years before many of the functions find their way to microprocessors. "The semiconductor industry is providing more power in microprocessor technology," says Langhorst. "Even with 32-bit devices emerging, it will still take us 18 to 24 months to create the software tools to maximize the use." □

Interest Quotient (Circle One)  
High 819 Medium 820 Low 821



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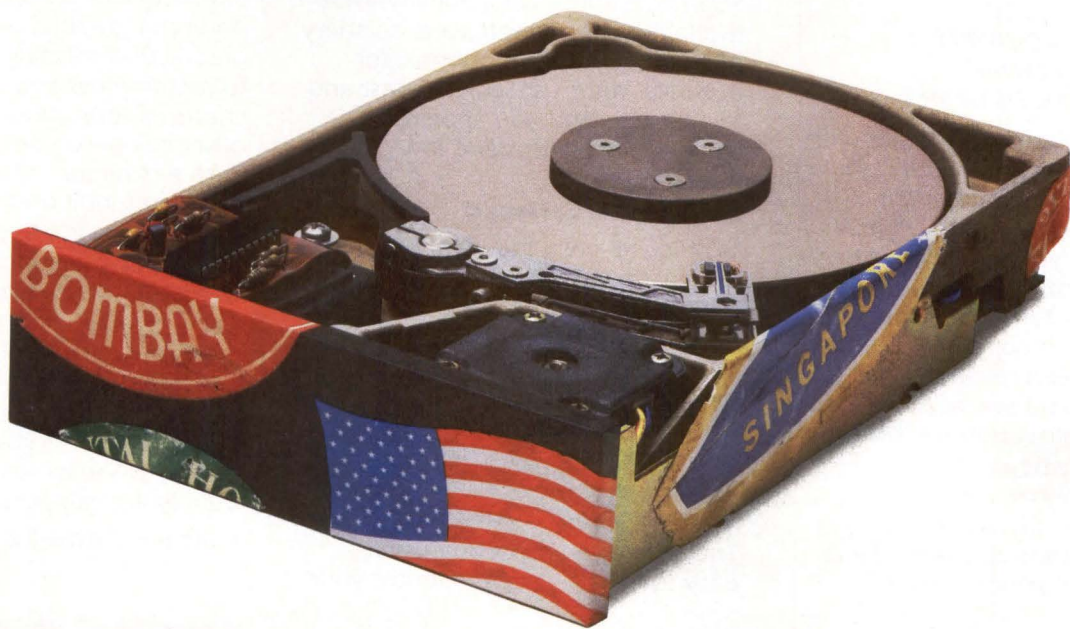
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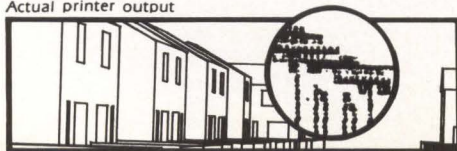
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# Low-cost multiuser system exploits PC-compatible workstations

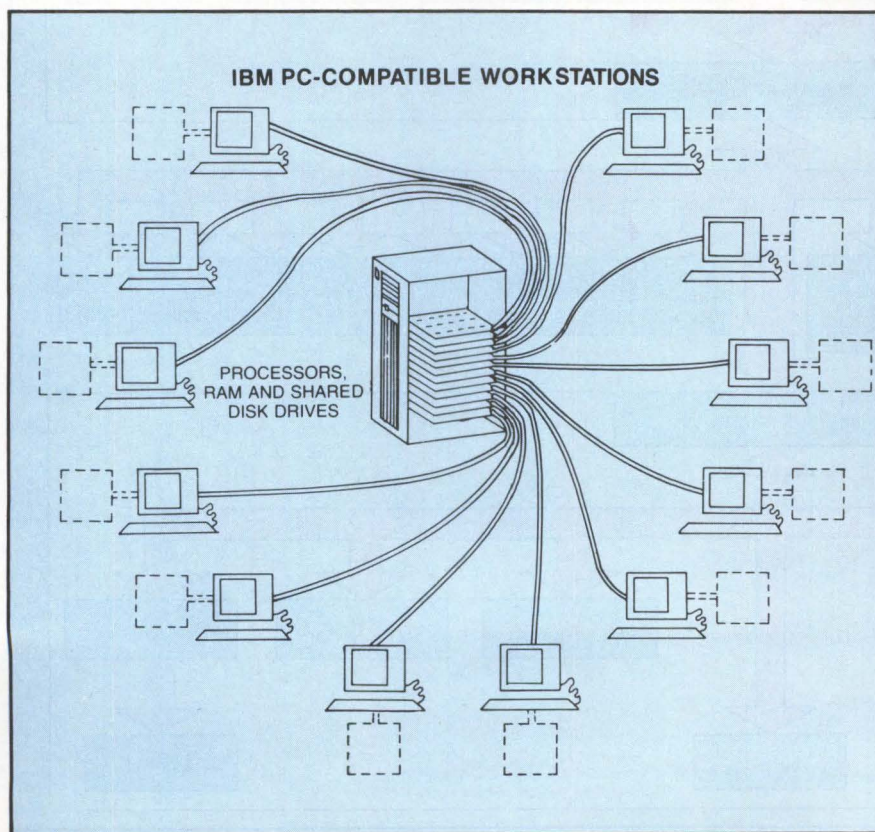
*By incorporating several processors and emulating the IBM PC I/O system, a microcomputer allows as many as 12 users to run concurrent applications*

**Mark Greenberg and Stephen Kanzler**  
North Star Computers Inc.

Hardware manufacturers and system integrators increasingly are incorporating single-user microcomputers into networks that allow multiple users to pool programs, data and peripheral devices. One such multiuser system is Dimension from North Star

Computers Inc., which includes as many as 12 IBM PC XT-compatible workstations at a price of approximately \$2,500 per station. The system achieves this per-station price by having multiple processors communicate through shared memory using an architecture that is a compromise between a loosely coupled and a closely coupled network.

Most multiuser microcomputers employ a single



**Fig. 1. A star network links as many as 12 Dimension workstations, each a maximum of 325 feet from the server. Each workstation is functionally equivalent to an IBM PC XT.**

## Spec summary

- **Name:** Dimension multiuser microcomputer
- **Manufacturer:** North Star Computers Inc., 14440 Catalina St., San Leandro, Calif. 94577, (415) 357-8500
- **Architecture:** multiuser, multiprocessing, star-type network with an 80186 server processor and as many as 12 8088-2 workstation processors
- **Memory:** 128K to 512K bytes per workstation, 256K to 512K bytes with the server
- **Disk storage:** 15M to 60M bytes per system
- **Video display:** 12-inch monochrome screen, 640-by-200-pixel or 640-by-400-pixel resolution
- **Software:** runs MS-DOS and IBM PC-compatible applications
- **Price:** \$7,000 to \$23,000 per system



processor and a timesharing operating system. This structure provides an economical way to achieve multiuser capability, but it can result in sluggish system performance because of heavy demands on the CPU. Dimension solves this problem by giving each user a dedicated workstation that is functionally equivalent to an IBM PC XT (Fig. 1).

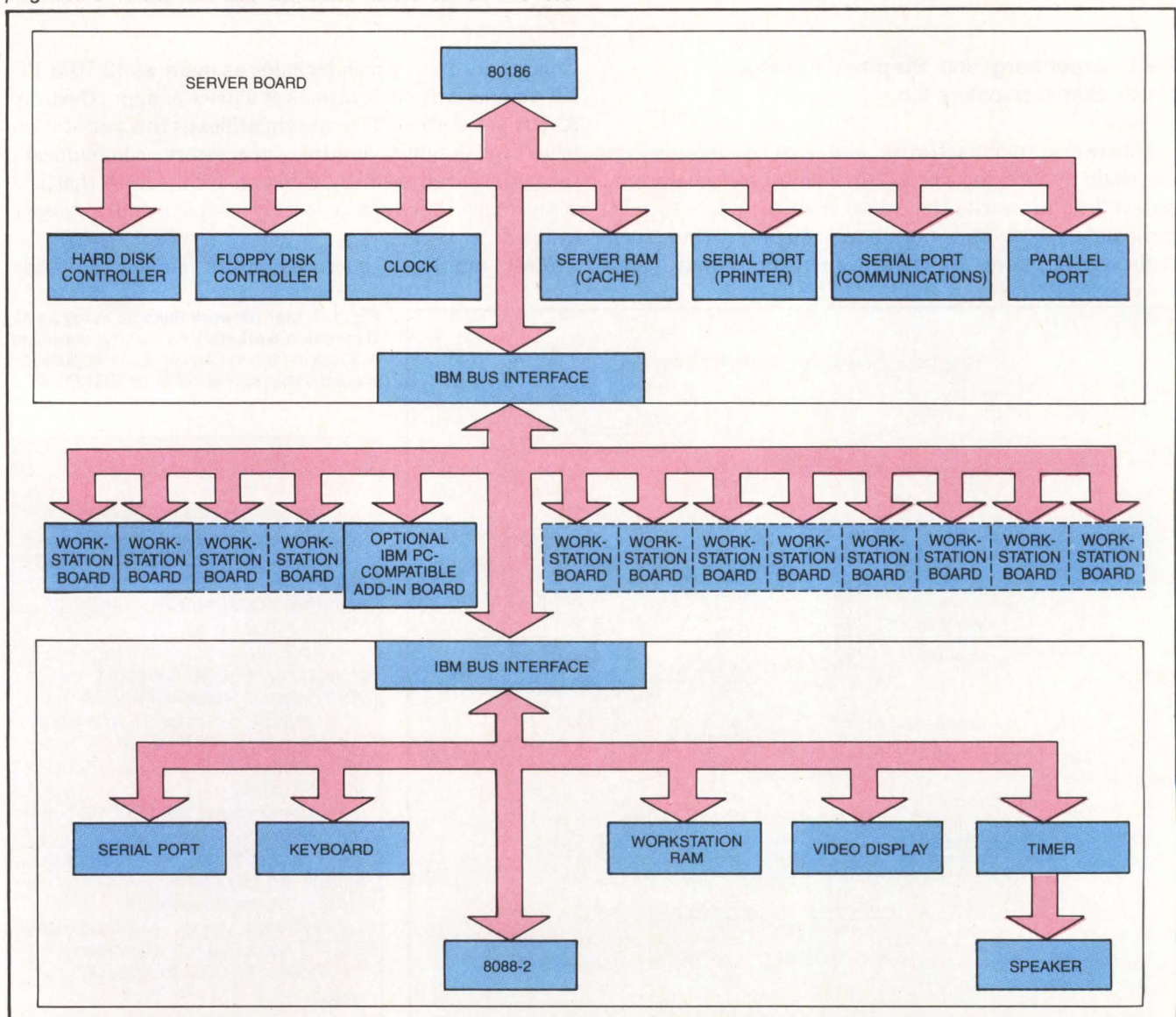
Each workstation incorporates an 8088 processor that runs an independent copy of Microsoft Corp.'s MS-DOS 2.0 operating system with a basic I/O system (BIOS) that emulates the IBM PC XT ROM BIOS. This emulation, combined with IBM PC-compatible keyboards and video displays, enables Dimension to run most off-the-shelf PC-compatible applications. The workstations contain their own RAM and connections

for user-specific printers, plotters and mice. Each workstation also maintains its own logical file system. However, Dimension stores user files on a shared hard disk, rather than on multiple private disks—a difference that is transparent to programs and users.

An Intel Corp. 80186 processor on a central server board coordinates access to shared system resources (Fig. 2). A real-time multitasking kernel schedules the 80186's workload. The server board includes as much as 512K bytes of main memory, controller interfaces for hard disks and a PC-compatible floppy disk drive, one parallel and two serial ports and a clock/calendar. The server also controls a PC-compatible system bus, which contains 13 slots for the workstation boards. The bus and backplane are mechanically compatible with the

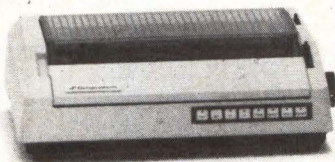
**Fig. 2. The 80186 processor on the server board coordinates data flow throughout the system. The 8088-2-based workstation boards plug into a 13-slot IBM bus connected to the server. The bus**

*backplane accommodates IBM-compatible add-in boards such as controllers for communications and tape backup.*

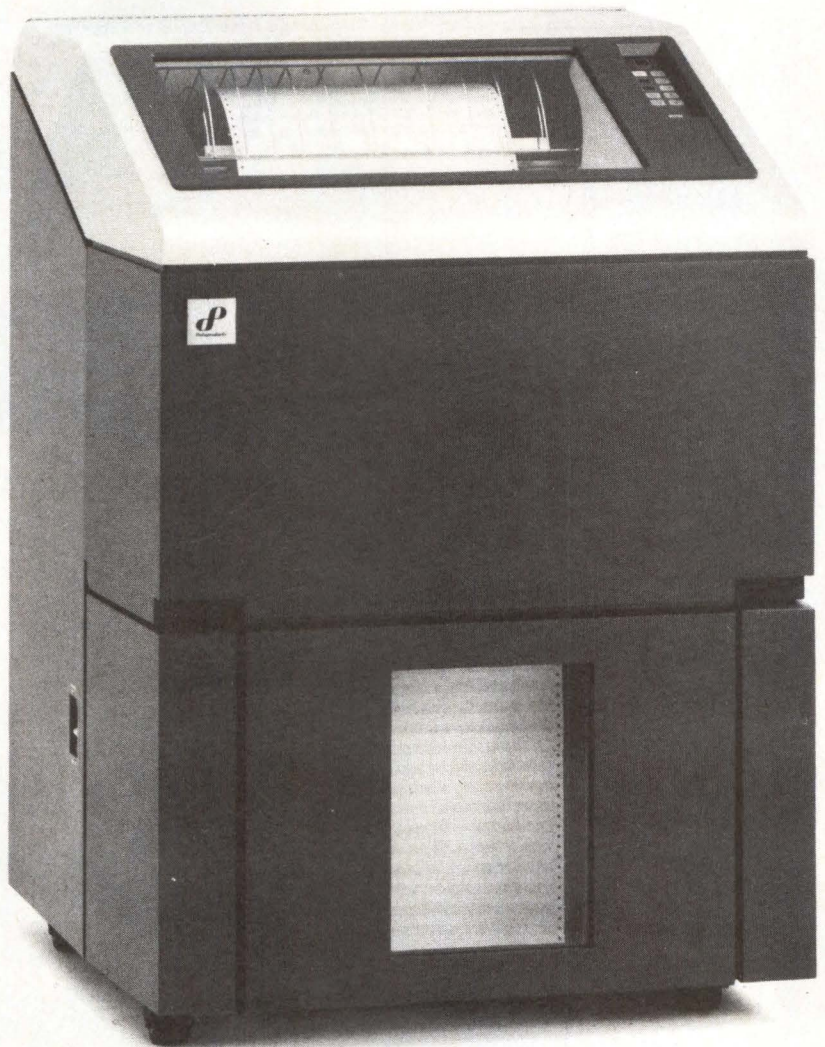




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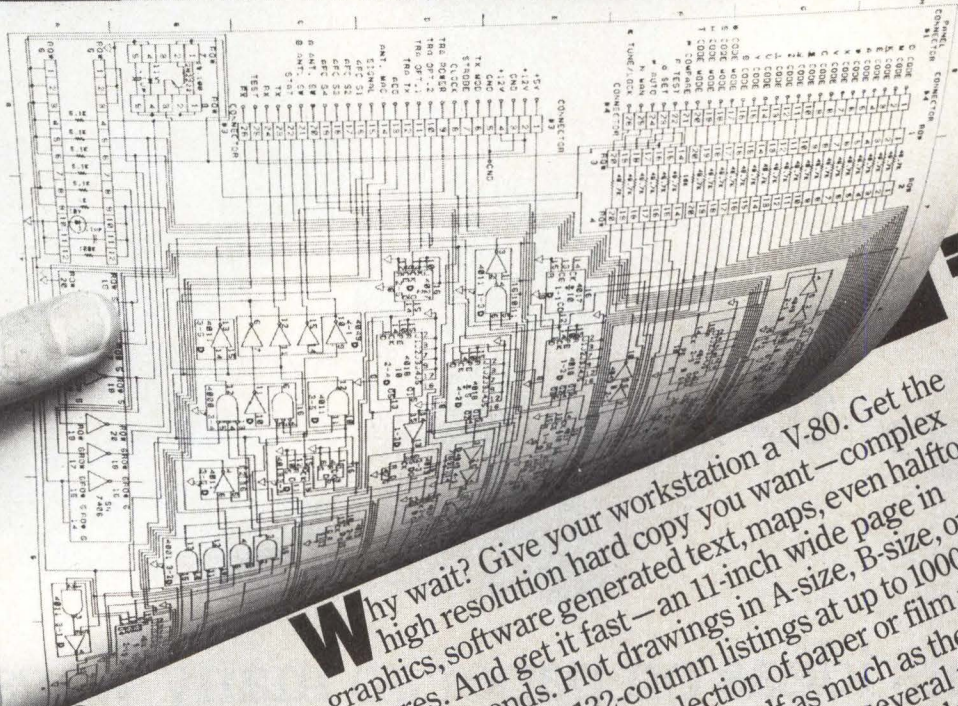
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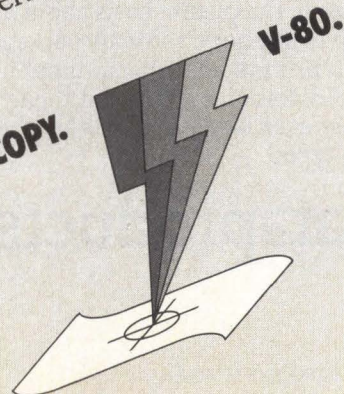


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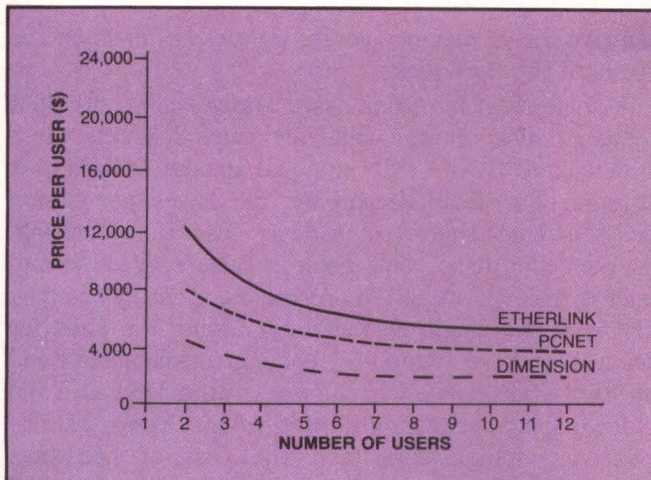


Fig. 3. Dimension's price per user is less than that of IBM PC networks such as Santa Clara Systems Inc.'s PCNet and 3Com Corp.'s EtherLink. The low price stems from shared peripherals and the use of one cabinet for all processors, disk drives and power supplies.

IBM PC, so users can allot spare slots in the bus to a tape-backup controller or to IBM-compatible add-in boards such as an Ethernet or a 3270 communications controller.

Integrating multiple processors yields efficiencies. Workstation processors run programs and manage files, while the central server processor handles system I/O. Throughput of the workstation processors increases because the server relieves them of such time-consuming tasks as writing data to the hard disk.

Communications between workstation processors and the server processor occur via I/O ports and shared-memory data transfers. This approach incorporates features of both loosely coupled and closely coupled networks.

A loosely coupled network such as Ethernet links multiple processors by cable connected to the processors' I/O ports. The disadvantage of this architecture is that serial data transmission by cable is inherently slow. Because multiple processors contend for the communications medium, collisions and retries cause delays. The risk of errors in transmission requires elaborate protocols for detecting errors, so that software overhead reduces effective bandwidth by as much as 90 percent. With the exception of a few very expensive systems, therefore, loosely coupled networks have low throughput.

In a closely coupled system, multiple processors communicate through shared memory. Reading and writing to memory are operations a processor performs rapidly. Moreover, memory-to-memory transfers entail a low risk of error. The results are that software overhead is minimal and throughput is high. The major disadvantage of a closely coupled system is the

processor address space it requires. A closely coupled network that provides each of 12 workstations with 1M byte of address space would require a server processor with much more address space than the 1M byte of the 80186.

The solution to the address-space constraint is to allow the workstation processors to operate independently except when they need to access system resources. A

---

*Throughput of the workstation processors increases because the server relieves them of such time-consuming tasks as writing to the hard disk.*

---

workstation initiates a request for system resources by interrupting the server and setting a service-request bit in an I/O port. When the server processor is ready to respond to the request, it uses the I/O port to establish a closely coupled relationship with the workstation processor. The processors transmit data through an area of memory that both can access. When data transfer finishes, the server restores the workstation processor to independent status.

Dimension uses shared memory in two ways. First, the server processor learns the details of a service request by mapping the top quadrant of a workstation's memory into the server's address space. This quadrant contains the system overhead area of 32K bytes that each 8088 processor uses to define its requests for system resources. The 80186 writes to this area to return the status of these requests. Second, when the 80186 needs to read data from or supply data to a workstation processor, it maps in the appropriate quadrant of workstation memory, copies the data to or from the server's cache RAM and then maps the quadrant back out again.

Segregating shared-memory areas protects their contents. No workstation processor can access the server's memory, so the programs and data stored there are protected from interference. Workstation RAM is accessible to the workstation processor and the 80186 server but not to any other workstation in the system.

Although workstation memory is accessible to two processors, it is not dual-ported. In a dual-ported arrangement, the memory arbitrates access by the processors. In Dimension, the server controls access to shared memory. Before the server can access an area of workstation memory, it must suspend the operation of the workstation processor and take control of the private workstation bus. It does not relinquish control until it has completed the transaction. In short, the



*Each Dimension workstation incorporates an 8088 processor that runs an independent copy of MS-DOS.*

server functions as master of not just the system bus but also the bus on each workstation board. This setup increases the server's efficiency because the 80186 does not need to compete with the 8088 processors for access to workstation memory, and it does not have to wait for arbitration on each cycle.

Dimension uses most of the server's 512K bytes of RAM as a cache memory for selected data from the hard disks, reducing the need for physical access to the disks. This configuration increases system responsiveness because the system can retrieve data from the cache in 1 percent of the time it takes to access the hard disks. The system reduces hard disk seek time by processing seek requests in the same kind of sequence an elevator uses to order its movements between floors, and it expedites the data transfer between the disk buffer and the server's cache RAM by dedicating one of

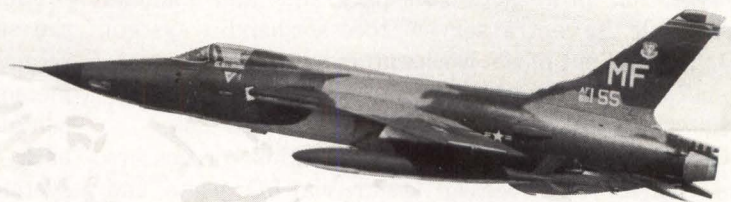
the two direct-memory-access (DMA) channels on the 80186 to the hard disks.

A network of five Dimension workstations with 30M bytes of disk storage sells for much less than five standalone PC XT's with an equal amount of hard disk storage. The main reason for the lower per-station price is that shared disks cost less than multiple user-specific disks. This network also realizes economies by incorporating the processors, memory and disk drives into a single cabinet, eliminating the need for separate power supplies, cooling mechanisms and enclosures (Fig. 3). Also, the workstation keyboard and video display are standard, high-volume items that are relatively inexpensive, and the cost of hardware overhead in the server processor is spread across the network. □

**Mark Greenberg** is vice president, research and development, and **Stephen Kanzler** is Dimension product marketing manager for North Star Computers Inc., San Leandro, Calif.

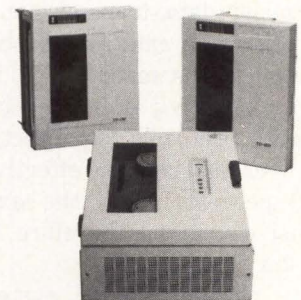
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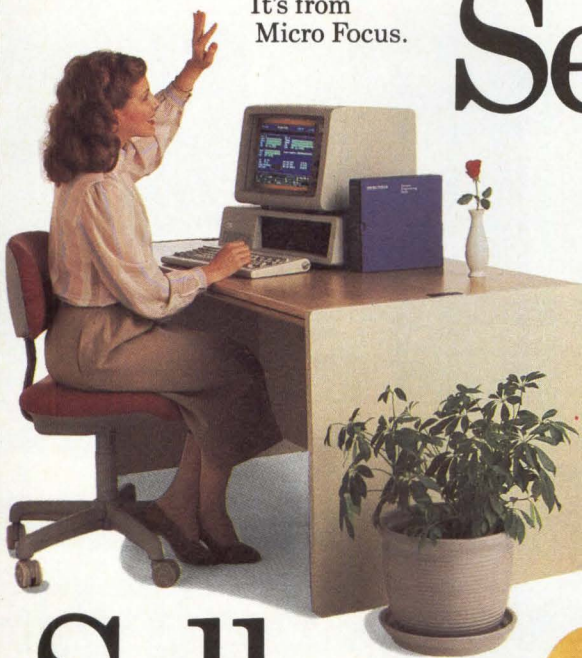
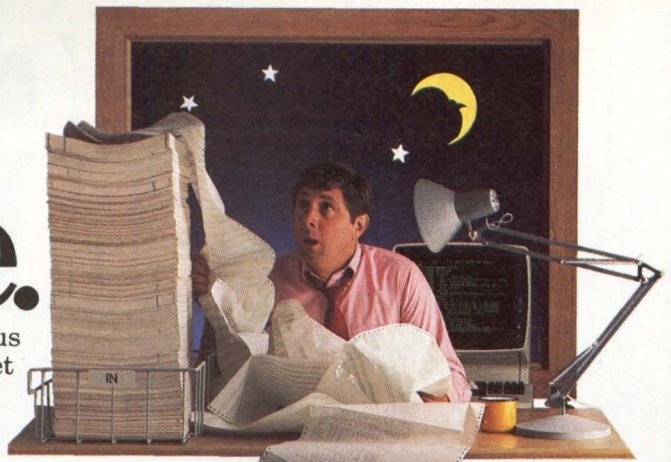


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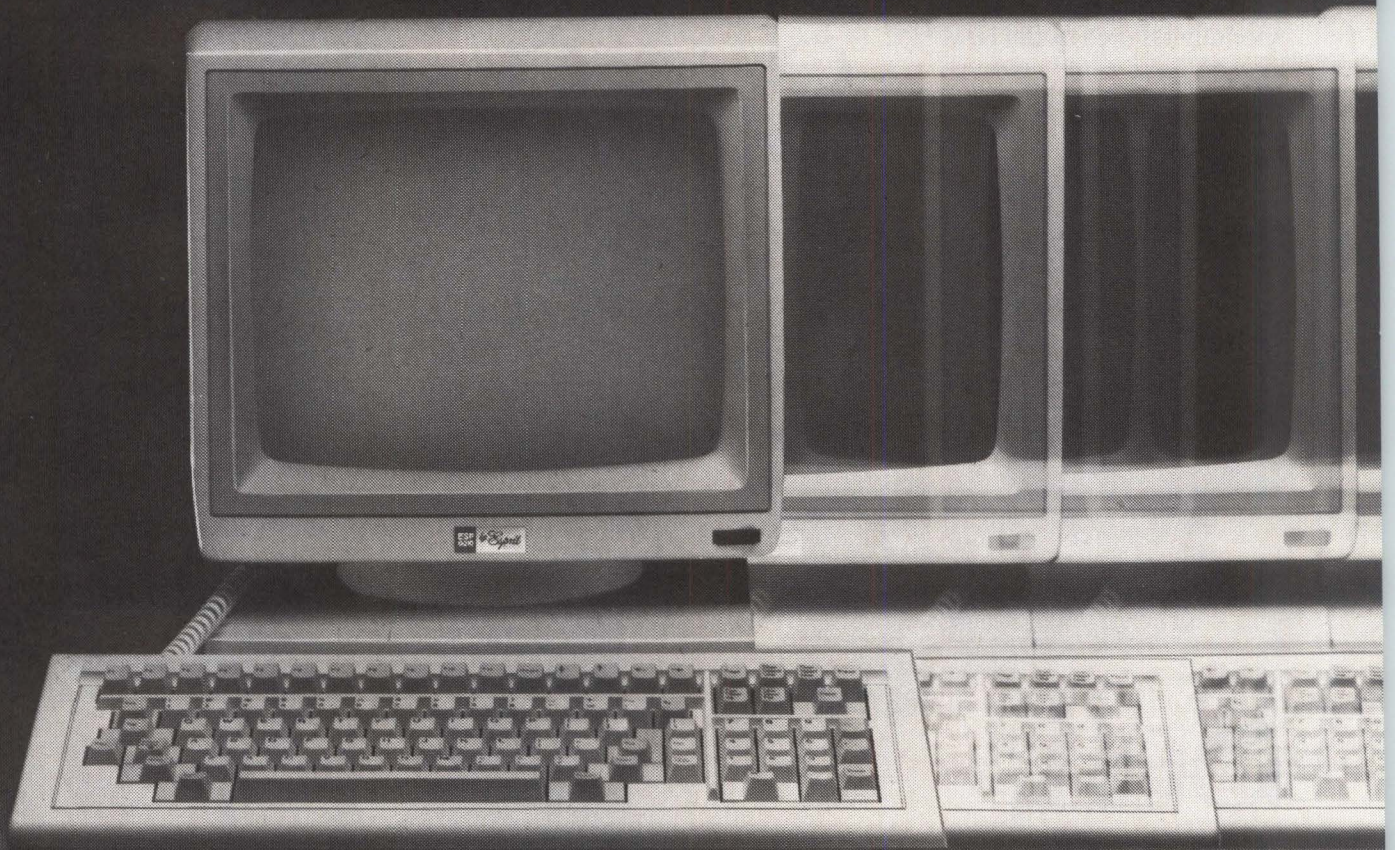
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# Value-added resellers pursue business markets with support and services

*Led by IBM and Apple, personal computer vendors are seeking to penetrate vertical markets with sales organizations that provide solutions to problems, not just products*

**Chris Bailey**, Western Editor

The burgeoning personal computer market has attracted wide attention, particularly in the area of retail computer store sales. But a significant and growing market for personal computers in applications normally serviced by system integrators and OEMs has emerged. This market is catching the eye of almost all of the major participants in the personal computer arena and provides an attractive channel for the smaller start-ups as well.

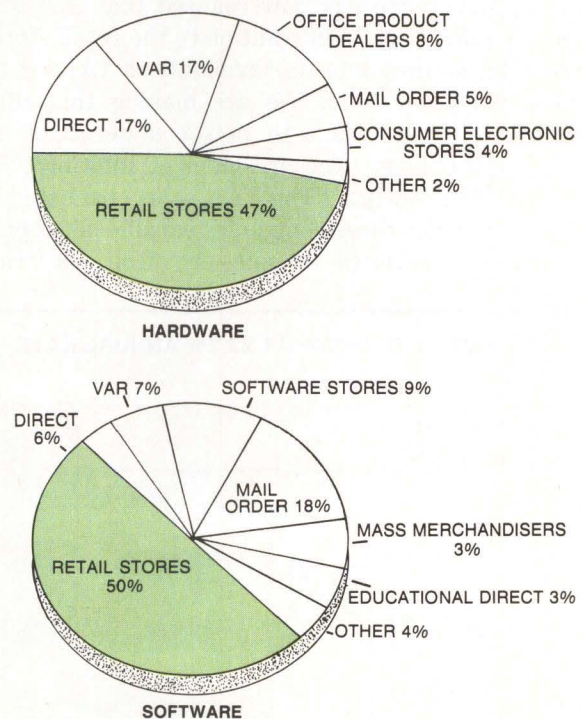
## A healthy market forecast for personal computers

According to Erna Arnesen, senior analyst for personal computer market research concern Future Computing Inc., Richardson, Texas, personal computer sales will reach \$12.2 billion this year in the United States. Of this figure, value-added resellers (VARs) will contribute over 17 percent of the hardware sales and 7 percent of the software sales. Sales through these channels—including system integrators, OEMs and independent sales organizations—are expected to grow to \$5 billion by 1989.

While these figures are impressive, in the opinion of some analysts they do not take into account much of the added-value application software sales that will accompany the sales of hardware and standard software packages by VARs. These analysts believe that the typical VAR will add more than 10 percent to product value through software.

Steven P. Korn, product manager of PC Network

**RETAIL STORES DOMINATE PERSONAL COMPUTER MARKET**  
(HOW PRODUCTS ARE SOLD—1984)



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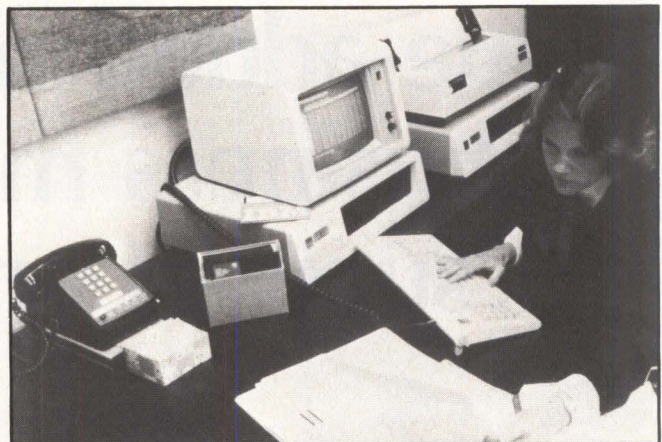


Operations at General Electric Information Services Co., Rockville, Md., says it is imperative for VARs to develop unique software products that make their systems more attractive than those sold through retail channels. GE Information Services historically has capitalized on selling mainframe-based application software and services through timesharing networks.

In 1982, GE began marketing IBM Corp. PCs to its customers along with a wide range of application programs utilizing the data-sharing and access capabilities of its network. A typical PC installation with 20M bytes of hard-disk storage, a modem, surge protectors and several application packages might sell for approximately \$15,000. "These special applications programs make our systems more valuable and justify a greater cost than a simple PC system with standard software. Because our systems solve difficult end-user problems that aren't addressed with standard software, our customers aren't lured by the widespread discounting by retailers," says Korn.

**VARs compete with systems**

Unlike the retailers who compete primarily on price and delivery, VARs depend on their ability to provide a hardware and software system solution. All major personal computer vendors now solicit and support VARs. Research companies such as Future Computing have begun tracking this sales channel. Notes analyst Arnesen, "Everyone has now realized that this is an important sales channel in addition to the retail stores. But to date, no firm data was available on VARs in the personal computer field. We are making this effort because our clients want to better understand this area." Ralph Gilman, vice president of InfoCorp, Cupertino, Calif., concurs: "The VAR sales channel holds great potential for those companies capable of supporting and attracting the better sales organizations. Tradi-



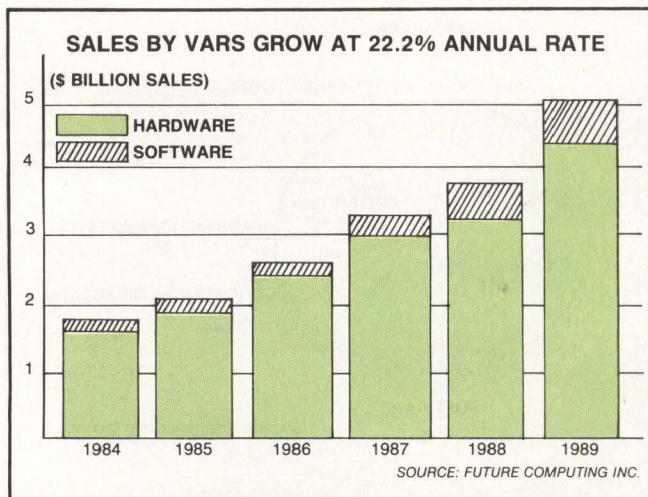
GE Information Services is selling IBM PCs as value-added workstations. End users access a variety of corporate databases with applications ranging from just-in-time inventory scheduling to claim processing and financial services.

tional minicomputer VARs are well-tracked, but many of the personal computer turnkey system suppliers are new to the computer business and thus not as well-understood."

Even before IBM officially announced their value-added dealer (VAD) program, it was negotiating with resellers eager to formalize a relationship based on PC and XT products. In 1983, IBM formed a new division, the National Distribution Division (NDD), to focus sales efforts in new directions.

In addition to responsibility for the IBM product centers, this new division has responsibility for the VAR channel that primarily supports IBM small-system products other than the PC and the VAD channel for PC and related products. Notes NDD representative Nadine Fletcher, "The purpose of this division was to bring single-management focus. . . for IBM's small computers." The new division focuses non-retail sales (except for IBM product centers) through a single organization based in White Plains, N.Y.

A pool of IBM machines is available for VARs or VADs participating in business shows. A direct-marketing kit with mailers, prospect forms and suggested telemarketing strategies is available. A national remarketer database is on-line for IBM field representatives with information on services offered by VARs and VADs nationwide. Seminars and special classes for resellers—focusing on handling the business problems—are part of a professional-enhancement program. There are also several classes of technical support, some free and some offered on a fee basis. These include call-in help as well as on-site training, service and consulting. Additionally, there are regional customer system centers for handling product questions. Finally, special VAD advisory councils have been formed to improve communications with IBM.





# Peripherals Digest

## Mini-Micro Systems

Semi-Annual\* Guide to  
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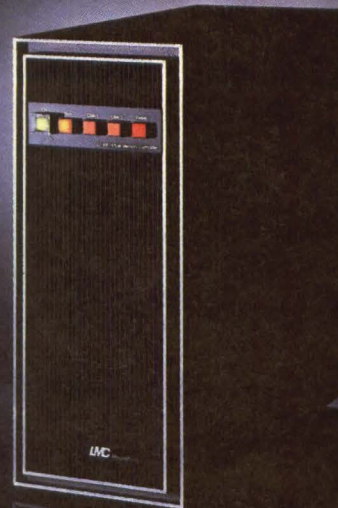
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CIRCLE NO. 136 ON INQUIRY CARD



## LMC's 32-Bit Virtual Memory MegaMicro Is The-State-Of-The-Art UNIX Microcomputer

LMC's 32-bit MegaMicro provides mainframe or super-minicomputer performance at prices competitive with today's far less powerful 8- and 16-bit microcomputers. This is made possible by use of the next generation of logic chips—the National Semiconductor 16000-series. LMC MegaMicros incorporate: the NS16032 central processing unit which has true 32-bit internal logic and internal data path configured on the IEEE 796 multibus; demand-paged virtual memory implemented in hardware; and hardware 64-bit double-precision floating-point arithmetic.

The LMC MegaMicro is supplied with HCR's UNITY\* which is a full implementation of UNIX\*\* and includes the Berkeley 4.1 enhancements to take advantage of demand-paged virtual memory. Also included are C and FORTRAN. Typical multi-user systems with 33 megs. of fast (30 ms. average access time) winchester disk storage, a half meg. of RAM, virtual memory, hardware floating-point arithmetic, UNIX, C, and FORTRAN 77 are available for \$20,000 (and even less with quantity or OEM discounts).

\* UNITY is a Trademark of Human Computing Resources.

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The IBM PC and XT configurations lead the "most-wanted list" for VARs. The PC is the most widely emulated computer system in history.

**Product and program options abound**

IBM, Apple Computer Inc. and Tandy Corp. pioneered development of personal computer system integrator sales channels. According to Apple's manager of VAR market research, Bill Broderick: "In the early days of personal computers, it was Apple and Tandy battling it out. Originally, Apple had better success with hardware OEMs because of its tremendous flexibility in supporting hundreds of add-in hardware products. Tandy, meanwhile, often did well with software geared for professional and business markets."

Apple's success with the Apple II product line significantly influenced the traditional minicomputer vendors in their system house/VAR marketing efforts. It also spurred them to provide competing personal computer products. In the past two years, minicomputer vendors Digital Equipment Corp., Data General Corp., Wang Laboratories Inc., Texas Instruments Inc. and Hewlett-Packard Co. have introduced personal computer products and programs geared toward VARs.

One of Apple's strengths has been its willingness to work with potential software vendors before officially announcing a new product. Apple won high praise for

its support of software vendors before February's introduction of the Macintosh. More than 100 software vendors received technical documentation, and 50 or so systems were in place at developers as early as nine months before the official introduction. These efforts paid off. Apple expects Macintosh software to have a large and growing market in its first year.

Particularly attractive to software application developers is the ease of interfacing with the Macintosh's internal ROM-based software drivers for screen and menu manipulations. Handcrafted for speed in use with Apple's Desk Manager software, the ROM code contains "hooks" for external software to access routines driving the screen and other input/output devices. This relieves software developers of the burden of analyzing the internal workings of the Macintosh hardware and creating their own driver routines.

Like IBM, Apple qualifies potential VARs before they are approved to resell Apple products. According to VAR program manager Matt Slavik, a strong business plan is a must. "Of course, they must add value in the form of a software application or hardware addition to the system, but foremost in our minds is whether the potential VAR can actually achieve its sales goal. This is usually revealed in a good business plan."

**HP makes its move**

Long a respected OEM and VAR supplier in the minicomputer arena, Hewlett-Packard struggled with its initial personal computer offerings, especially at the retail level. But its systems were highly regarded by traditional scientific and technical OEMs. This year, the company made a four-pronged attack on the mainstream personal computer market with the introduction of the HP150 desktop computer, the Portable, and the Thinkjet and Laserjet printers.

With these products, strategists believe, the company is poised not only to penetrate the general retail personal computer market but also to provide attract-

Apple's Lisa and Macintosh computers sport high-resolution graphics, interactive mouse interfaces and menu-driven operation.



HP's Portable weighs 9 pounds, features a 16-line-by-80-character display, built-in application software like word-processing and spreadsheet programs, and terminal-emulation capabilities.



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CIRCLE NO. 96 ON INQUIRY CARD



### VARs, VADs, ISOs—what are they?

Few agree on how to define VARs, VADs and ISOs. IBM Corp.'s National Distribution Division (NDD) defines a "VAR" as a value-added *remarketer*. It's an organization that buys a computer from IBM and resells it to the end user after adding software products that turn the computer into a turnkey system.

The rest of the industry uses the term "VARs" to mean value-added *resellers*. These are system houses or

system integrators. This term originally applied to minicomputer turnkey suppliers who received the "iron" or plain-vanilla computers from the minicomputer vendors, added application software or operating systems and sold the bundled system to the end user complete with support/service.

Organizations that resell IBM PCs are called "VADs," or value-added dealers. These groups are entitled to buy and resell products in the IBM PC

family if they pass stiff qualification standards. In this group are resellers who add software and hardware to create turnkey systems.

The term "ISO," or independent sales organization, can mean large dealers who buy systems wholesale and resell them to smaller dealers, distributors or system houses, making a profit on the markup. But often they add value in training, support, software and other services, too.

ive alternatives for VARs and OEMs. HP commercial OEM market manager Vince Mancuso explains, "The OEM and VAR portion of sales is a large part of the overall personal computer business. In the past, we have done well with the scientific and technical OEMs, but with our new products we have a much more appealing general-purpose product line."

One of HP's strengths is its long-term relationships with traditional minicomputer system houses. These companies are especially interested in applications that tie personal computer workstations to existing minicomputer-based information networks. Analysts such as the Yankee Group have given HP high marks for its office-automation product strategies, and the personal computers are designed to fit in information networks.

The HP150 has built-in hardware and software to support standard HP block-mode terminal emulation. Versions without disks are available to provide a low-cost avenue for connecting computers to networks.

Tom Anderson, general manager of personal software operations at HP, says the company has improved many standard software packages and added proprietary software that helps broaden the appeal of its small computers. Proprietary software includes desk-manager functions and communications links to other systems, including the IBM PC. Improvements to existing third-party software include a user-friendly shell around the MS-DOS operating system and utilization of soft function keys for programs like MicroPro International Corp.'s WordStar.

Extra hardware features have been added to the HP small-systems lineup. In particular, the HP150 sports a touch-screen interface that eliminates the need for keyboard input of many commands. The Portable features a 16-line liquid-crystal display and a battery-driven electronic RAM disk that allows users to access a minifloppy-equivalent, mass-storage device without rotating storage drives.

Anderson explains that system integrators are very important to HP's personal computer program. He sees the most activity in two areas: use of a personal computer as a productivity tool—primarily in stand-alone applications—and use of a personal computer as a low-cost network workstation node. HP's large business computers serve as ideal back-end database managers in such a configuration. The built-in communications facilities of the HP personal computers help them serve as easy-to-use front-end systems.

This communications effort is part of HP's AdvanceNet communications strategy that integrates data-communications capability with data-management capability. Based around the International Standards Organization (ISO) Open Systems Interconnect (OSI) model for a layered approach to open system architecture, the AdvanceNet idea is to develop communications protocols that allow computers, terminals, personal computers and other workstations to communicate, even when manufactured by different vendors. Included in the AdvanceNet umbrella are communications products supporting access to IBM, DEC and IEEE 802.3 and IEEE 802.4 standards.

Like HP, TI is pursuing an MS-DOS product strategy that is not fully compatible with the mainstream IBM PC. But it hopes to attract VARs and OEMs by offering better product features than IBM does.

TI says its Professional computer offers better screen resolution, more colors, a more familiar IBM Selectric-oriented keyboard and a number of specialized peripherals that provide natural-language and speech-command capabilities, as well as mainframe and Ethernet communications. □

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Interest Quotient (Circle One)  
High 834 Medium 835 Low 836

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It gives you exactly what

you want. Fast draft speed printing at 180 characters per second. Fanfold paper capabilities in widths up to 15". A choice of 8 character widths. And extensive communications support, including auto answerback and auto disconnect.

Most importantly, the DECwriter III teleprinter is a true master of forms. Some 45 features, like horizontal pitch, left/right and top/bottom margins, as well as horizontal and vertical tabs, are all summarized right on the keyboard, allowing you to set up formats in an unusually quick and sim-

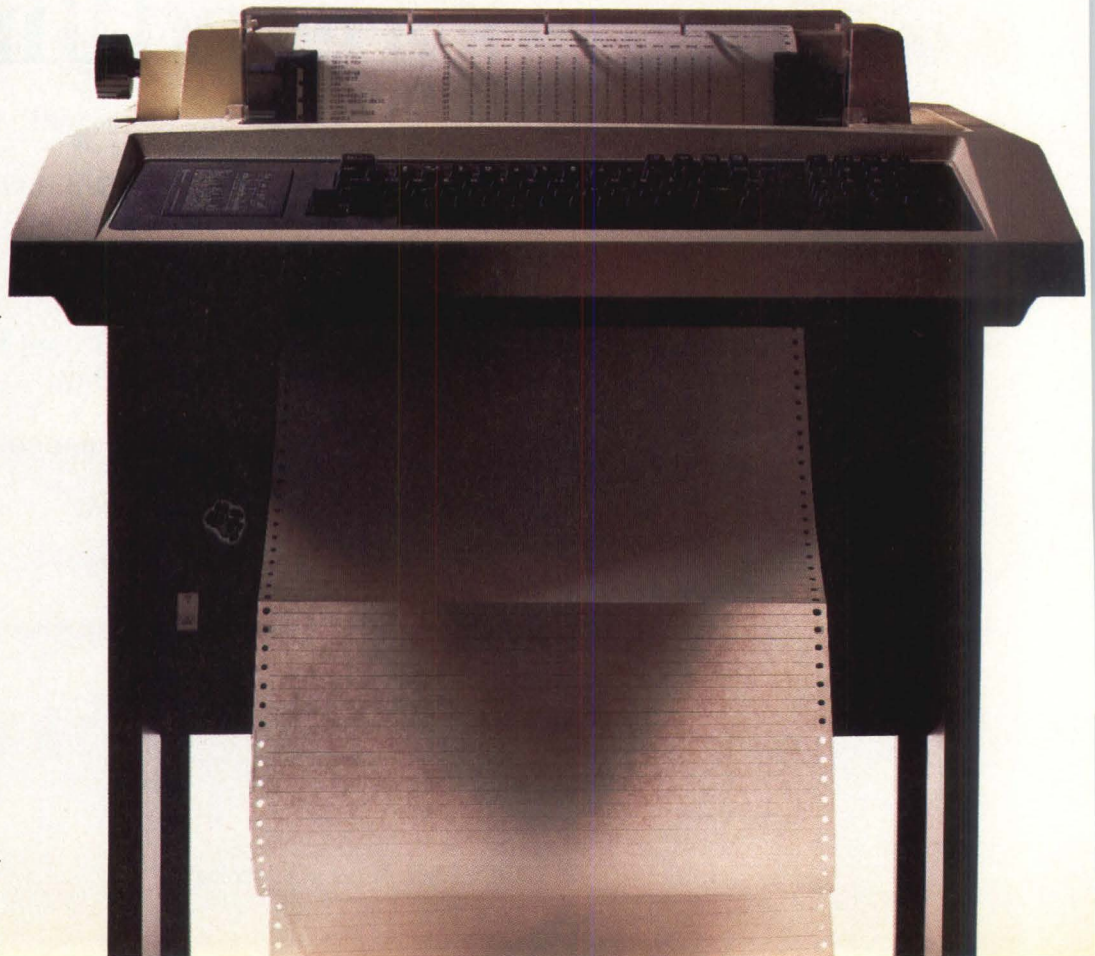
ple manner. Then, once set, all can be stored in non-volatile memory. And the DECwriter III teleprinter can provide crisp, legible forms up to an impressive 6 parts.

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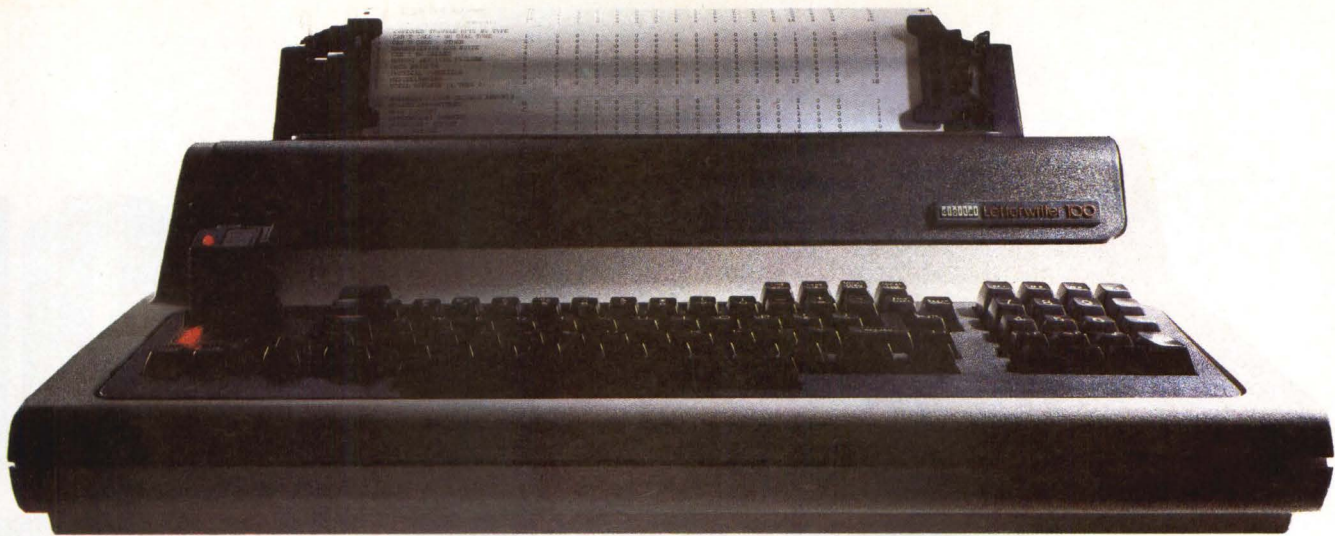
## **DIGITAL'S LETTERWRITER 100. THE BEST ENGINEERED TELEPRINTER FOR THE OFFICE.**

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Flexibility is the word that best describes the Letterwriter 100™ teleprinter. For starters, you have a choice of multiple print speeds. You can print a draft copy of a one page proposal in just 10 seconds. Then,







by simply pressing a single button, you can shift from a high speed 240 characters per second to a high quality 30 characters per second, with printing that's difficult to distinguish from true letter quality. There's even an optional 80 character per second memo mode that's ideal for interoffice correspondence.

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The Letterwriter 100 can handle the paper that best suits your needs. Sheet, fanfold or roll, in any width up to 15"

Finally, the Letterwriter 100 product tackles all your forms. Setup is simple, and the high quality dot matrix printhead provides crisp, legible copies through 4 part forms.

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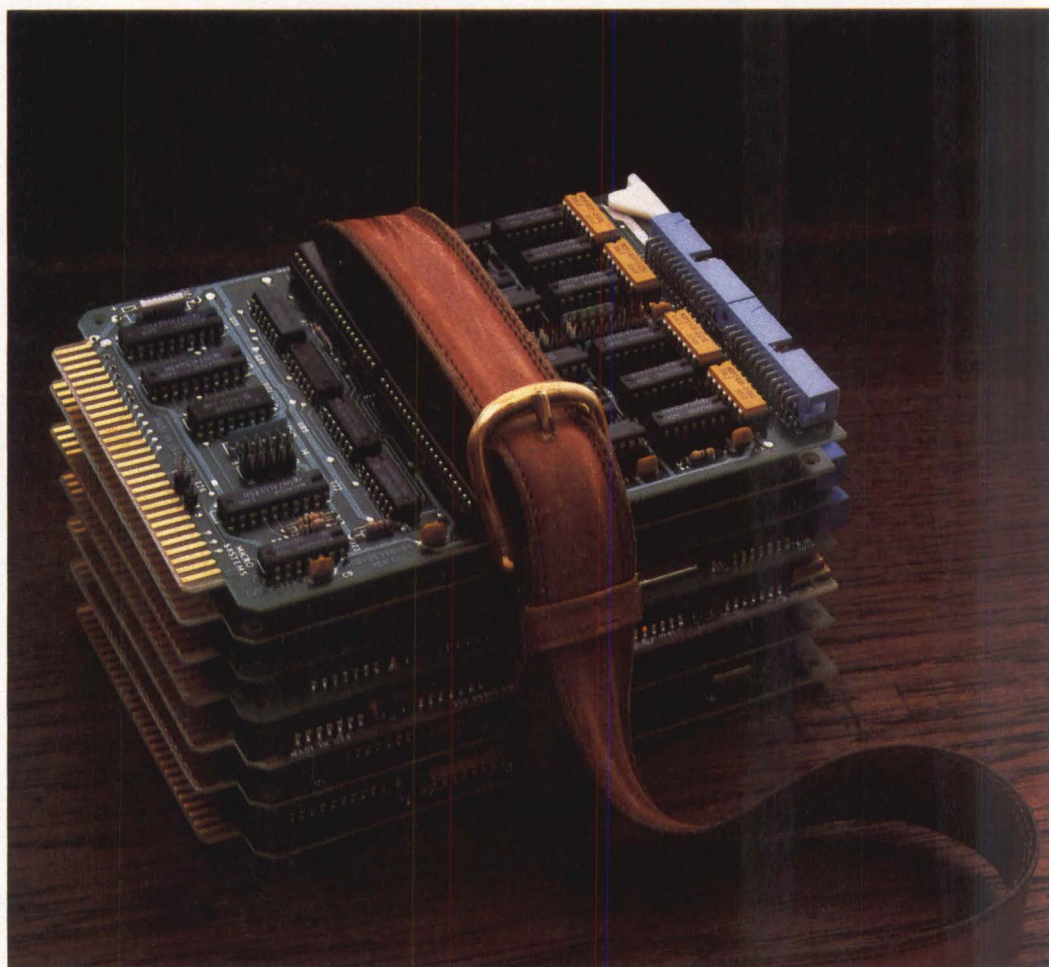
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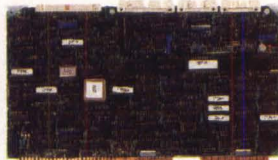
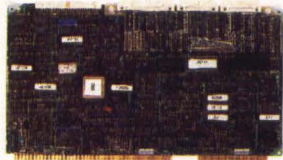
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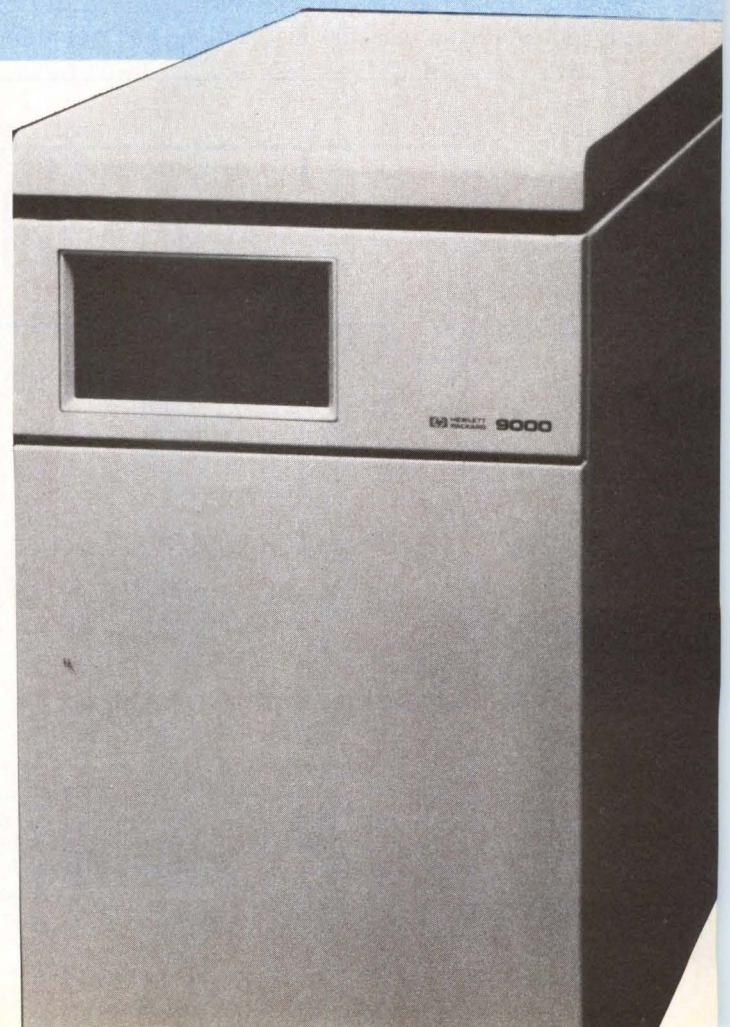
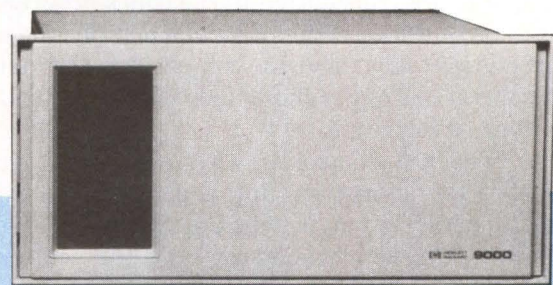
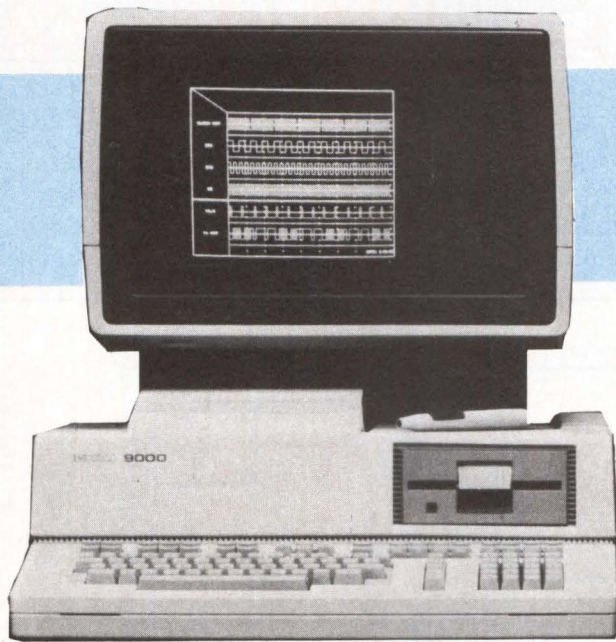
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# HP's model 9000: squeezing a mainframe into a shoe box

*HP's top-end desktop system, a 32-bit micro, has as much as 2.5M bytes of RAM and runs at 1 MIPS*



Chris J. Christopher, Hewlett-Packard Co.

Designing a 32-bit desktop computer with 1 million-instruction-per-second (MIPS) power requires technological advances and innovations spanning component chips, physical packaging and even a temperature-control system. A close look at Hewlett-Packard Co.'s HP 9000—its CPU, I/O and memory architectures and software environment—reveals why it's billed as a machine that can compete with superminicomputers at a fraction of their price.

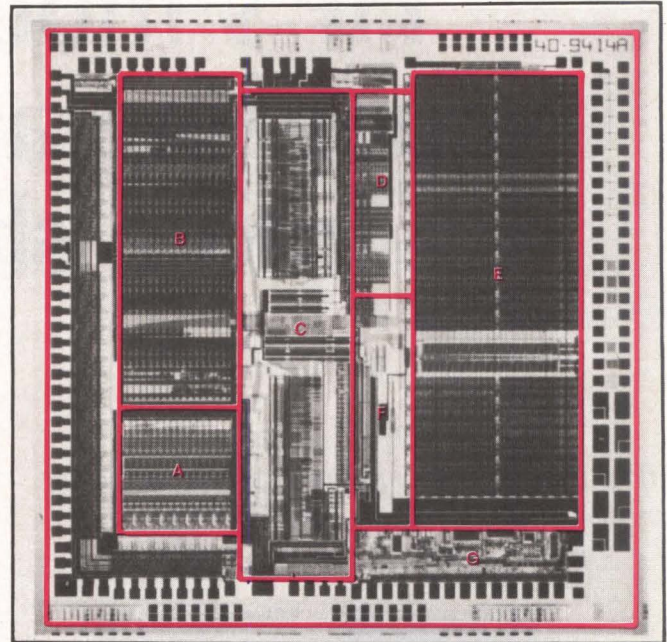
**The HP 9000** is available in three models: the desktop model 20 (above), the model 30 (above, right) and the cabinet model 40 (right).



**Heart of the system: the HP-32 CPU**

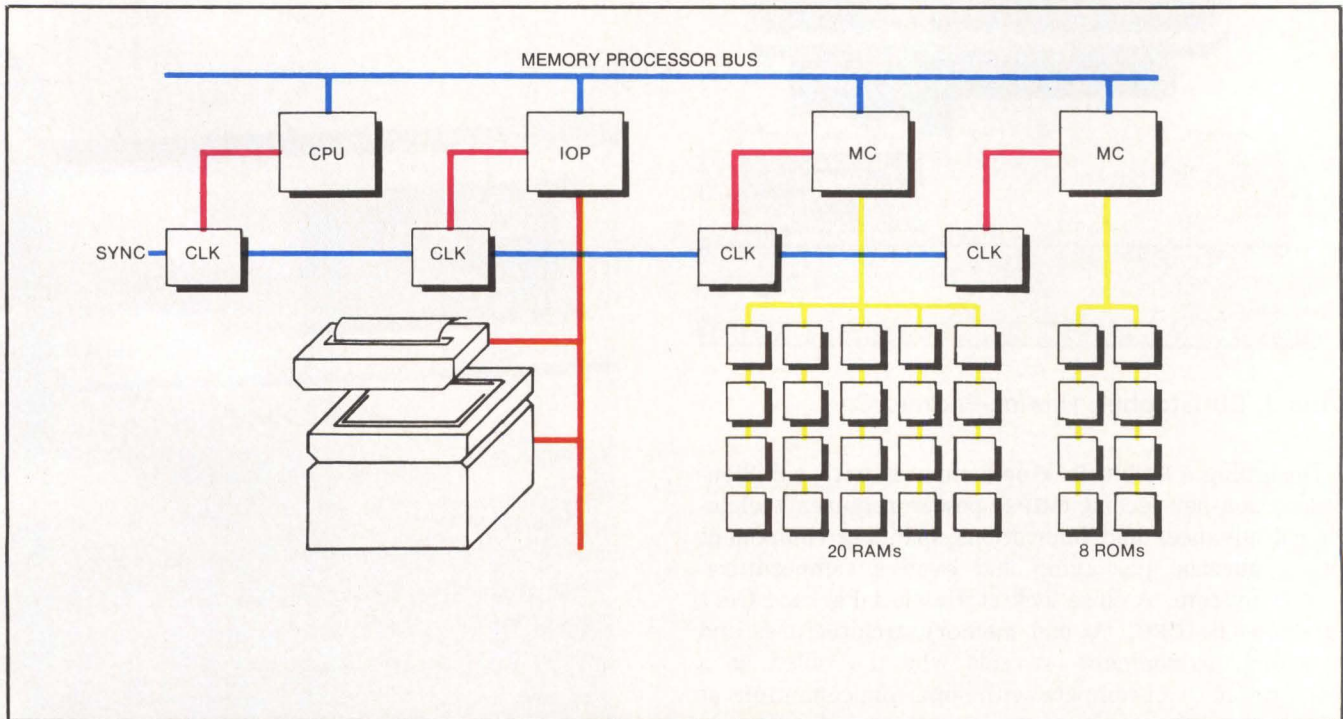
The 9000 system's microprocessor, which is not available to the commercial market, is fabricated in HP's NMOS-III technology with 1.5- $\mu$ m. lines and 1- $\mu$ m. silicon-gate circuitry on three and one-half layers of interconnect. The microprocessor chip measures 6.3 mm. on a side, has 83 pins and comes bonded directly onto a 4 $\frac{3}{4}$ -by-7-inch board. The processor comprises seven major sections (Fig. 1). Its microcode control store ROM has 9,216 38-bit words arranged in 38 sections, each a 32-by-16 array of 18-bit "series field effect transistor" (FET) strings. Program instructions address the microcode ROM and access microinstructions that are transmitted to the chip's programmable-logic-array (PLA) section. The PLA decodes the microinstructions, which drive the control lines that determine the operations of the chip's 32-bit register stack and its arithmetic logic unit (ALU).

A sequence controller with nine 14-bit registers handles the instruction flow sequence. The controller has a microprogram counter, a set of incrementers, a machine instruction operator code (OP code) decoder and three registers for microcode subroutine return addresses. The op code decoder generates the starting address in control store for the microcode routine that implements each machine instruction. For conditional



**Fig. 1. Floor plan of the CPU.** The overlay indicates the seven major sections of the chip: the arithmetic logic unit (A), the general registers (B), the program logic array (C), the sequencer (D), ROM (E), test circuitry (F) and the multiprocessor bus interface (G).

jumps and skips in the microcode, a test condition multiplexer uses a 6-bit microcode field to select one of



**The memory processor bus (MPB) is the backbone of the HP 9000 system architecture.** The bus has 32 parallel lines for data and 12 for control and can handle as much as 36M bytes per second. All subsystems interface with one another via the MPB. They are closely coupled and transfer data synchronously to the beat of the 18-MHz clock. As many as 20 RAMs and eight ROMs containing 128K bits each can be accessed via the memory controller (MC) chip. The CPU, I/O processor and RAM boards plug into connectors on the memory/processor module, a card cage for as many as 12 boards.



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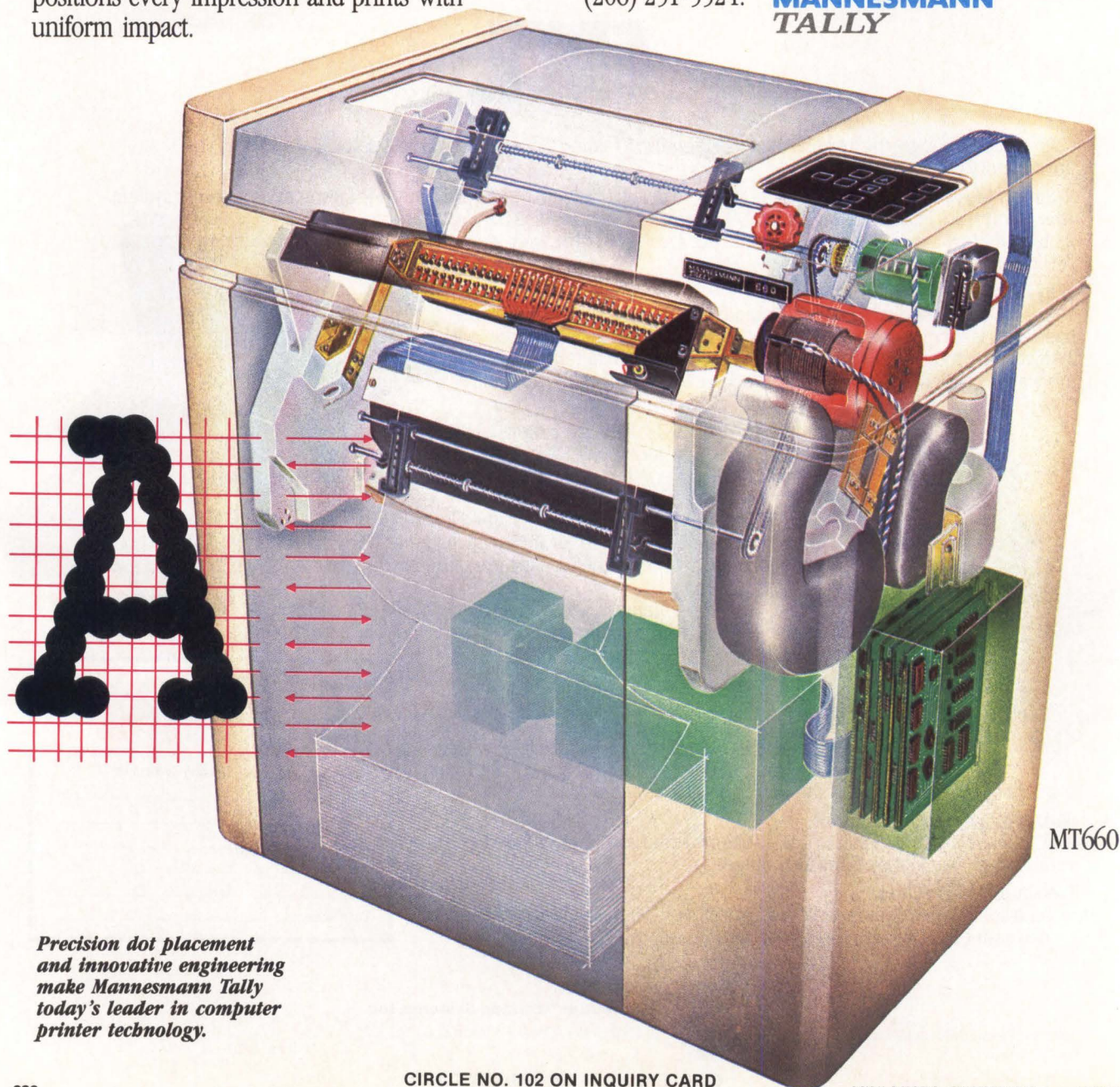
- ▶ The proof's on paper.
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and innovative engineering  
make Mannesmann Tally  
today's leader in computer  
printer technology.*



55 qualifiers that originate in different portions of the chip.

The HP 9000 uses a stack-oriented architecture—a set of 28 32-bit registers and two buses. Each register comprises 32 identical bit cells, and each cell receives data from or dumps data to the two data buses, according to the PLA output codes.

The ALU cycles in 55 nsec. and consist of an N-bit shifter, a 32-bit logical selector and a 32-bit full look-ahead adder, which is used with special hardware for integer multiplication and division. ALU results are stored in four internal result registers. The ALU, under microcode control, can perform a 32-bit integer addition in 0.39  $\mu$ sec. and a 64-bit floating-point multiplication in 10.4  $\mu$ sec.

In addition to the CPU functions, the chip includes a section dedicated to inter-chip communications. The memory/processor bus (MPB) interface section is the communication channel between the internal chip data buses and the external MPB data bus. This section of the chip uses seven 32-bit registers for addresses and data entering and leaving the CPU.

Chips are mounted on “finstrate” (cooling *fin* substrate) boards. The finstrate boards cool as well as connect the chips, contributing to the CPU’s low power dissipation of 4W (see “Cooling off,” Page 222).

The system can support as many as three CPUs, offering 2.7 times the performance of a single CPU. The CPUs are mounted in a card cage that can house as many as 12 finstrate boards. Because multiprocessing is software transparent, the user program need not reflect the actual number of operating CPUs. The operating system treats each CPU as an allocatable resource.

I/O interface functions are classified as dependent or independent of peripheral hardware. The system’s I/O processor performs non-hardware specific, or independent, functions. Separate I/O cards that interface to direct-memory-access (DMA) channels handle hardware-specific, or dependent, functions, such as device drivers.

One card handles the 8-bit parallel HP-IB (IEEE-488) interface, which serves as the host interface for a local-area network (LAN) controller. HP-IB-based instruments can communicate with the HP 9000 at rates as high as 500K bytes per second. The card also supports disk storage systems with data-transfer rates as high as 1M byte per second. A general-purpose I/O (GPIO) serial interface has a 1M-bit-per-second (bps) rate, a programmable handshake interface and local data-sense-inversion facilities. It interfaces asynchronous peripherals, such as keyboards and displays, using the asynchronous serial I/O card with remote-terminal support, RS232C compatibility, half- or full-duplex

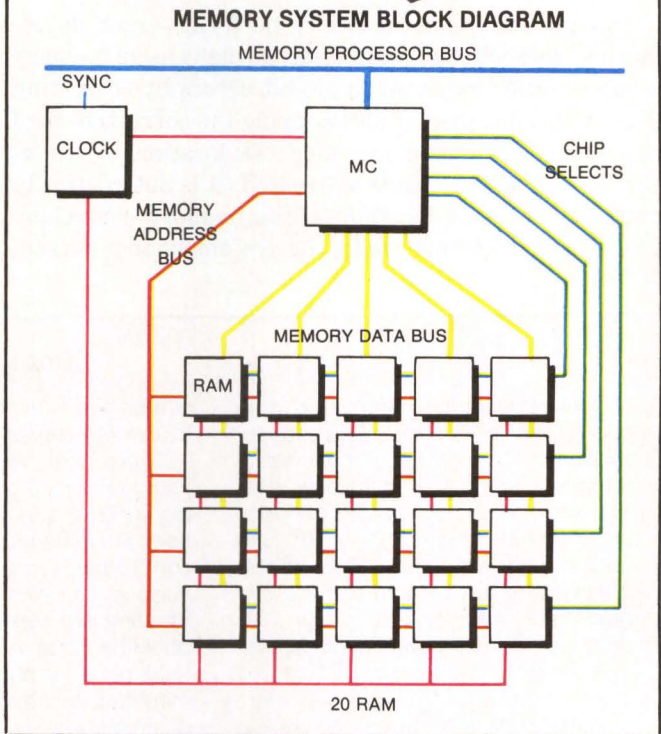
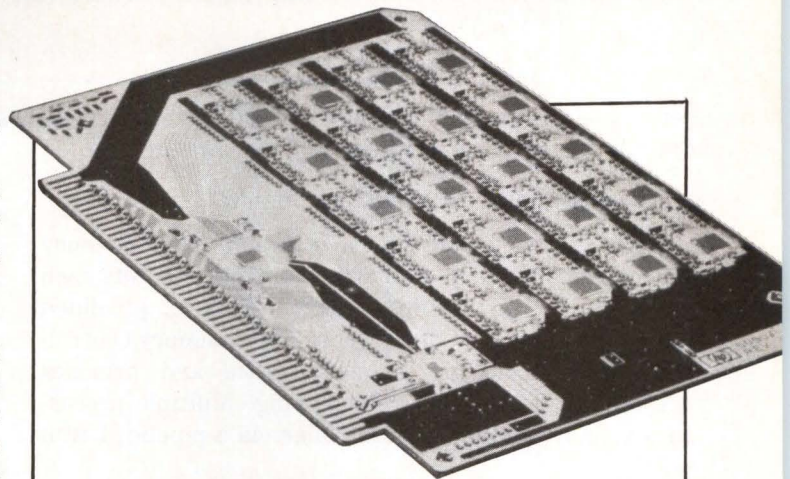


Fig. 2. The RAM board contains 20 RAM chips and a memory-controller chip.

channel support and baud rates as high as 19.2K bps.

A programmable serial interface card that lets OEMs tailor its characteristics to proprietary computer adjuncts or special I/O devices accommodates special peripherals. A color video interface card with 512-by-512- or 576-by-455-dot resolution, four display memory planes and a performance of 1,000 50-pixel vectors per second supports color video displays. An asynchronous eight-channel multiplex card brings eight terminals to one I/O slot. HP 9000 systems share data and resources via an Ethernet-based LAN control card.

At the heart of the I/O system is the host-independent I/O processor with eight DMA channels. Each channel can handle data bursts of as much as 6M bytes per second. The I/O system is message based: the I/O processor buffers data into message blocks and then



sends them to the CPU or to memory. The result is low CPU I/O overhead, freeing the CPU for computation.

**Memory system self-tests and 'heals'**

Each memory subsystem contains one memory controller chip and 20 RAM chips storing 128K bits each (Fig. 2). The RAM chips feature 165-nsec. pipelined access and 110-nsec. cycle times. Each memory controller has a 256K-byte memory space and provides self-test, memory test and mapping. Multiple processors access the memory controller via a pipelined MPB port.

The controller automatically performs error detection and correction. It can "heal" as many as 32 memory locations suffering from single-bit errors by correcting the error and transparently copying the corrected word into a memory controller healer RAM location. Whenever the original location is addressed, it is automatically routed to the new location on the memory controller. The memory controller halts the system when it detects

a double-bit error (Fig. 3).

The HP 9000 memory system is pipelined, and controller and RAM chips are structured so that memory accesses and returned data words are overlapped. For example, the system accepts three accesses during the first data-word interval (Fig. 4). Similarly, instructions are overlapped so that fetch, decode, execute and cleanup operations occur simultaneously.

**The software environment**

The HP 9000 features a choice of system software environments: a single-user environment based on the HP BASIC operating system for the desktop model 20, which includes an integral keyboard, a display and a floppy disk drive. The HP-UX operating system runs on any shared HP 9000 family computer.

HP 9000 BASIC is a memory-based, multiprogramming system limited only by the amount of physical memory available. Each program runs in its own "virtual" machine, or partition.

**Cooling off**

"Finstrates" take their name from cooling *fin* substrates. The copper substrate at the center of the finstrate multilayer sandwich is the key heat sink for the chips, which are bonded to the substrate with a heat-conducting epoxy adhesive (left). Two layers of insulating Teflon separate the two gold trace interconnection surfaces on each side of the copper substrate. The finstrate board plugs into the memory/processor module. A variable-speed DC fan blows a cooling

stream of air over the finstrate surface to remove heat dissipated by the chips.

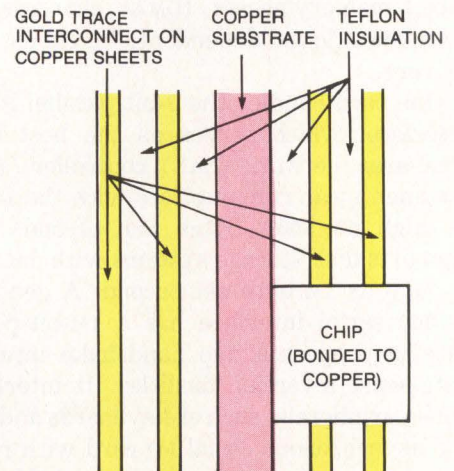
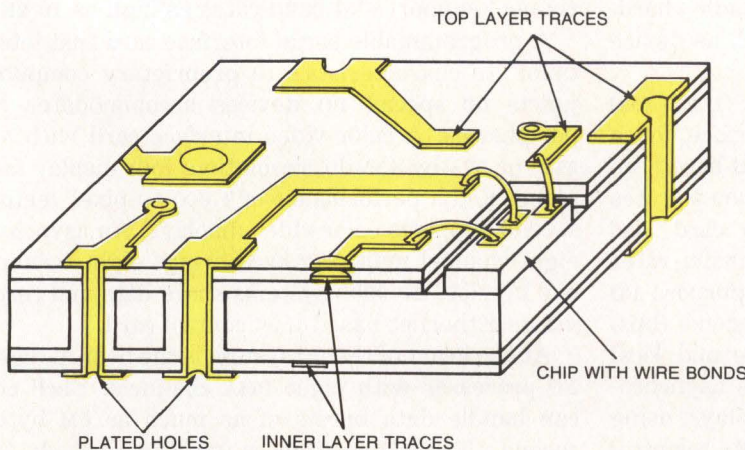
There are nine layers on the finstrate board (right). All conducting surfaces are coated with Teflon. A special material is plated to the conducting layers to create a rougher surface, to which the Teflon adheres. The first two Teflon layers are applied on either side of the substrate and held by a combination of heat and mechanical pressure. The two conducting surfaces are then laid on top

of the first Teflon coatings and are then etched and drilled.

After the second layers of Teflon are applied, the second conducting surfaces are laid down, etched and drilled. Insulated plated-through holes are fashioned by laser-drilling a large hole, filling it with Teflon and then drilling and plating a smaller hole. This creates connections between the outer and inner conducting surfaces without shorting the central copper substrate.

The finstrate board comprises an all-copper substrate and two layers of metal interconnect on each side of the board. The chips are wire-bonded to the board.

The side view of a finstrate board shows the nine layers.





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**TWIST** The Facit Twist Video Terminal can be viewed from an entirely new angle: a real multipurpose workstation with a large, dual display monitor that can be tilted, lifted and even twisted, to suit any operator's convenience.

The Twist capability means that you can use the conventional landscape format (24 lines by 80 characters) to display large detailed characters – or you can Twist the monitor to portrait format (72 lines by 80 characters) to display the information in full-page layout.

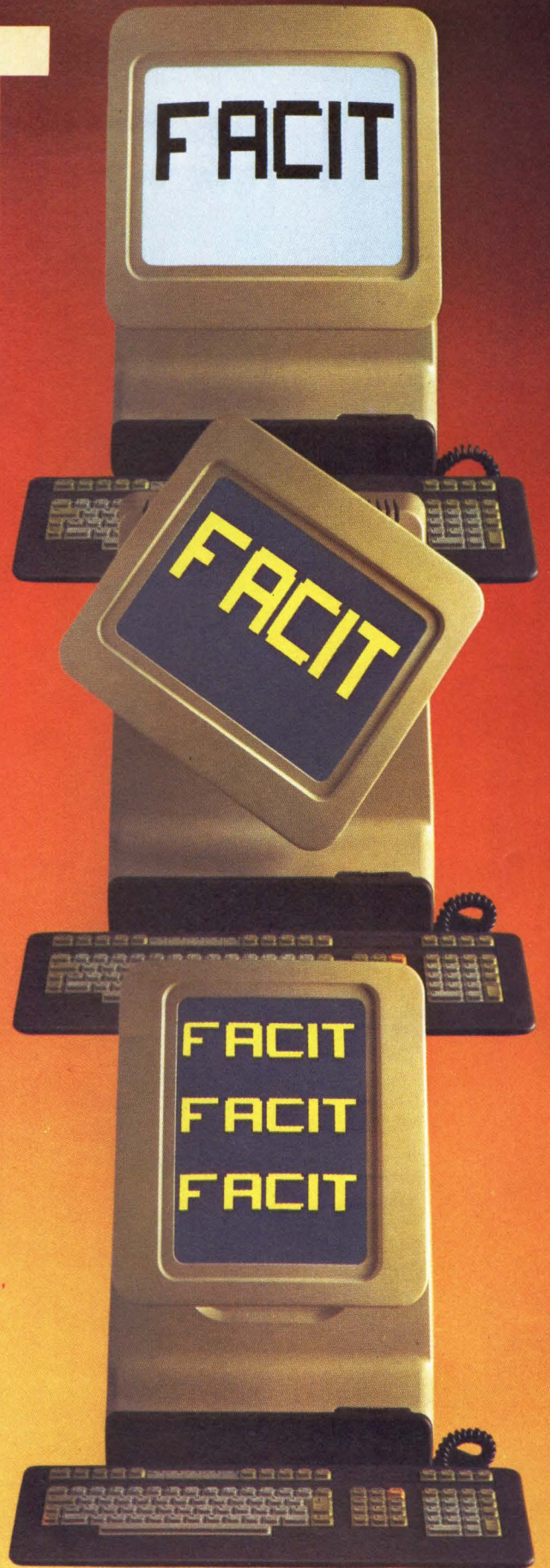
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# ON THE FIRST WE CREATED

- Ethernet Activity ●
- Packet Received ●
- Data Received ●
- Boot State ●
- Self Test ●
- Reset ●
- Power ●




Communications Server #1





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When Bridge Communications first opened for business, we took a good look at what the computer age was creating.

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COMMUNICATIONS

The Multiple Area Network

CIRCLE NO. 104 ON INQUIRY CARD





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On a professional level, of course.**



Personal computers have become a valuable asset in business. The problem is that most personal computer systems are originally sold with "personal printers"...printers built for home use, not for heavier business work.

These "personal printers" are too slow for many business needs. They can tie-up your computer for extended periods of time...time you could be using to do other work.

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That's why Genicom has created the 3014, 3024, 3184, 3304 and 3404... professional printers built for personal computers.

Price/performance matched for small business systems, the Genicom 3000 PC printers are designed to increase productivity and maximize the value of your personal computer.

The 3000 PC printers provide 160-400 cps draft, 80-200 cps memo, and 32-100 cps NLQ printing...performance for both high productivity and high quality printing.

The 3014/3024 models print 132 columns. The 3184, 3304

and 3404 models give you a full 136 column width, and offer color printing as well.

Each printer is easy to use, lightweight, functionally styled and attractive. And you can choose options from pedestals and paper racks to document inserters, sheet feeders and 8K character buffer expansion, plus more.

Genicom 3000 PC printers feature switch selectable hardware, dual connectors and dual parallel or serial interfaces. Plus the 3014 and 3024 emulate popular protocols for both Epson MX with GRAFTRAX-PLUS™ and Okidata Microline 84 Step 2™, while the 3184, 3304 and 3404 emulate popular protocols for Epson MX with GRAFTRAX-PLUS™. So your current system is most likely already capable of working with these Genicom printers without modification.

Most important, the Genicom 3000 PC printers are quality-built, highly durable printers designed for rapid, continuous duty cycle printing. So take some personal advice. Get a Genicom professional printer for your personal computer today.

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**CIRCLE NO. 105 ON INQUIRY CARD**



The CPU uses a round-robin discipline to allocate programs of equal priority on five priority levels. Users can support inter-program synchronization with event semaphores. To guarantee uninterrupted access, devices can be "locked" to a particular partition. Within a program, a user controls task execution via the keyboard, another program or external interrupt.

The BASIC run-time compiler combines the interactive program-development environment of an interpreter with the performance of a compiled language. Line-by-line compilation of the code begins when a user runs a program in source-code form. The code executes as it is compiled, and both the source and object code remain in memory. Because the object code is stored, it has to be compiled only once. Thus, an iterative loop routine is compiled and executed the first time. If the combined source and object code exceed available memory, a portion of the previously compiled code is "thrown away" to make room for a new compiled routine. This process gives the "throwaway compiler" its name.

The compiler also stores the source code, so all BASIC debug and development capabilities, such as trace, pause and edit, are available to the programmer. Furthermore, each subprogram can be completely compiled before program execution by appropriate directives.

With HP 9000 BASIC, a user can divide a CRT display into separate screens, or windows, attached to various system functions such as PRINT or INPUT. Windows are defined as "public" (always displayed) or "private" (displayed only when the CRT is "attached" to the defining partition or virtual machine).

Three mass-storage file system directory formats can

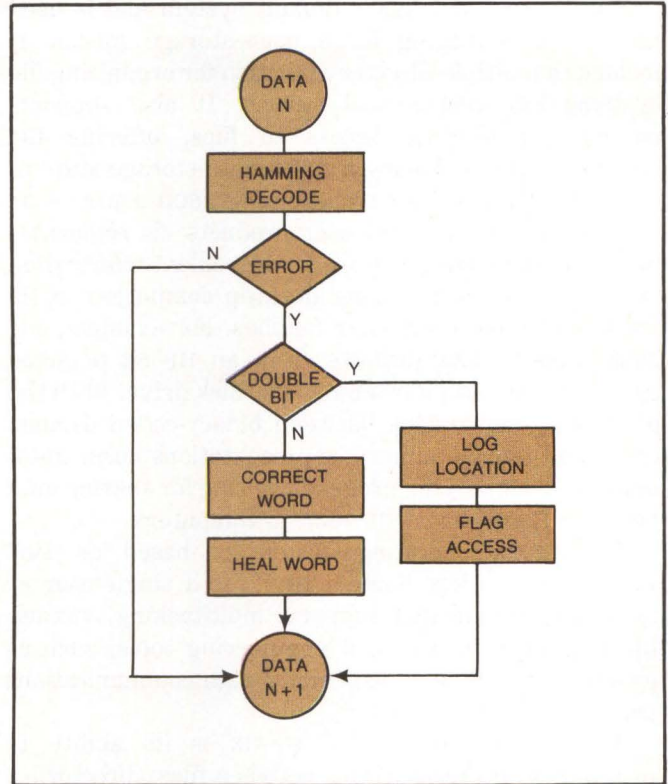


Fig. 3. The memory controller automatically performs error detection and correction. The diagram illustrates the method for "healing" single-bit errors as well as the flag subroutine for double-bit errors.

be selected: a hierarchical file format called structured directory format (SDF), a logical interchange format (LIF) and the 9845 desktop computer format (DCF). LIF and DCF provide a convenient growth path with HP 9845 and 9826/9836 desktop computers.

Fig. 4. The memory cycles in the HP 9000 are pipelined. The three-stage pipelining shows the overlapping of functions in each 55-nsec. cycle. The functions in orange are in the first stage of the pipeline, those in yellow are in the second stage, and those in green are in the third stage.

MEMORY PROCESSOR BUS	READ ADDRESS		READ ADDRESS		READ ADDRESS	READ DATA		READ DATA		READ DATA
MEMORY ADDRESS BUS		X ADDRESS	Y ADDRESS	X ADDRESS	Y ADDRESS	X ADDRESS	Y ADDRESS			
CHIP SELECTS			READ SELECT		READ SELECT		READ SELECT			
MEMORY DATA BUS					READ DATA		READ DATA		READ DATA	
	55 NSEC.									



SDF is HP 9000 BASIC's default system and is used mainly for managing large mass-storage media. It includes a multiple-directory function for organizing file systems into hierarchical format. It also supports password read/write access to files, offering file security to users sharing a large mass-storage system.

LIF is a standard for transporting ASCII source code and data among HP computer products via removable mass-storage media. It is also a convenient information transport format for tying desktop computers to HP 1000 and HP 3000 computer families. For example, one could take a data diskette from an HP 86 personal computer and read it on an HP 9000 disk drive. With the 9845 DCF, conversions between binary-coded decimal (BCD) and binary numeric representations occur automatically, simplifying program writing for sharing data between HP 9000 and HP 9835/45 computers.

The HP-UX operating system is based on Bell Laboratories' UNIX System III. It is a single-user or multiuser system that supports multitasking, virtual-memory management and engineering tools, such as graphics, database management, data communications and local-area networking.

A prominent feature of HP-UX is its ability to program all I/O transactions between files, directories, processes and devices using identical read and write

**Spec summary**

- **Model:** HP 9000 (models 20, 30, 40)
- **Microprocessor:** 32-bit HP-32
- **Clock cycle:** 18 MHz
- **Main memory:** 256K to 2.5M bytes
- **Speed:** 1 MIPS
- **Operating systems:** HP BASIC, HP-UX
- **Languages:** BASIC, FORTRAN 77, Pascal, C

statements. This facility is further enhanced by the HP-UX command interpreter, which lets the programmer declare an input and an output as standard when programming in FORTRAN or Pascal. This means that programs can be copied without directing I/O toward a specific object. The command interpreter lets users specify the I/O objects at run time, a productivity booster for programmers modifying, testing and reusing software.

HP-UX supports as many as 59 concurrent processes using UNIX system III's "pipes" and first-in, first-out (FIFO) files. These two features permit inter-process communication, in which data can be passed asynchro-

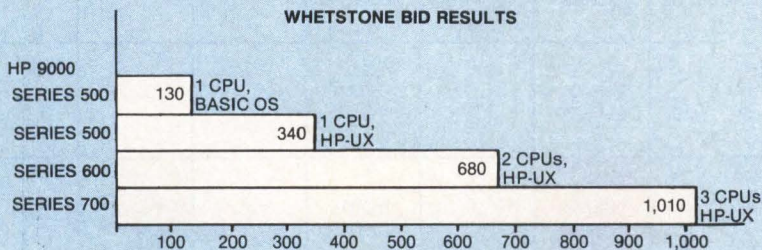
### Benchmarking the HP 9000

One standard for comparing scientific and engineering systems is the Whetstone B1D, which is expressed in thousands of double-precision instructions per second. Using this benchmark, Hewlett-Packard Co.'s HP 9000 Series 500 (single CPU) with HP BASIC system software is rated at 130. The same hardware using HP-UX rates 340, and a dual-CPU Series 600 rates a 680. A three-CPU Series 700 (and HP-UX system) garners the

highest rating—1,010 (left). In contrast, the Digital Equipment Corp. VAX-11/750, running the VMS operating system, is rated at 150, and equipped with a floating-point accelerator, at 490.

Other parameters can be used to gauge a system's performance (right). The HP 9000 CPU, for example, has a 230-instruction repertoire. A 32-bit LOAD instruction takes 0.3 μsec. It performs a 32-bit addition in

0.3 μsec., a 32-bit multiplication in 2.9 μsec. and a full 32-bit division (with a 64-bit dividend) in 9.4 μsec. CPU performance is measured at 1 million instructions per second (MIPS).



Data path width	32 bits
Instructions	230
Memory access time	165 nsec.
Memory cycle time	110 nsec.
32-bit addition	0.3 μsec.
32-bit multiplication	2.9 μsec.
32-bit division	9.4 μsec.
32-bit load instruction	0.3 μsec.
64-bit floating-point multiplication	10.4 μsec.



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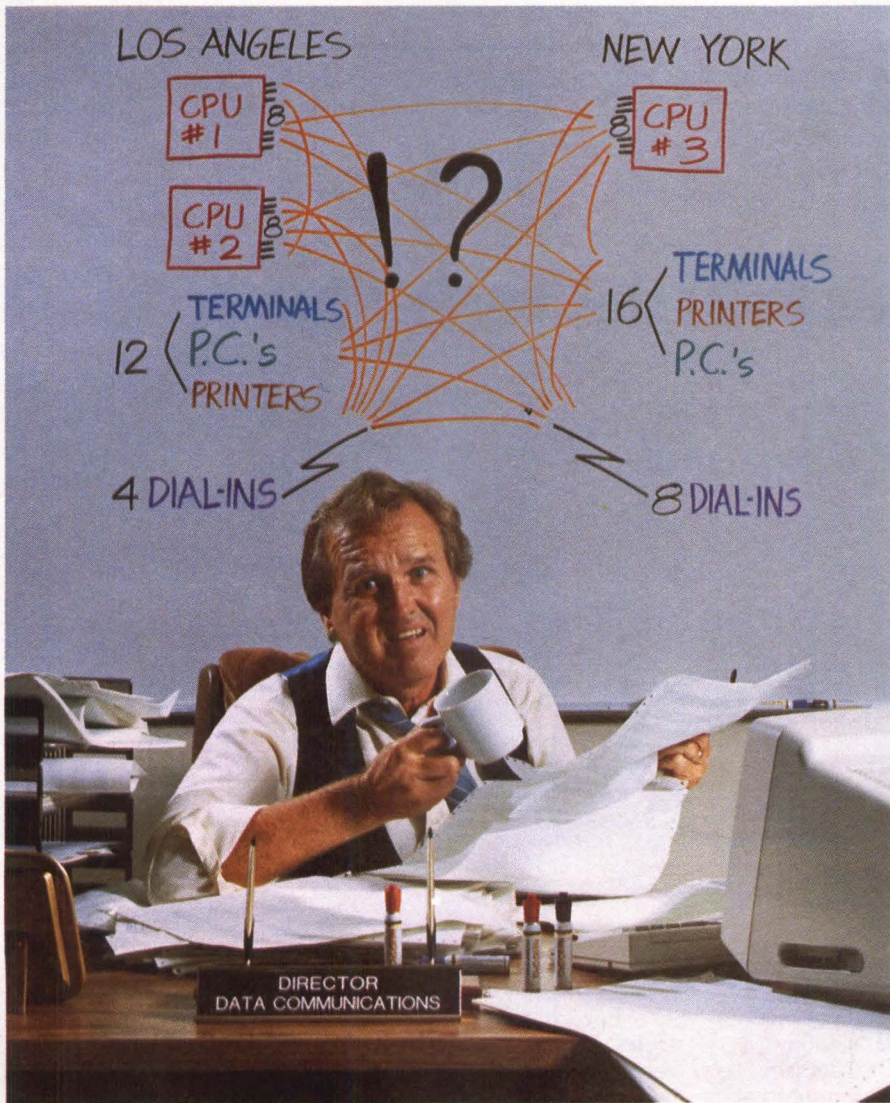
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nously between two tasks using a high-level language's read and write commands.

HP-UX's virtual memory allows program code segmentation and data segmentation or paging. Each process has a maximum virtual address space of 1G byte, half of which can be used for local code and data and half for shared system code.

The minimum HP-UX operating system occupies 300K to 400K bytes of memory. A demand-loading feature lets users choose between loading an entire program into memory before execution or only those segments needed for execution, leaving the remaining segments in mass storage.

The HP-UX file system is hierarchical and supports large mass-storage media, making it well-suited to a multiuser software-development environment. Each file is set up with controlled access for read, write or execute to tailor the system to each project team member. HP-UX also includes utilities for converting and copying files to LIF ASCII files, allowing information exchange between a wide variety of HP computers.

HP-UX supports FORTRAN 77, Pascal and C, and both system software environments support graphics and database management. HP 9000 BASIC 3D graphics

implements the full SIGGRAPH CORE standard and supports the IMAGE/QUERY database-management package used with the HP 3000, HP 1000, HP 250 and HP 9845 computer families. Graphics/9000 on the HP-UX system consists of two sets of procedure libraries, both of which can be called from application programs: the advanced graphics package (AGP) and device-independent graphics language (DGL). DGL provides fundamental graphics functions and device support; AGP builds on DGL to provide 2D or 3D viewing transformations with parallel or perspective projections and picture segmentation for rapid, interactive graphics image manipulation.

The HP 9000 can be used as a general-purpose computer, but its strengths are in engineering and scientific applications. Application-software support is mainly in the electrical, mechanical and software engineering areas.

**Chris J. Christopher** is research and development manager of Hewlett-Packard Co.'s Systems Division, Fort Collins, Colo.

Interest Quotient (Circle One)  
High 828 Medium 829 Low 830

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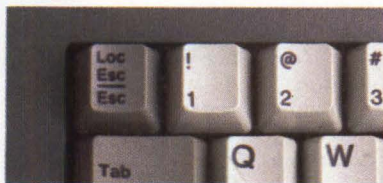
### DELTA AIR CARGO. READY ALL-AROUND.



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The new TeleVideo® 922 shares but one feature with the VT220®: full DEC® compatibility. The similarity ends there.

**1.** Take our keyboard, for example. The RETURN key is within direct, easy reach. But VT220 users must stretch over an additional key to hit RETURN. Or have the hands of a concert pianist.



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Where's the VT220 ESCAPE key?

That's a true accounting keypad, complete with a Clear Entry, Double Zero and a TAB key. Not merely the numeric keys you get with the VT220.

**2.** Our ESCAPE key is located above the TAB key, right where you'd expect to find it.

Theirs isn't.

In fact, you have to go hunt for the VT220 ESCAPE key halfway across the row of function keys.

**3.** Take a look below at the 922 key-



DEC VT220

**4.** Our SHIFT key is exactly where it should be, so it does exactly what it should do—shift. Their SHIFT key is shoved over by the < and > key to create lots of < and > on the CRT. Of course with a little practice, you could re-learn their keyboard. But why, now that you've seen our 922?

Moving The Shift Key Is A Mistake.

922 Display Screen.

<oving <he <hift Key <s A <istake.

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**5.** And after we built a better keyboard, we built a better terminal. With exceptional reliability. Quality. Advanced ergonomics. Everything you'd expect from the industry ANSI leader.

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True Accountant Keypad	YES	NO
Plug-in Graphics Upgrade Option	YES	NO
Non-glare, Green Phosphor Screen	YES	NO
Full Tilt & Swivel	YES	NO
Enhanced ANSI Mode	YES	NO

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# STRAIGHTTALK

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"Combined with our HH-612 10 MB 5.25" half-height disk drive, Microscience now provides a product family of superior quality and better performance than any other drives available.

"Time after time, we have proven that Microscience has the performance, quality, and price personal and portable computer manufacturers demand.

"The secret is the way we design and manufacture drives for you.

"Microscience disk drives have extremely low voltage requirements because small business and portable computers don't have the luxury of excess power or cooling capacity.

"We've used procedures and components that will be power misers, yet they still provide long-term performance and reliability.

"Our drives feature a thermally isolated stepper motor for precise head alignment and optimum seek performance. A proprietary linear actuator assembly was employed to ensure data reliability

and provide greater drive durability.

"A buffered seek mode and highly accurate proprietary micro-processor-controlled closed-loop servo positioning system keeps the head precisely on track. This maintains data integrity through a wide range of operating conditions regardless of thermal expansion, system hysteresis, or long-term wear.

"Microscience drives are not limited to functioning horizontally. Because of the growing use of portable computers and increasingly compact packaging, we designed our Winchester drives so you can use them in almost any position.

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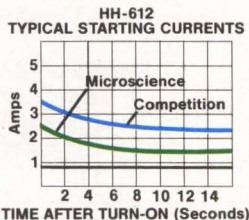
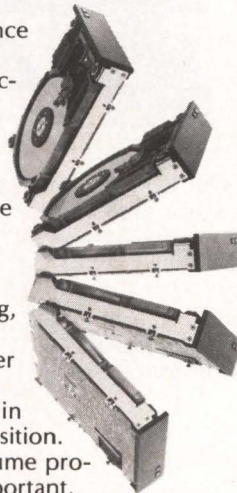
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*Jeffrey Z. Liu*

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CIRCLE NO. 107 ON INQUIRY CARD



# Computer-integrated-design graphics terminal incorporates local database

*CID terminal combines a graphics engine,  
a hierarchical graphics database  
and a local processor to reduce host intervention  
in graphics applications*

**Stephen H. Van Horn, Megatek Corp.**

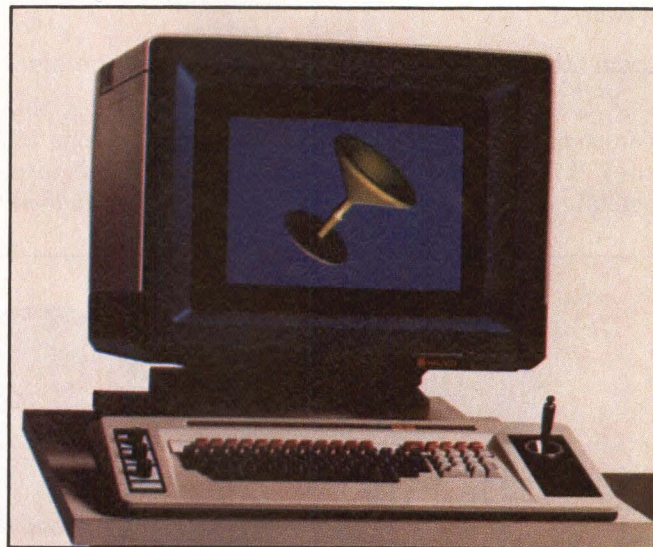
Unlike most graphics terminals, computer-integrated-design (CID) terminals combine a graphics engine with a local database and a local task processor. CID terminals perform most of the real-time database updates and transformations traditionally handled by the host, thus providing faster response to input data and a corresponding reduction in design time. Incorporating a local database reduces delays resulting from lengthy queues that can develop when a host is supporting a large number of users.

Because the major advantage of a CID terminal is the virtual elimination of communications delays, internal throughput is a primary design consideration. But price is a consideration, too. In the case of Megatek Corp.'s Merlin 9200 CID terminal, achieving the required level of performance at an affordable price meant a new approach to graphics-terminal architecture.

## **Communicating within and between terminals**

To provide maximum throughput, the 9200's internal functions are distributed among several independent logical units. Partitioning internal functions simplifies resource sharing among units in a multiterminal installation and improves throughput via a pipelined architecture.

The basic 9200 CID terminal contains dedicated processor boards that handle peripheral interfacing,



**The Merlin 9200 computer-integrated-design graphics terminal combines a graphics engine with a local database and a local task processor.**

the local graphics database and the graphics display. An optional Ethernet interface with a dedicated Intel 80186 is also available (Fig. 1).

Logical units on the same processor board communicate with each other over standard parallel microprocessor buses. Because there is only one processor on a board, there are no local bus-contention problems. However, arbitration can be added should it become necessary for expansion.



Board-to-board communications take place over a 32-bit, 32M-byte-per-second, synchronous transmit-receive message bus. The use of byte-by-byte multiplexing and a rotating priority that interleaves messages and provides "concurrent" communications eliminates contention between logical units for access to the inter-board message bus.

To facilitate communications, the system transmits data in 512-byte packets specifically addressed to the destination logical unit. A real-time executive controls communications. When a logical unit needs to transmit data to another logical unit, it requests a block of local memory from the local executive's memory manager, forms as many packets as are needed to contain the data and adds a header that contains the logical address to which they are to be sent. The executive's communications utility then examines the pointer, determines how to route the packets and begins the data transmission.

An optional fourth processor board, the extended communications processor (ECP), provides a gateway between the logical units and an Ethernet cable. The Ethernet gateway facilitates high-speed communications between the Merlin 9200 and the host computer and between logical units in different Merlins on the network.

**Local task processor links terminal to peripherals**

A local task processor (LTP) board provides the man-machine interface (Fig. 2). The LTP contains an Intel 80186 microprocessor because its architecture facilitates handling numerous peripherals. An added

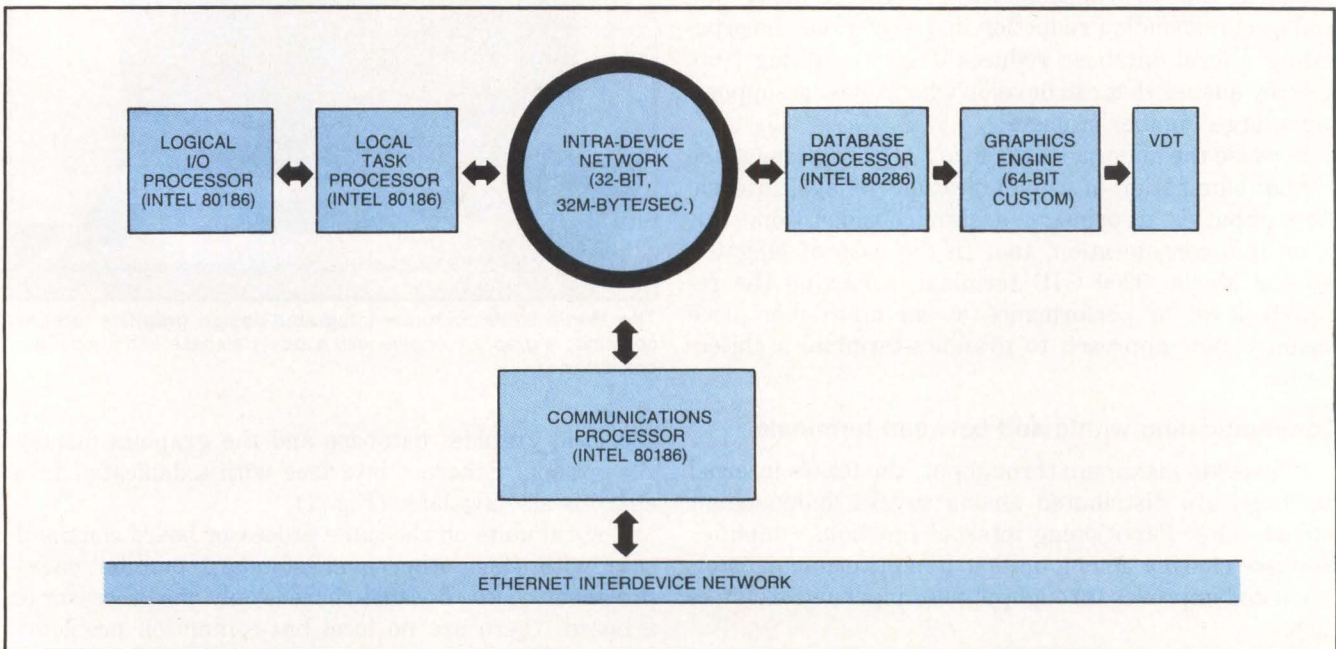
benefit is its compatibility with existing application software.

The LTP has a local memory consisting of 32K bytes of bootstrap and diagnostic code in ROM and 256K bytes of program and user memory in dynamic RAM, expandable by 1M byte with a plug-in local task extension (LTE) board. A modified Multibus handles communications between the LTP and LTE boards.

The LTP board also includes a gateway to the inter-board message bus, as well as a Centronics-compatible printer interface and a floppy disk controller that can support two drives. The Merlin includes at least one 5¼-inch, 1M-byte drive because, with the exception of the bootstrap and basic diagnostic routines, the system is completely soft-loaded. The decision not to follow the conventional practice of loading graphics-terminal operating instructions in firmware was based on the amount of code involved. A typical 9200 comes with more than 400K bytes of functional and diagnostic code, far more than is practical to put in ROM. Soft-loading allows updating by replacing the system floppy disk.

Users control the LTP via a local task language (LTL), a high-level language that facilitates the configuration of, and provides access to, the system's logical devices. With LTL, users can create and run small programs that, among other things, can control graphics peripherals. One supervisory and eight subordinate user tasks can run concurrently. The supervisory task controls the creation, initiation and suspension of the other eight user tasks.

To achieve application compatibility, the internal



**Fig. 1. The Merlin 9200 multiprocessor architecture** includes processors dedicated to local database processing, local task processing, communications and networking, peripheral control and graphics.





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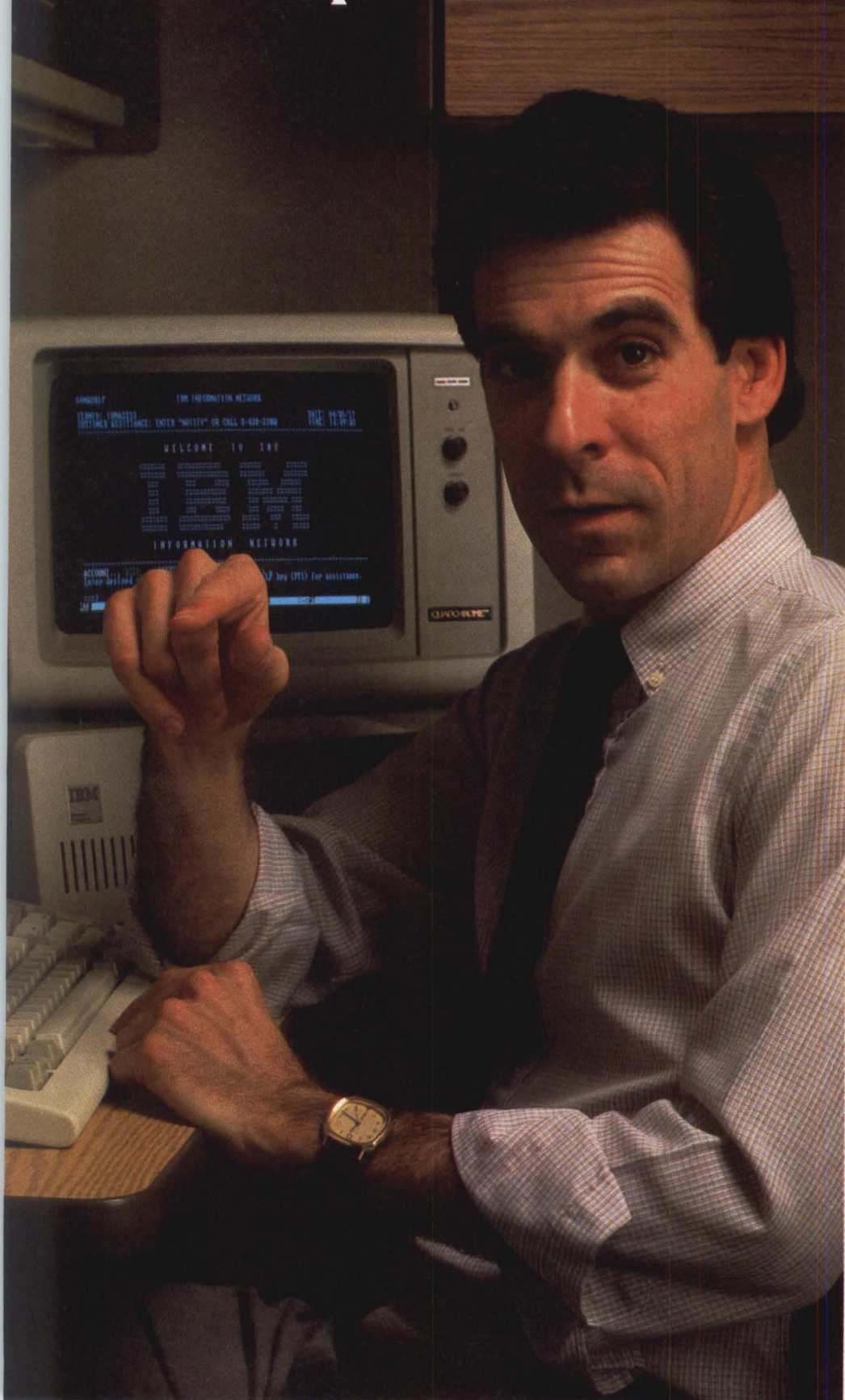


CIRCLE NO. 108 ON INQUIRY CARD



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**CIRCLE NO. 109 ON INQUIRY CARD**



database has to use the same kind of data constructs and structures as those typically found in an application database. The 9200's freely structured database eliminates the need for a complex program to convert information in the application database into the graphics database needed by the graphics terminal. The Merlin 9200 can accommodate a hierarchical database, among others, in which information is stored in a pyramid-like tree structure consisting of a series of linked files.

Each file can be named by a 32-bit symbolic address that usually represents an entity's part number or a code number that identifies it. Some users tie the symbolic address to the numbers of the disk sector in which the file is stored.

The database processor (DBP) board contains the local database and comprises an Intel 80286 microprocessor and a 512K-byte database memory. A user can expand the DBP's memory by adding as many as four 1M-byte plug-in database expansion (DBE)

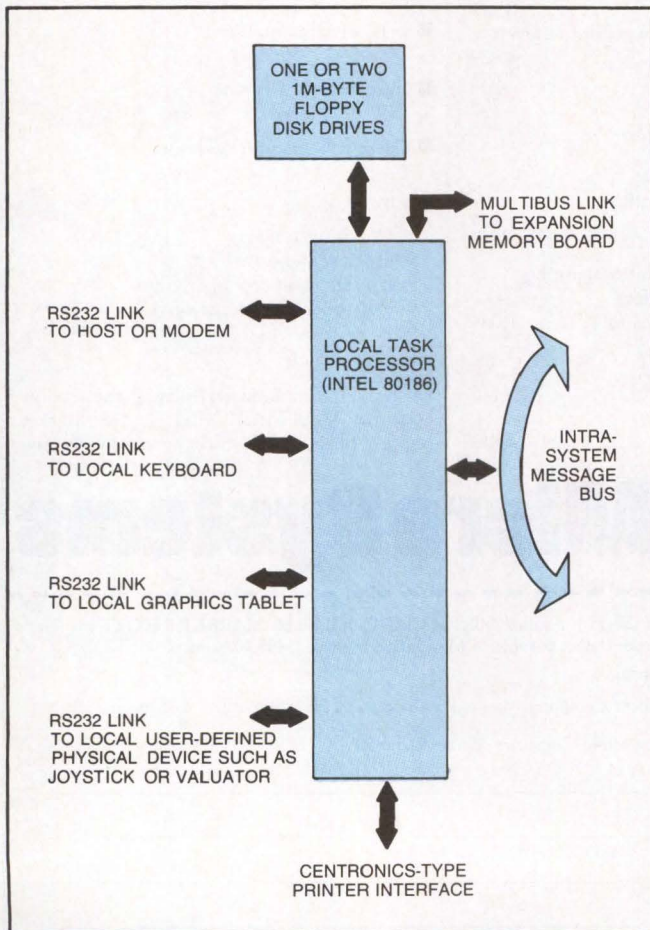
boards. Communications between the DBP and DBE take place over a modified Multibus.

The database operating system includes a traverser and a filter function. Integrating the traverser into the DBP itself speeds data retrieval. The filter function enables the operator to restrict the information the traverser retrieves to items that meet certain criteria.

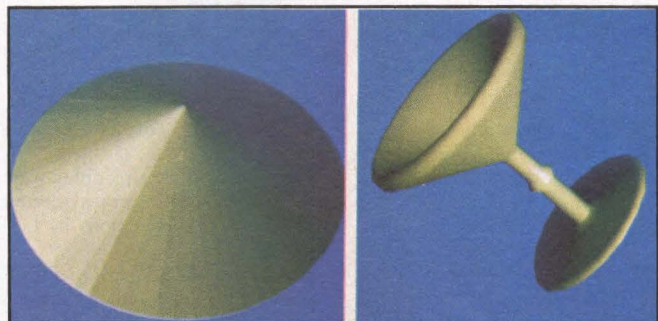
To minimize the amount of memory needed for a given application and to maximize transaction speed, the system uses a free-structured database language. Because the language is not bound by fixed-length memory structures, the Merlin can handle individual database entries, called entities, from a few bytes on up. Each entity fills only as much memory space as it needs. Equally important, the database processor retrieves and manipulates only the number of bytes needed to contain the required data.

### Graphics engine paints the picture

The Merlin 9200 supports vectors, polygons, meshes,



**Fig. 2. The local task processor** includes an Intel 80186 microprocessor with 256K bytes of dynamic RAM. The task processor supports as many as eight concurrent user tasks and provides the man-machine interface via RS232 ports to peripherals, input devices and the host.

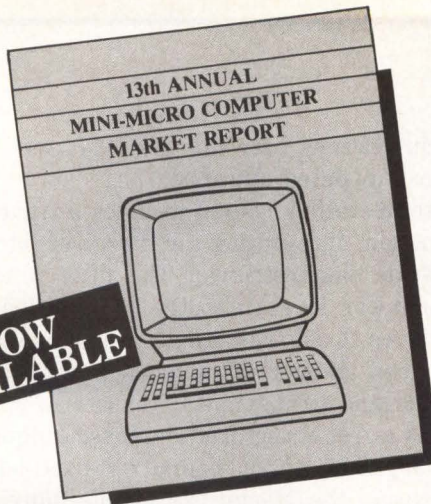


**Fig. 3. Solids modeling** on the Merlin 9200 is available with three types of shading: flat (left), Gouraud (right) and Phong (not shown).

pixel data, run codes, hidden-surface removal, real-time shading and the ability to "wrap" a predefined pattern around a complex shape. The hardware needed to support these graphics functions comprises two processor boards and a number of frame-buffer memory boards. A raster display processor (RDP) provides the gateway between the graphics engine and the remaining hardware. The RDP is a 64-bit microcoded processor with dual memories and dual input buses. Microcoding enables the RDP to fetch two pieces of data from memory, perform a multiply and write the results back to memory within one 150-nsec. machine cycle. The RDP converts the information contained in the database into X, Y and Z coordinates. It also provides perspective, and 3-D clipping and viewport transforms.

A digital vector generator/video timing and control (DVG/VTC) board converts coordinate information from the RDP into the pixel map the monitor needs to paint the vector on the CRT screen. Pixel information





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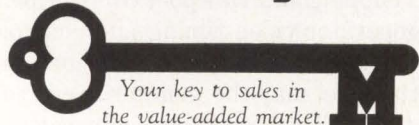
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  - Units acquired
  - Major applications
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\$500,000 or more.....	1,403
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CIRCLE NO. 110 ON INQUIRY CARD

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CIRCLE NO. 111 ON INQUIRY CARD



generated by the DVG/VTC board is stored in the frame buffer memory contained on additional plug-in boards.

The RDP can directly address the frame buffer to load data already in pixel form. This data includes information such as photographs or schematic diagrams stored in pixel form in the database, as well as alphanumeric characters. The monitor can simultaneously display as many as 4,096 distinct colors from a palette of 16.7 million.

The VTC reads the logic state of the bit in each of the raster planes at each pixel address to recreate the 12-bit color word. The VTC then refers to its video look-up table to determine the percentages of red, green and blue needed to produce the corresponding user-defined color. These percentages are applied to three on-board digital-to-analog converters that change them into the analog signals that drive the CRT's guns.

The DVG/VTC board contains four DVGs that perform interpolation functions. Three are used for shading and hardware pattern generation, and the fourth performs z-axis address generation. The hardware pattern generator provides a 64-by-64 or 128-by-32 arbitrary surface pattern.

Merlin provides three kinds of shading: flat, Gouraud and Phong (Fig. 3). Flat shading provides uniform intensity across a polygon surface. Gouraud and Phong shading provide realistic, smooth color shading, based on a light source via interpolation.

An important attribute of a graphics terminal is the ability to remove hidden surfaces when solids are modeled. The Merlin 9200 includes back face testing as

standard; true z-buffer hidden surface removal is optional. The z-buffer and associated processor maintain depth information for each surface of the solid. To facilitate this, the terminal uses a DVG and a dedicated frame buffer connected directly to the RDP. The z-axis frame buffer contains 16 raster planes, each corresponding to one bit of a 16-bit z-axis "granularity" word. With 16 bits of depth information, the terminal can recognize as many as 64,000 distinct depth values.

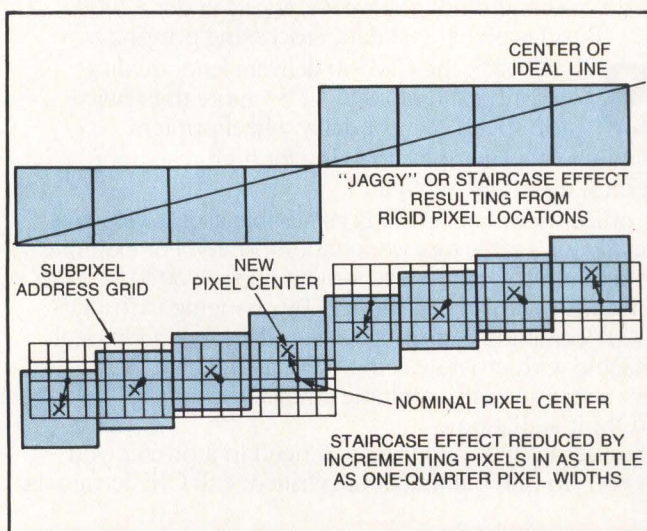
The z-axis DVG provides the pixel data needed for depth cueing, a process in which depth is simulated by varying pixel intensity. Depth cueing can be used on solid surfaces as well as on wire models. When depth cueing is implemented, the user trades off the breadth of the color palette in the video lookup table for variable intensity. Typically, the 12-bit word read-out of the display raster planes is divided into a 4-bit color word and an 8-bit intensity word. With 8 intensity bits, Merlin can provide 256 distinct levels of intensity along its z-axis.

#### Pixel phasing reduces 'jaggies'

The CID terminal provides an economical display that is virtually free of the staircase "jaggies" normally found in raster displays. Jaggies are most apparent in lines drawn at angles very close to one of the major axes. They result from the inability of a raster display to represent the small change in one axis that occurs during a large change in the other axis.

Pixel phasing (patent pending) virtually eliminates jaggies and involves the displacement of pixels from their screen location into a 4-by-4 array. With precise beam steering, the center of each pixel can be shifted to any one of the resulting 16 subpixel addresses in accordance with data contained in four raster planes in the frame buffers (Fig. 4).

To minimize the dark areas that would result if a pixel were fully shifted to one extreme of its address grid, the terminal elongates the affected pixels along their axis of displacement. In other words, the pixel is expanded on one side rather than simply displaced. Although not as smooth as the lines drawn on a calligraphic vector stroke display, the lines drawn with pixel phasing exceed the best high-resolution raster scan monitors. □



**Fig. 4. Pixel phasing** eliminates jaggies by displacing pixels from their normal screen locations. Traditional raster display terminals produce jagged lines (top). Pixel phasing divides each pixel's screen location into a 4-by-4 array and shifts the center of the pixel (bottom) to get a smoother line.

**Stephen H. Van Horn** is a product specialist and technical liaison on the Merlin 9200 system at Megatek Corp., San Diego. He holds a B.S. in computer engineering from the University of California, San Diego.

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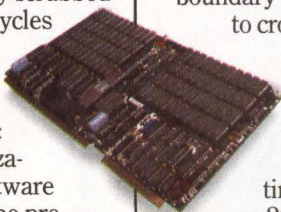
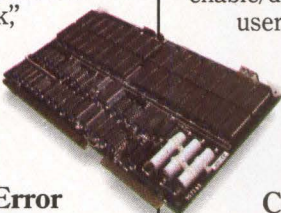
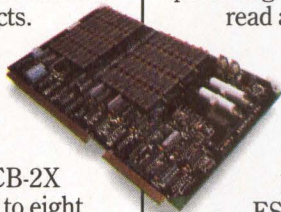
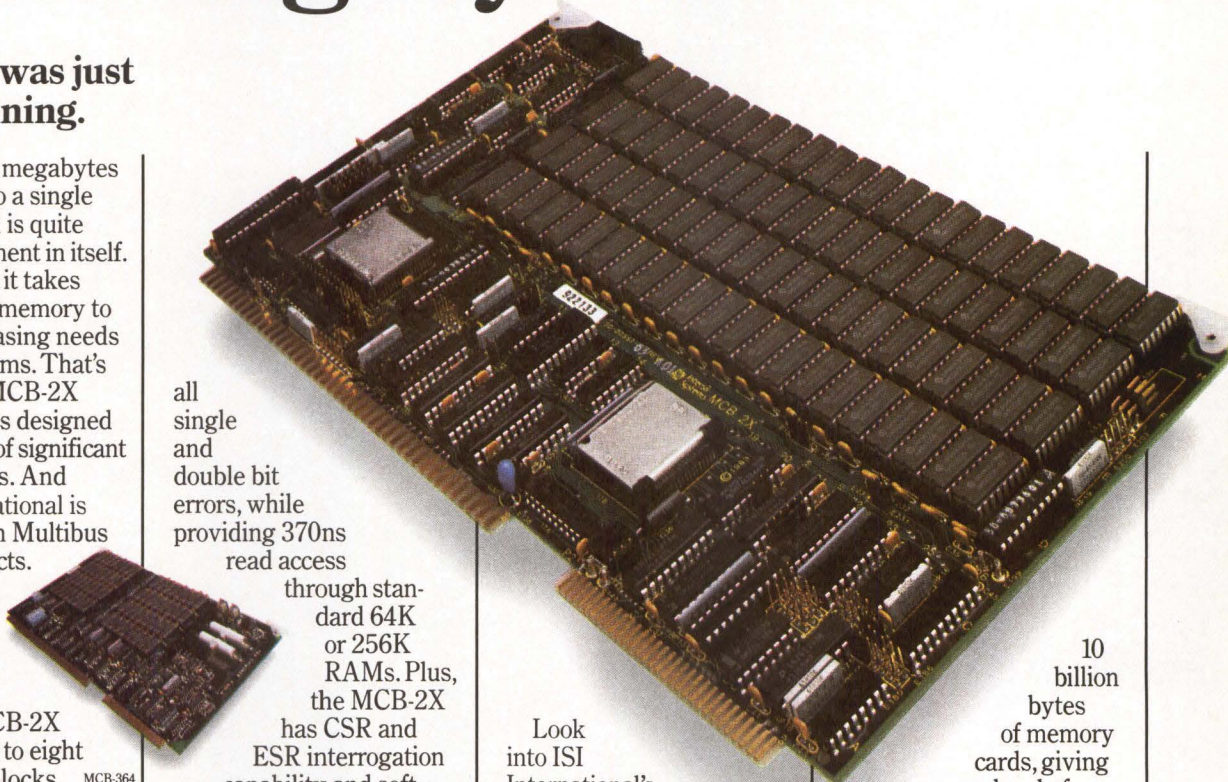
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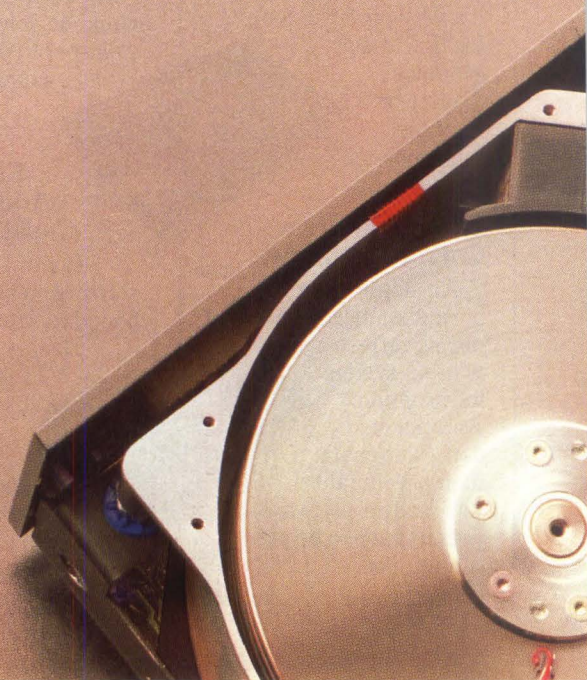
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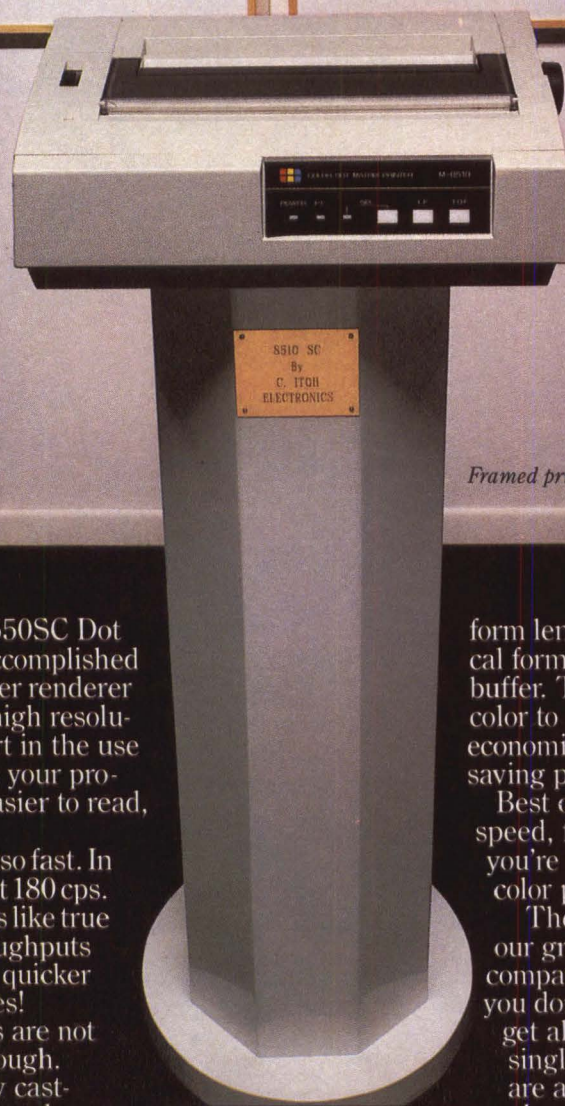
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CIRCLE NO. 114 ON INQUIRY CARD



## GUEST VIEWPOINT

# Needed: new Winchester error specifications

**James Adkisson,**  
Executive Vice President  
Vertex Peripherals Inc.

System integrators continually demand that Winchester disk drive manufacturers provide more capacity, lower cost, greater capability and greater volume, while maintaining high data integrity. Currently, high-capacity Winchester disk drive manufacturers maintain high data integrity and low defects even with densities of 1,000 tracks per inch (tpi) and greater than 10,000 bits per inch (bpi).

Acceptable system data integrity is determined arbitrarily more by disk technology capability than by pre-defined system requirements. Current 5¼-inch Winchester disk drive products support error rates of one error in  $10^{10}$  bits for recoverable, or soft, errors and one error in  $10^{12}$  bits for non-recoverable, or hard errors. Acceptable system data integrity requires an error rate of one in  $10^{12}$  bits transferred.

The increased cost penalty for high-capacity disk drives to maintain these error rates is not necessary for system integrators to achieve the specified system data integrity.

By definition, soft errors are recoverable by multiple read retries and therefore do not necessarily affect system data reliability. However, excessive soft errors might degrade throughput because of multiple read retries to recover data. On the other hand, hard errors occur primarily as a result of defects in the recording surface of a disk. Most drive manufacturers guarantee that no more than one defect per megabyte of storage will be allowed on a drive.

As disk drive capacity increases, particularly with higher tracks per inch and bits per inch, maintaining minimum defects per megabyte becomes increasingly expensive. A small disk defect that is not noticeable in a 300-tpi disk drive is a repeatable hard error in a 10,000-tpi disk drive.

Generally, hard errors or defects are mapped by disk drive manufac-

turers before disk drives are integrated into a system. These mapped defects are entered into the system disk controller by the system integrator or OEM and then are omitted during disk-formatting operation. Thus, the system never sees hard errors (according to the specification, only one error in  $10^{12}$  bits are read).

But what about the hard errors that were not mapped as they should have been? And what about hard errors that show up later? What does a system integrator do about them?

The solution requires the use of error-correction codes (ECC). The most common type of ECC are called Fire codes (named after their inventor). Fire codes are especially constructed to detect and correct single-burst errors. The new generation of ECC, sometimes called "computer generated," has improved detection capabilities for even multiburst errors.

With the use of ECC, both hard and soft errors are correctable. However, care must be taken in its use. ECC should not necessarily be invoked to correct soft errors, depending on the correcting code used, where a code's miscorrection is greater than the probability of recovery from multiple read retries. ECC solutions vary in terms of redundancy required, correction capability and miscorrection errors. The significance of ECC centers on its ability to detect and correct hard errors, thus maintaining high system data reliability.

An industry consultant on ECC, Neal Glover of Data Systems Technology, believes that disk drive manufacturers unnecessarily carry the primary burden for maintaining disk system data reliability. According to Glover, "Disk manufacturers, by providing nearly perfect disk media and sophisticated read/write channels, have maintained very low disk drive error rates. If the controller manufacturers/designers were to improve the error-correction schemes with greater redundancy and a selection of ECC that increase correction capability while minimizing miscorrection,

then the system data reliability could be easily maintained, even with a significant increase in raw disk drive error rates. However, system manufacturers should implement ECC in any case to guard against error-rate variations among disk drives."

Larry Boucher, president of Adaptec Corp., a leading controller manufacturer, agrees: "With the use of the more sophisticated computer-generated ECC incorporated with new controllers, it is possible to maintain system data integrity of one in  $10^{12}$  bits error even if the native disk drive error rate is several orders of magnitude higher."

Offering high storage capacities, optical disks are currently operating with inherent hard-error criteria of one in  $10^6$ . However, with use of redundancy and ECC, the system data reliability from optical disks is maintained at one in  $10^{12}$ . The same is possible if magnetic-disk-inherent data errors are similarly reduced.

Now is an ideal time for the industry to review and reduce error and disk-media-defect criteria. Many alternative proposals offered for interface standards are still up in the air, and ECC schemes could be easily incorporated into any one of them. A reduction of error rates by two orders of magnitude could provide significant cost reductions in disk-drive-media and read-channel implementation without jeopardizing system data integrity. Those emerging higher-performance disk drive interface proposals supporting higher data rates and more efficient encoding, such as run length limited (RLL) will make disk quality requirements even greater and, therefore, bring higher costs unless error criteria are reduced.

The market is demanding higher-capacity/higher-performance disk drives in large volumes—but at lower costs. A cooperative effort between disk drive manufacturers, system integrators and controller manufacturers to maintain system data reliability and reduce disk drive error and criteria would offer benefits to all.



# New Products

## SYSTEMS



### Display workstation features high resolution

The WY-1000x10 graphics workstation can be configured with windowing software for business or CAD/CAM applications. Containing all of the features available in the company's WY-1000 workstation, the WY-1000x10 also includes a 15-inch, monochrome monitor with a 1,000-by-800 bit-mapped display, the GSX operating system and a serial input/output port. The WY-1000 16-bit, 80186 microprocessor-based microcomputer provides two 5¼-inch IBM-PC-compatible floppy disk drives, 128K bytes of RAM and three I/O ports. Less than \$5,000. **Wyse Technology**, 3040 N. First St., San Jose, Calif. 95134, (408) 946-3075. **Circle No 300**



### Microcomputers run IBM PC software

The Z-150 series desktop and Z-160 series portable microcomputers offer software and expansion-board compatibility with the IBM PC. Both series use the Intel 8088 processor, the IBM expansion bus and the MS-DOS operating system. The computers include two RS232 ports and a Centronics-compatible parallel port. They come standard with 128K bytes of RAM, expandable to 640K bytes. The products also have RGB color output and a redesigned, IBM-compatible, detachable keyboard. Desktop models

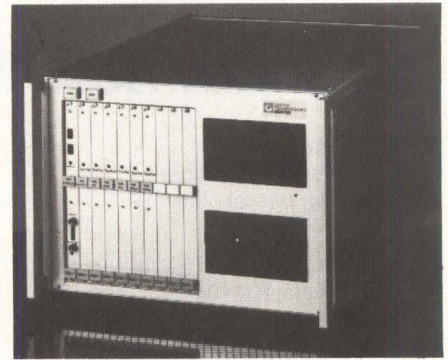
also provide gray-scale monochrome output. All models support basic, smooth and jump scrolling modes. Desktop systems are available in three configurations with 5¼-inch floppy disk drives: a single-drive system (\$2,699), a dual-drive system (\$3,099) and a dual-drive system with one floppy disk drive and one 10.6M-byte Winchester disk drive (\$4,799). Desktop systems do not include a monitor as standard equipment. The two portable systems, both with built-in 9-inch amber monitors, are priced at \$2,799 for the single-floppy-disk-drive version and \$3,199 for the dual-floppy-disk-drive version. **Zenith Data Systems**, 1000 Milwaukee Ave., Glenview, Ill. 60025, (312) 391-8744. **Circle No 301**

### Workstation meets engineering needs

The System One integrated workstation engineering and scientific package is based on a Motorola 68010 main processor and features virtual-memory support, high-resolution graphics and a multiwindow extension of BSD 4.2 UNIX. The package includes a 640K-byte, 5¼-inch floppy disk drive, a 24M-byte Winchester disk drive, a 14-inch, 1,024-by-768-pixel, bit-mapped display with 128K bytes of memory and a graphics processor, a general I/O processor with a mouse pointing device and a battery-backed clock/calendar. Standard software includes a UNIX-derived operating system, a window manager, a software-integration shell and the C programming language. \$15,475. **NBI Inc.**, P.O. Box 9001, Boulder, Colo. 80301, (303) 938-2795. **Circle No 302**

### Multiuser microcomputer is 80286-based

The system 816/F, an IEEE-696-compatible multiuser microcomputer based on a 6-MHz 80286 CPU with a 287 math processor, features 512K bytes of 16-bit static memory, 12 serial ports, a Centronics printer port, a parallel port, 1.2M bytes of floppy disk storage, 40M bytes of hard disk storage and 1.5M bytes of M-Drive/H solid-state disk storage. The computer includes the CP/M-86 and MP/M-86 operating systems. \$14,995. **CompuPro**, 2506 Breakwater Court, Hayward, Calif. 94545, (415) 786-0909. **Circle No 303**



### Multiuser UNIX system is VMEbus-based

The VME Matrix 68K is a multiuser, VMEbus-based UNIX system designed around the 68000 microprocessor. The product has seven VMEbus-compatible cards in a 10-slot card cage, 36M bytes of Winchester disk storage and 1M byte of floppy disk storage. The system also has five serial ports, one parallel printer port (Centronics compatible) and 640K bytes of main memory (512K bytes on the two DRAM boards and 128K bytes on the MMCPU). Software includes the UniPlus+ UNIX System III operating system, 68000 assembler, C compiler and a system diagnostics package. The system firmware initializes the system and controls bootstrap loading. \$16,500. **Mostek Corp.**, 1215 W. Crosby Road, Carrollton, Texas 75006, (214) 466-6000. **Circle No 304**

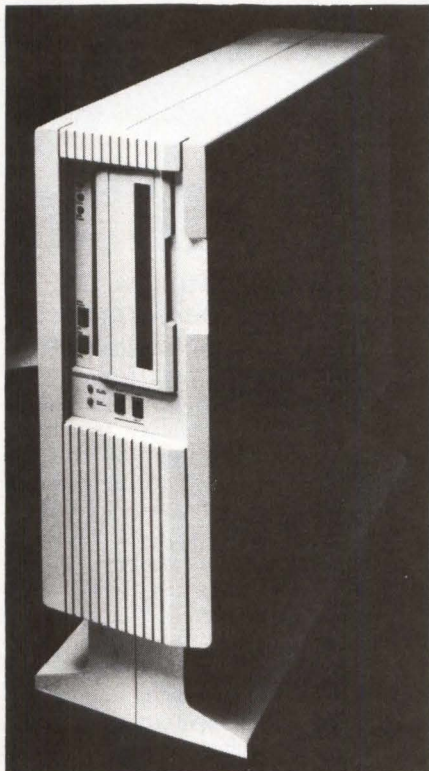


### Hand-held microcomputer draws graphics

The Husky Hunter hand-held microcomputer measures 8½ by 6¼ by 1¼ inches and weighs 2 pounds. The water-proof unit incorporates an NSC800-4 microprocessor, 80K to 208K bytes of CMOS RAM, an RS232 port, an LCD and a 57-key QWERTY-style keyboard.



The product displays alphanumeric in an 8-line-by-40-character format and can draw 240-by-64-dot resolution graphics. The microcomputer has a BASIC interpreter and can run CP/M-compatible software. Programs and data are stored in battery-supported memory. Prices start at approximately \$2,000. **Sarasota Automation Inc.**, 1500 N. Washington Blvd., Sarasota, Fla. 33577, (813) 366-8770. **Circle No 305**



### Variable computer offers flexibility

The Powerframe series of variable-architecture computer systems offers a selection of processors, operating software and peripherals. Model 2340 employs a DEC PDP-11/23 Plus processor, a DEC operating system and an 8-inch fixed/removable rigid disk drive with 40M bytes of user storage. Standard equipment also includes 256K bytes of dynamic RAM, dual ports and an expandable pedestal cabinet. The free-standing cabinet contains a slide-out wire cage that provides access to internal components for exchanging logic and memory boards as well as storage subsystems. \$13,990. **Ford/Higgins Ltd.**, 4755 Walnut St., Boulder, Colo. 80301, (303) 449-8803. **Circle No 306**

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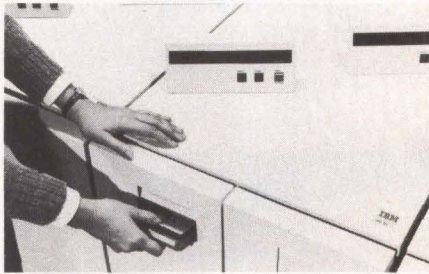
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# New Products

## DISK/TAPE



IBM's 4-by-5-inch magnetic-tape cartridge inserts in a slot in the model 3480 subsystem.

### Tape cartridges feature 20 percent more storage

The model 3480 magnetic-tape subsystem employs tape cartridges instead of standard tape reels. Approximately one-fourth the size of a 10½-inch reel of magnetic tape, the rectangular cartridges store as much as 20 percent more data. Designed for large-machine backup, the model 3480 contains dual drives, each of which stores 200M bytes unformatted and arranged in 18 tracks with a packing density of 38K bytes per inch. The subsystem transfers data at 3M bytes per second—more than double the rate at which other IBM tape drives read and write information. The 3-foot-by-2-foot-by-39-inch unit moves the tape at 80 ips in a streaming-only mode. Decoupled control maintains steady operation of the drive, freeing the host from handling tape operation. A typical configuration, consisting of one controller and eight drives, is priced at \$237,910. **IBM Corp., Information Systems Group**, 900 King St., Rye, N.Y. 10573. **Circle No 307**

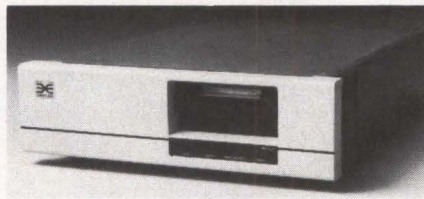


### Tape streamers pack 500M bytes

The MT-2000 family of streaming-tape drives packs 500M bytes on a book-sized cartridge containing 1,500 feet of ½-inch-wide tape. The drives operate at 200 or 50 ips in streaming mode and at 50 ips in start/stop mode. The devices

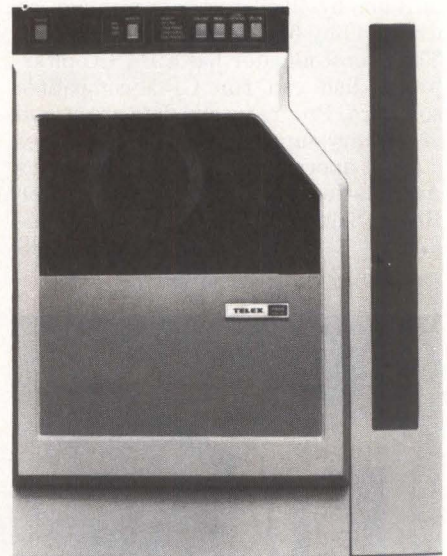
transfer data at 240K bytes per second at 200 ips and store data using a 24-track, bit-serial, serpentine format with a 9,600-bpi packing density. An integral formatter encodes data in a 4/5 GCR format and is transparent to the controller. The head-stepping arrangement permits random access of stored files within an average of 30 seconds. The full-width model MT-2210, priced at \$5,500, measures 19 by 8¾ by 17½ inches. The half-width model MT-2220, priced at \$5,750, measures 8.4 by 10.2 by 24 inches. **MegaTape Corp.**, 1041 Hamilton Road, P.O. Box 317, Duarte, Calif. 91010, (213) 357-9921.

**Circle No 308**



### Storage subsystems enhance DEC computers

Employing the SCSI, Medley subsystems provide software-transparent storage and backup for DEC Q-bus and Unibus computers. The subsystems come in a 5¼-by-19-by-22-inch RETMA rack-mounted cabinet or an optional desktop unit and include a 5¼-inch Winchester disk drive, a CDC Sentinel ¼-inch cartridge-tape drive, power supply and a cooling fan. The Winchester disk drive offers 36M or 110M bytes of formatted data storage; the tape drive offers as much as 70M bytes of backup storage, depending on block size. The Medley is offered in a Q-bus version for the DEC LSI-11 through 11/23 Plus, the Micro/PDP-11 and the Micro/VAX CPUs or in a Unibus version for applicable PDP-11 and VAX-11 CPUs. The subsystem package includes the appropriate host adapter: the vendor's UC02 for Q-bus applications and UC12 for Unibus applications. The company's TC05 (Q-bus) and TC15 (Unibus) tape couplers handle tape-control functions. Prices for the subsystem with 110M-byte disk and tape backup is \$12,455 for the Q-bus version and \$12,855 for the Unibus version. **Emulex Corp.**, P.O. Box 6725, 3545 Harbor Blvd., Costa Mesa, Calif. 92626, (714) 662-5600 or (800) 854-7112. **Circle No 309**



### GCR tape product offers large-system performance

The 50-ips Shamrock model 9250, a start/stop, auto-load/auto-thread, vacuum-column tape drive, has an embedded GCR formatter. Standard recording densities are 6,250 and 1,600 bpi; an 800-bpi recording density is optional. The peak throughput rate at 6,250 bpi is 312.5K bytes per second. At 1,600 bpi, the unit transfers data at 80K bytes per second. It maintains a 0.3-inch inter-record gap and provides 3-msec. write and 3.4-msec. read access times. In GCR mode, the drive can store as much as 145M bytes of formatted data on one 2,400-foot reel of tape. It incorporates the Telex bus-structured standard interface. \$7,399 (OEM quantities); deliveries begin in October. **Telex Computer Products Inc.**, 6422 E. 41st St., Tulsa, Okla. 74135, (918) 627-1111.

**Circle No 310**

### Winchester subsystem replaces four RL01 drives

The 4xRL01 disk system for DEC Q-bus microcomputers emulates four 14-inch DEC RL01 cartridge drives. It incorporates a controller and two fixed/removable 5¼-inch Winchester drives, providing a storage capacity of 20.8M bytes. Data-transfer rate is 625K bytes per second; average seek time is 40 msec. \$10,000. **Winchester Systems**, 400 W. Cummings Park, Woburn, Mass. 01801, (617) 933-8550.

**Circle No 311**



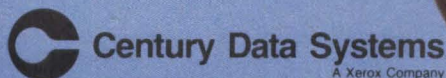
# More than A Memory A Commitment To Quality

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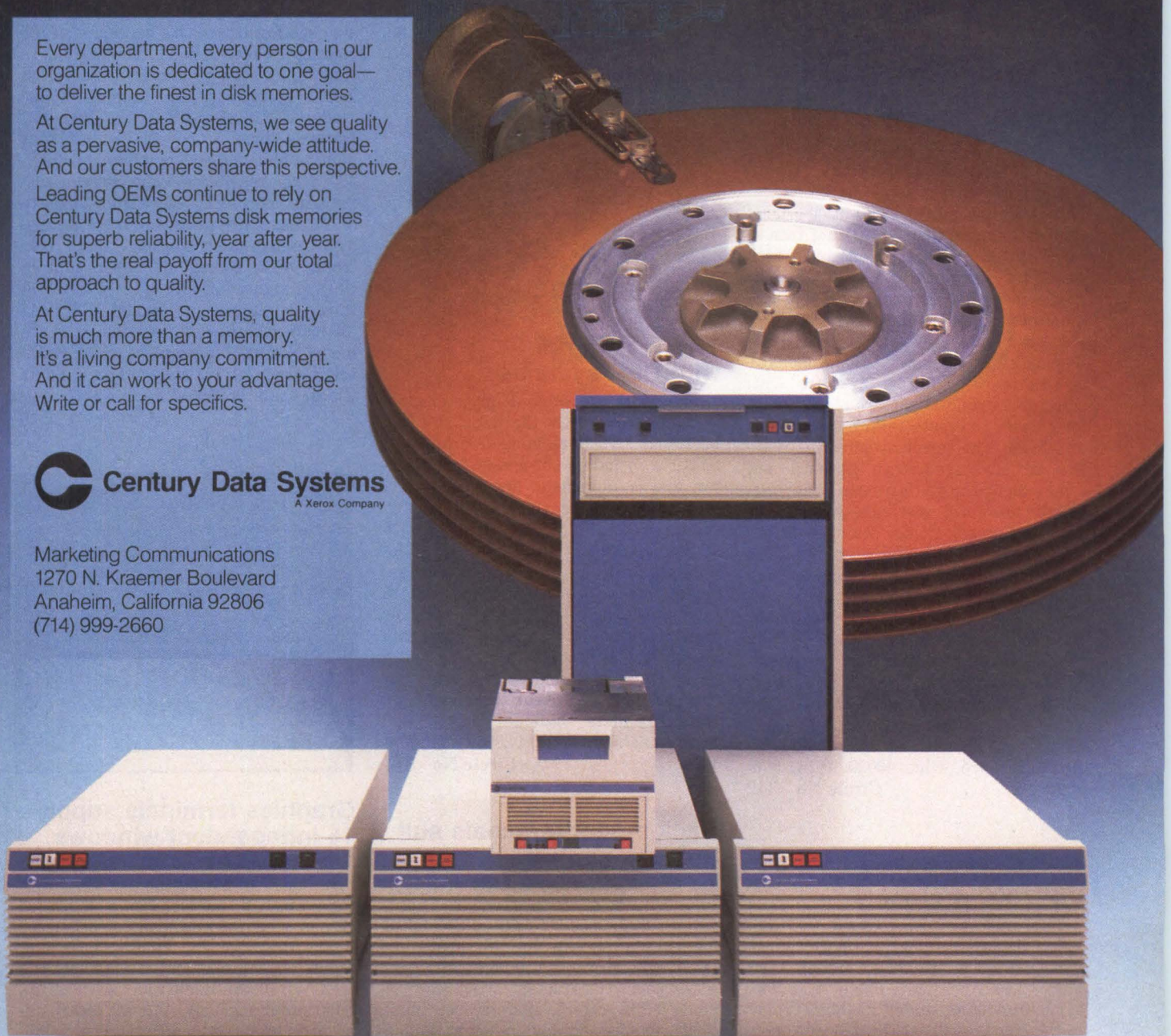
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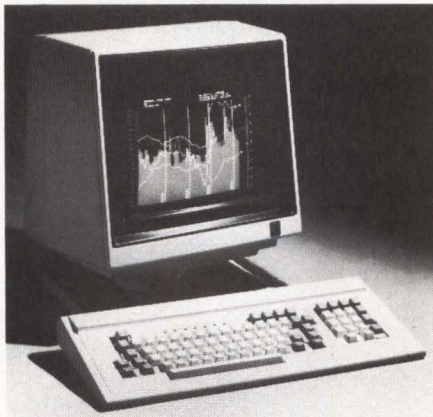


CIRCLE NO. 116 ON INQUIRY CARD



# New Products

## TERMINALS



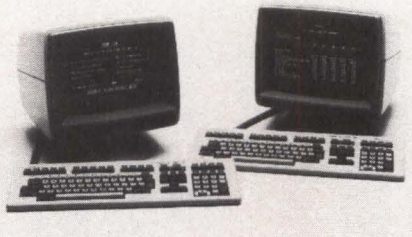
### Terminals feature NTSC color signal output

The ID-200 series of graphics terminals offers dual display architecture, NTSC compatibility, 1,280-by-480-pixel resolution and a display writing rate of 1.25M pixels per second. A dual video generator can split and display alphanumeric and graphics images on separate monitors. The terminal provides hardware pan and 16 levels of zoom and can display eight windows simultaneously. A palette of eight or 16 colors with selectable graphics pattern elements allows users to create textures, patterns and hues. The terminal performs polygon fill and seed with fill-until and -while algorithms. Users can draw vectors by absolute, relative or concatenated coordinates. Other drawing primitives include circle, bar, arc, pie and polygon; programmable window and scales; and four independent plane controls. The unit also has graphics-command compatibility with Tektronix models 4010, 4014 and 4027 terminals; VT100 features; and VT132 multipage editing compatibility. ISSCO, SAS and Template software supports the series. \$4,295. **ID Systems Corp.**, 4089 Leap Road, Hilliard, Ohio 43026, (614) 876-1595. **Circle No 312**

### Terminals support VIP-7800 protocols

The microprocessor-based TE-780x video display terminals support Honeywell VIP-7800 protocols. Model A replaces the Honeywell model VIP-7801 asynchronous terminal, model S replaces the Honeywell VIP-7814 synchronous terminal, and model V operates in a user-selectable DEC VT100 or ANSI X3.64 mode. All models feature a 14-

inch green screen that displays 7-by-11-dot-matrix characters in a 24-line-by-80-column format. The terminals also offer more than 60 menu-selectable setup options and an auxiliary printer port. Other features include a detachable keyboard; a tilt-and-swivel monitor; 12 user-programmable non-volatile function keys; and blink, underline, reverse, bold and blank video attributes that require no display space. Model A: \$1,695; models S and V: \$1,895 each. **Thomas Engineering Co.**, 1040 Oak Grove Road, Concord, Calif. 94518, (415) 680-8640. **Circle No 313**

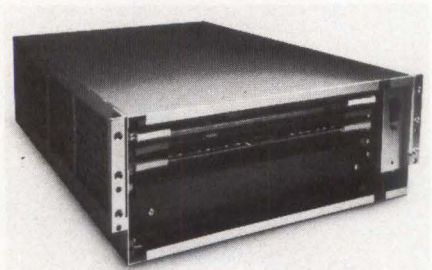


### Terminal works with DEC systems

The ADM 220 video display terminal is compatible with the DEC VT220, VT100 and VT52 terminals. Ergonomic features include a tilt-and-swivel monitor and a detached, low-profile keyboard. The unit provides an 80- or 132-column-by-24-line display (plus a 25th status line), a split screen, double-width/double-height line attributes, vertical or horizontal scrolling and 15 function keys. A 12-inch, green or amber screen is standard. Users can display the terminal's selectable setup parameters in English, French or German. \$1,165. **Lear Siegler Inc., Data Products Division**, 901 E. Ball Road, Anaheim, Calif. 92805, (714) 774-1010. **Circle No 314**

### Rack-mount terminals suit process control

The R6210 family of rack-mountable color terminals for process-control applications measures 7 by 19 by 21 inches. The entry-level model R6210/01 (\$3,495), features VT100 emulation and extensions. Character attributes include eight colors, underscore, blink, bold, reverse and double-height/double-width lines. Users can design special fonts and symbols for charts and flow diagrams, locally store the fonts and



symbols and display them in as many as six page formats with a maximum of 160 characters by 48 lines. The terminal's communications protocol meets ANSI X3.64 standards. The top-of-the-line model R6210/21 (\$4,995) has R6210/01 features plus an overlay with four planes of bit-mapped graphics at 640-by-480 pixel resolution. The system displays as many as 16 colors from a palette of 64. Users can program in the company's Colorgraphic language or in Tektronix 4014 commands. User subroutines are stored in 40K bytes of RAM. A third configuration, model R6210/11 (\$3,995), has the same attributes as the model R6210/21 in graphics mode. **Ramtek Corp.**, 2211 Lawson Lane, Santa Clara, Calif. 95050, (408) 988-2211. **Circle No 315**



### Graphics terminals supply 16 independent windows

The Graphos II and III color graphics terminals feature shifttable cell architecture and 16 independently managed screen windows that can smooth scroll in any direction. The windows have individual color tables and can emulate the DEC VT100 and Tektronix 4010 terminals simultaneously. An MC68000 microprocessor runs subroutines in a 130-command set supplied in firmware. Both terminals offer user-selectable resolution of 640-by-480-by-4-bit pixels or 640-



by-384-by-4-bit pixels. Priced at \$3,995 without a monitor, Graphos II runs at 6.25 MHz and displays 16 colors on a TTL monitor. It has a 128K-byte graphics RAM and a 128K-byte local-storage RAM. Priced at \$5,495 without a monitor, Graphos III operates at a 12.5-MHz clock speed and generates 32,768 colors on an analog RGB monitor. It has 256K bytes of graphics RAM and 224K bytes of local-storage RAM. **Ithaca InterSystems Inc.**, 1650 Hanshaw Road, Ithaca, N.Y. 14850, (607) 273-2500.

Circle No 316

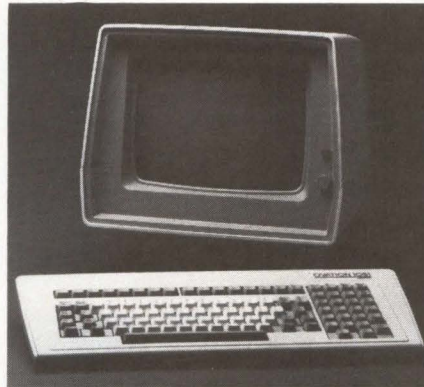
### Displays use high-speed technology

Featuring a proprietary CMOS graphics coprocessor working with a Z8002 16-bit microprocessor, HiScan graphics terminals achieve graphing speeds of 1M pixels per second. The terminals are based on DEC VT200 series monitors and keyboards. They offer a non-interlaced display and deliver 800-by-600-pixel resolution on the monochrome model 4210 and 800-by-300-pixel resolution on the color model 4205. Using two memory planes, HiScan monochrome terminals provide a four-level gray scale; using four memory planes, HiScan color terminals can display 16 colors simultaneously from a palette of 64. The terminals support 80- and 132-column formats, with characters formed in a 10-by-20 cell. Standard features include DEC VT220 text and Tektronix 4010/4014 graphics functions as well as buyer-specified Tektronix 4027, Tektronix 4104 or DEC ReGIS protocols. \$2,195 and \$2,995 for the models 4210 and 4205, respectively. **Digital Engineering Inc.**, 630 Bercut Drive, Sacramento, Calif. 95814, (916) 447-7600.

Circle No 317

### Intelligent terminal can be customized

The Ovation 1041 and 1051 terminals feature soft setup using non-volatile RAM, firmware customization and expansion capabilities to support custom logic. The Ovation 1051 features 256 graphics characters and 128 alphanumeric characters and provides an 80- or 132-column display mode and 16K bytes of memory, expandable to 64K bytes. The low-profile, detached keyboard has 103 alphanumeric keys and 16 user-pro-



grammable function keys. Based on the Z80A microprocessor, the terminal incorporates RS232C/RS422 and RS232C communication ports and is compatible with DEC VT132 and ANSI X3.64 standards. The Ovation 1041 terminal features an 84-key low-profile keyboard with eight user-programmable function keys, displays 24 lines by 80 columns with a 25th status line and offers 32 graphics characters. Based on the 8085A microprocessor, the product emulates the Lear Siegler ADM 31 and TeleVideo 925 terminals and contains 16K bytes of memory. Both models incorporate non-glare green or amber, 12-inch screens on a tilt-and-swivel base. Ovation 1051: \$1,295; Ovation 1041: \$1,095. **Zentec Corp.**, 2400 Walsh Ave., Santa Clara, Calif. 95050, (408) 727-7662.

Circle No 318

### Terminal displays large characters

The Annunciator graphics terminal can instantaneously draw large characters on its 19-inch video screen in response to one ASCII code. Users can construct messages in a combination of eight colors, letter sizes as high as 3 inches and blinking. Operators can also store as many as 96 full-screen formats (including graphics diagrams) in the terminal's non-volatile memory and access the formats via simple codes. Graphics display resolution is 384 by 480 pixels. The unit can display a maximum of 80 characters by 48 lines with ¼-inch-high characters and a minimum of 13 characters by 3 lines with 3-inch-high characters. RS232C and current-loop interfaces come standard. Prices start at \$4,660. **Mystic Valley Engineering Co. Inc.**, 400 W. Cummings Park, Woburn, Mass. 01801, (617) 933-9383.

Circle No 319

### Asynchronous terminal features ergonomic design

The model 7811 asynchronous terminal has a detached, low-profile keyboard and a non-glare, high-contrast, 12-inch display screen. The tilt-and-swivel screen features a 24-line-by-80-column format, displays a 128-character set and supports reverse video, underline and reduced-intensity attributes. The 93-key keyboard includes 14 function keys and a numeric keypad. The product provides 45 special characters for foreign languages and 64 graphics characters and transmits data over an RS232 asynchronous link at selectable baud rates from 300 to 19.2K. \$695. **Paradyne Corp.**, 8550 Ulmerton Road, Largo, Fla. 33540, (813) 530-2000.

Circle No 320



### Video display is TeleVideo 950-compatible

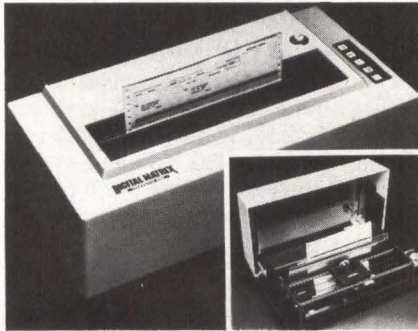
Code-compatible with the TeleVideo 950, the Smart Link 150 terminal features a tilt-and-swivel display, a 12-inch, non-glare, green or amber phosphor screen and a detached, low-profile, DIN-standard keyboard. The product furnishes four pages of memory that can be used as one 96-line page or four independent pages. Other features include 11 programmable function keys, soft setup, full editing, protected fields, smooth or jump scroll, 15 independent baud rates as high as 19.2K bps and business graphics. \$895. **Link Technologies Inc.**, 1887 O'Toole Ave., San Jose, Calif. 95131, (408) 943-0142.

Circle No 321



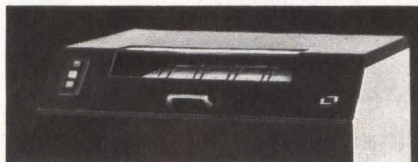
# New Products

## PRINTERS



### Machine emulates journal printer

Aimed at applications in which multi-part, continuous forms are printed singly or in the demand-document mode, the 132-column Formwriter 9/132 dot-matrix printer performs like a journal printer and requires no special programming or instruction codes for normal operation. Depressing the "tear form" button advances the paper so that the last line printed or the head-of-form is brought to the tear bar for separation. Releasing the button reverses the tractors so that the head-of-form is again aligned with the print head. This setup allows handling of continuous forms in demand-document mode while printing within 1/8 inch of the top or bottom. The printer operates at 165 cps. RS232C and Centronics interfaces are standard. \$1,595. **Digital Matrix Corp.**, 105 Filley St., Bloomfield, Conn. 06002, (203) 242-3048. **Circle No 322**



### Line printer emulates IBM 2780/3780 devices

The Innovator 202-FC line printer provides IBM 2780/3780 emulation with its built-in printer and ASCII terminal port. It supports space compression/expansion, processor-interrupt reception, conversational mode, reception of EBCDIC transparent data, vertical-format control and horizontal-format control. The device also features processor-interrupt transmission, switch-selectable 2780/3780 modes, switched network/leased-line control, auto-answer, switch-selectable ASCII/EBCDIC modes and built-in diagnostics. The printer uses chain technology and prints

at 300 lpm. It prints 80 or 132 columns on one- to six-part forms and comes in a freestanding, acoustically-damped metal enclosure. Operating noise level is less than 50 dBa. \$5,495 for the 132-column model. **Innovative Electronics Inc.**, 4714 N.W. 165th St., Miami, Fla. 33014, (305) 624-1644. **Circle No 323**

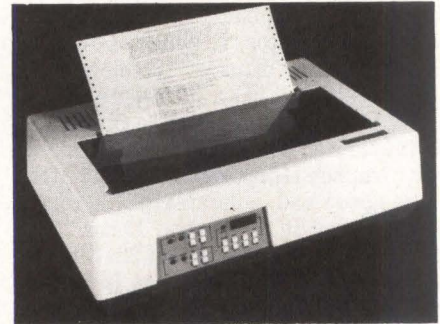


### Dot-matrix printers suit text processing

The model H80 dot-matrix printer features an 8-inch print line, 140-cps draft printing using an 11-by-9-dot-matrix pattern, 27-cps near-letter-quality printing using a 23-by-16-dot-matrix pattern, overstrike, condensed, pica, elite and expanded print modes and true superscript/subscript printing. Model H136 has the same print capabilities as model H80 but features a 15.6-inch print line. Both models include built-in, adjustable tractors, pin-addressable graphics in seven densities, down-line loading of character sets, italics, and resident international character sets. The printers can handle cut-sheet, fan-fold and roll paper. A Centronics interface is standard; an RS232 interface is optional. H80: \$699; H136: \$899. **Centronics Data Computer Corp.**, 1 Wall St., Hudson, N.H. 03051, (603) 883-0111. **Circle No 324**

### Multimode unit prints at 220 cps

The DS220 multimode matrix printer provides correspondence printing for word-processing applications, draft-quality printing for data-processing applications and dot-addressable graphics. In correspondence mode, the printer generates an 18-by-48 dot matrix for near-letter-quality appearance. Using a two-pass technique, the unit prints at 40 cps. Multiple type fonts can be selected from the operator panel or under program control. Features include two correspondence-quality fonts, two memo fonts, variable pitch draft fonts, a



micro-character set and seven international character sets. For print-intensive applications, the unit operates at 220 cps using bidirectional logic-seeking printing. In this mode, the printer uses a 9-by-7-dot matrix and offers selectable pitches of 10, 12 and 16 cpi. The unit prints as many as 217 cpl. An RS232 and a Centronics-compatible interface are standard. \$1,995. **Datasouth Computer Corp.**, P.O. Box 240947, Charlotte, N.C. 28224, (800) 222-4528. **Circle No 325**

### Portable matrix printers operate in multiple modes

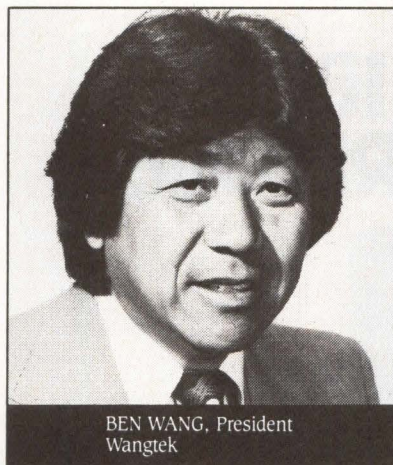
The Riteman line of 9-by-9-dot-matrix, bidirectional, logic-seeking, portable printers possess word-processing and graphics capabilities. The Riteman Plus (\$399) prints at 120 cps, offers 66 character modes and has Epson MX-80FT Type III Graftrax Plus software compatibility. The Riteman Blue Plus (\$499) prints at 140 cps, offers 128 character modes and is compatible with the IBM graphics printer and Epson RX-80FT and Epson MX-80FT Type III Graftrax Plus software. This printer also prints in elite pitch, proportional spacing and 70-cps quiet modes. The Riteman II (\$599) prints at 160 cps, offers 128 character modes and has Epson FX-80 software compatibility. It includes an 8K buffer, and prints in proportional spacing and 80-cps quiet modes. The Riteman 15 (\$799) prints at 160 cps, offers 128 character modes and is Epson FX-100 software-compatible. This printer features a 15-inch carriage and adjustable tractor feed, and prints in elite and 80-cps quiet modes. The printer also has a character set of 256 units that can be re-defined as a 9-by-11 matrix for custom character sets. **Inforunner Corp.**, 1621 Stanford St., Santa Monica, Calif. 90404, (800) 824-3044 or (800) 421-2551. **Circle No 326**



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BEN WANG, President Wangtek

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# New Products

## DATACOMM

### Low-cost network shares resources

The Plan 2000 system links IBM PCs, PC XT's and IBM PC-compatible computers, allowing users to access shared multiuser database applications and hard disks and printers. The network consists of interface cards for each PC,

software for network-wide resource sharing and cabling. The network software features exclusive access to personal work volumes, read-only access to program libraries or information owned by other users, locks to implement multiuser applications and passwords to protect private information. Plan 2000 uses the ARCnet token-passing protocol

that has a 2.5M-bps data rate. It can link clusters of PCs—typically two to four per disk server. The PC that acts as a file server is not dedicated to network functions; it can run applications while processing network functions. File printer server program: \$750; interface cards: \$595 each. **Nestar Systems Inc.**, 2585 E. Bayshore Road, Palo Alto, Calif. 94303, (415) 493-2223.

Circle No 327

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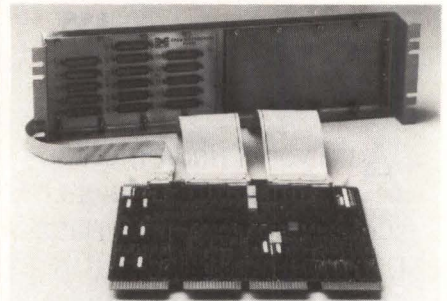
\*OEM quantities, 1600 bpi PE format, domestic prices.

**IBEX**

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CIRCLE NO. 119 ON INQUIRY CARD



### Multiplexers work with DEC computers

The CS02 series communications multiplexer for DEC computers has two configurations. The CS02/HA configuration works with LSI-11/23 and LSI-11/23 Plus CPUs and comprises the model CC02 communications controller and the model CP22/B 16-line distribution panel that uses 25-pin connectors. The CS02/HB configuration works with Micro/PDP-11 CPUs and comprises the model CC02 communications controller and the model CP24 16-line distribution panel that uses nine-pin connectors with RS423 capability. The model CC02 printed-circuit board features bipolar microprocessor architecture that supports 16 terminals. The first four distribution lines provide full- or half-duplex modem support. The remaining 12 lines provide full-duplex-only modem support. The board features switch-selectable emulation of the DEC DHV11 or DH11 multiplexers, allowing transparent operation with installed DEC software and diagnostics. Each of the 16 lines can simultaneously transmit and receive data at speeds as fast as 38.4K baud. The controller board installs in one Q-bus backplane slot of the resident CPU. The CS02/HA and CS02/HB sell for \$2,300 each. **Emulex Corp.**, 3545 Harbor Blvd., P.O. Box 6725, Costa Mesa, Calif. 92626, (714) 662-5600 or (800) 854-7112.

Circle No 328



# New Products

## SOFTWARE

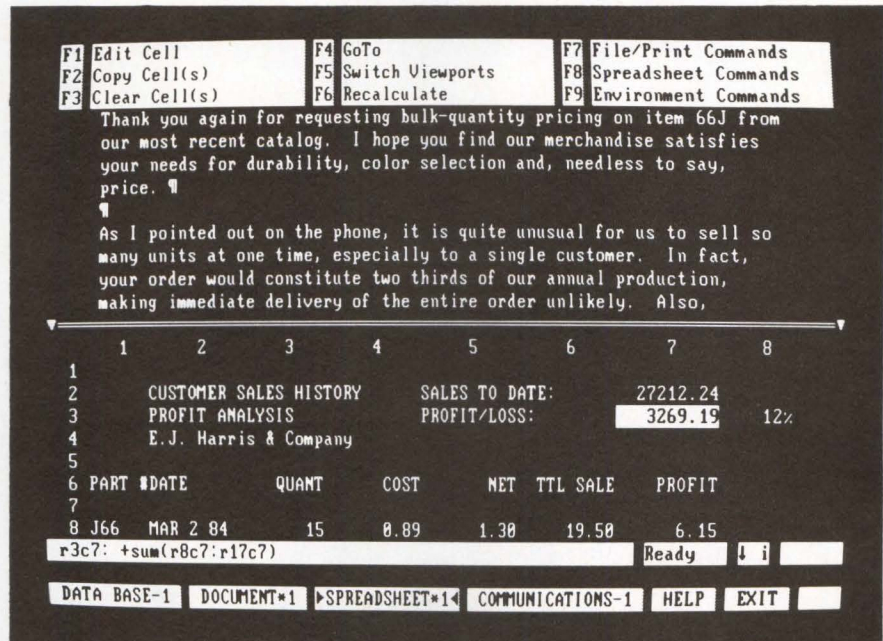
### Integrated software package runs on IBM PCjr, PC and XT

The Electric Desk, claimed to be the first integrated software productivity program for the IBM PCjr personal computer, combines spreadsheet, word-processing, database-management and communications functions. The program also runs on the IBM PC and PC XT computers. The product provides concurrent operations, a windowing feature, a macro programming language and context-sensitive help screens. Use of function keys simplifies program operation.

The word-processing program offers automatic page numbering, headers and footnotes; copy and insert text; continuous justification; on-screen center, bold and underline; and the ability to print six type styles with a dot-matrix printer. Users can insert information, such as from a database or a spreadsheet, into the document using Electric Desk's windowing and cut-and-paste facility. Users can also open as many as nine documents simultaneously.

The spreadsheet occupies 255 rows by 255 columns. It features variable cell widths, numeric formats, text formats and automatic recalculations. The spreadsheet's viewport (windows) function allows a user to see two views of a spreadsheet on the screen at once.

The database can have as many as 50 fields and 1,000 characters per record and as many as 65,000 records per file. Users can define as many as five index fields. Field types include alpha, numeric and capitalized. Field attributes can



Alpha's Electric Desk provides a windowing function that enables users to move screen information between spreadsheet and word-processing documents simultaneously.

be set as underline, reverse video and bold. The database can also automatically dial a phone number.

The communications service transmits information at eight baud rates from 110 bits per second (bps) to 9,600 bps. It provides electronic mail and enables users to access commercial databases and automatically dial telephone numbers stored in a Rolodex-like file.

Priced at \$295, the Electric Desk for

the PCjr requires 128K bytes of RAM and one disk drive. Most of the program code resides on ROM cartridges, and the remaining code resides on diskette. The IBM PC and PC XT versions require 256K bytes of RAM and one disk drive and sells for \$345. **Alpha Software Corp.**, 300 B St., Burlington, Mass. 01803, (617) 229-2924.

Circle No 329

### BASIC language version displays program flow

The Professional BASIC language accesses the full memory of the IBM PC and can use the 8087 coprocessor. It contains a window-oriented system of more than 12 tracing and debugging screens. Users can view changes in variables or array elements and the progress of FOR...NEXT loops or GOSUBS as a program executes. The package provides a dynamic syntax-checking feature and permits labeled GOSUBS, cross-referencing and the setting of breakpoints. The product is written in

assembler and requires 256K bytes of RAM. \$345. **Morgan Computing Co. Inc.**, 10400 N. Central Expressway, Suite 210, Dallas, Texas 75231, (214) 739-5895.

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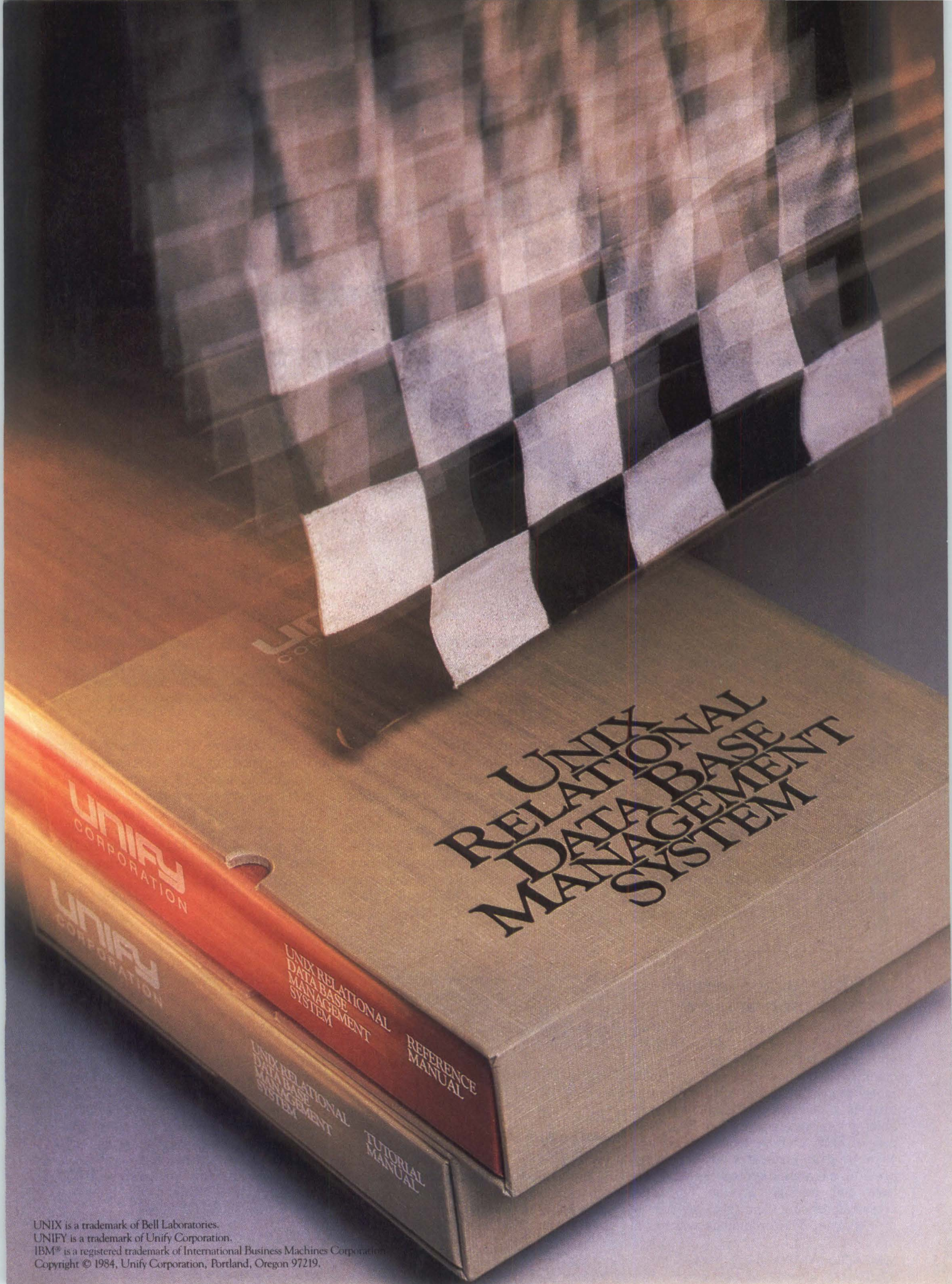
### Software emulates many terminals

The Impersonator communications software package for IBM PC and IBM PC-compatible microcomputers features emulations of seven CRT terminals, an

auto-dial directory and file-transfer and internal text-editing capabilities. With the Impersonator, an IBM PC can emulate Lear Siegler's ADM-3A, DEC's VT52 and VT100, Hazeltine's Esprit, IBM's 3101, DG's D210 and TeleVideo's 912 terminals. A macro command language allows users to custom-design additional emulations and to pre-define actions in handling data transfers. The package provides more than 60 context-sensitive help screens for creating a custom emulation program. \$195. **Direct.aid**, P.O. Box 4420, Boulder, Colo. 80306, (303) 442-8080.

Circle No 331





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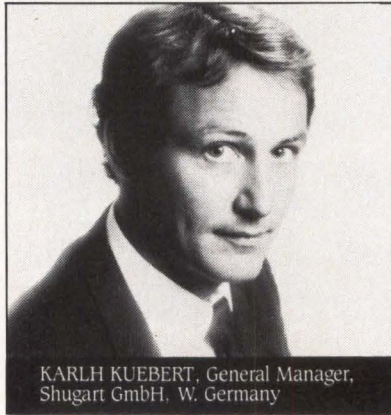
CIRCLE NO. 120 ON INQUIRY CARD



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KARLH KUEBERT, General Manager, Shugart GmbH, W. Germany

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- Oct. 23, '84 Milan, Italy
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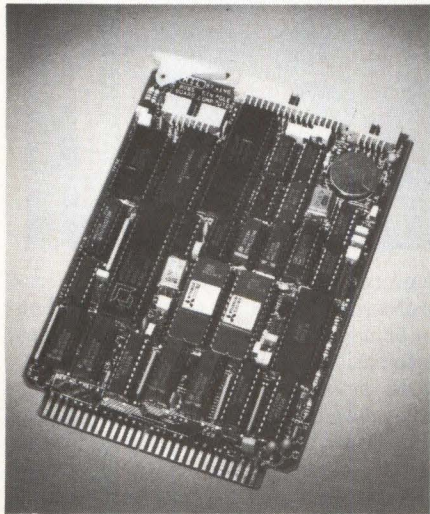
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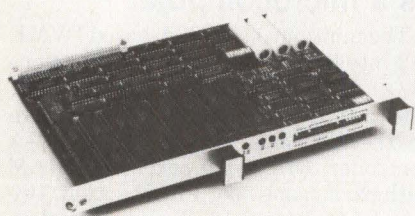
# New Products

## SUBASSEMBLIES



### Board furnishes 8085A processor functions

The single-board STD-145 computer furnishes an 8085A processor on an STD-bus-compatible card. Two 28-pin JEDEC sockets accept EPROM memories and static RAMs. The product features a battery-backed time-of-day clock, a full-duplex serial USART port, 24-bit programmable parallel I/O and three programmable counter/timers. It accommodates ROM/RAM implementations as small as 2K bytes or as large as 64K bytes, and the RAM can be battery-backed. The card's peripheral functions are I/O-mapped and occupy 32 consecutive locations. Users can set the base address of the on-board I/O at 32-byte boundaries. \$325. **Micro-Link Corp.**, 14602 N. U.S. Highway 31, Carmel, Ind. 46032, (317) 846-1721 or (800) 428-6155. **Circle No 332**



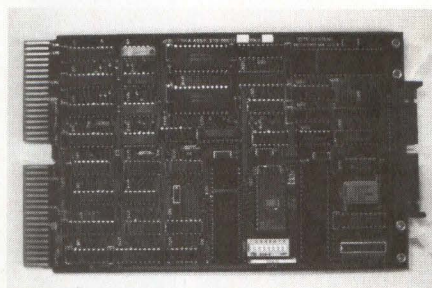
### VMEbus memory board provides 128K bytes

Providing 128K, 64K or 32K bytes, the model MM-6500C memory board is compatible with 16-bit VMEbus microcomputers. It employs low-power, 8K-by-8 or 2K-by-8 CMOS static RAMs, which users can mix with 2764 or 2716

EPROMs, respectively. Three redundant, on-board, paralleled and separately fused backup batteries ensure operation in the event of a power failure. An on-board, real-time calendar/clock provides programmable, periodic, switch-selectable interrupts that occupy 32 locations in the memory map. Other features include 24-bit addressing of as much as 16M bytes and 220-nsec. cycle and access times. The 128K-byte, rechargeable-battery version sells for \$1,175. **Micro Memory Inc.**, 9436 Irondale Ave., Chatsworth, Calif. 91311, (213) 998-0070. **Circle No 333**

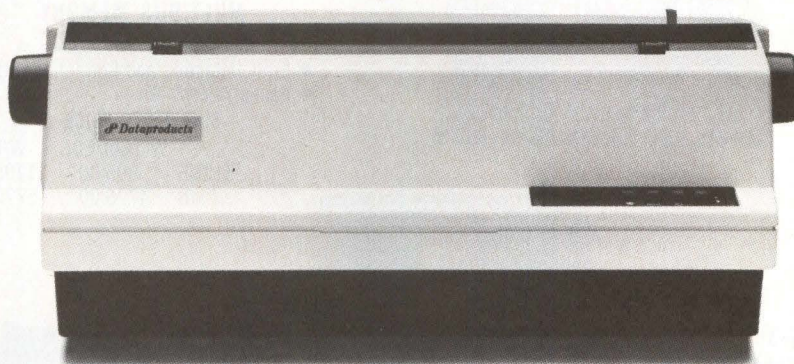
### Adapters interface controllers to LSI-11 bus

The TDL-11WD and TDL-11SA dual-width host adapters reside on the DEC LSI-11 bus and interface to a variety of Winchester disk controllers. Both versions emulate DEC RLX11/12 controllers with RL01/02 disk drives and are

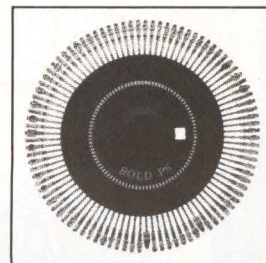


software-compatible with DEC LSI-11 operating systems. The products feature multiple-sector buffering and perform host-transparent flaw mapping. The TDL-11WD interfaces to Western Digital's WD100X family of controllers, which handle as many as four 5¼- or 8-inch Winchester disk drives that have standard ST-506 or SA1000 interfaces. The TDL-11SA interfaces to SASI bus controllers. \$575 for either version. **TD Systems Inc.**, 7 Williams St., Medford, Mass. 02155, (617) 391-1166. **Circle No 334**

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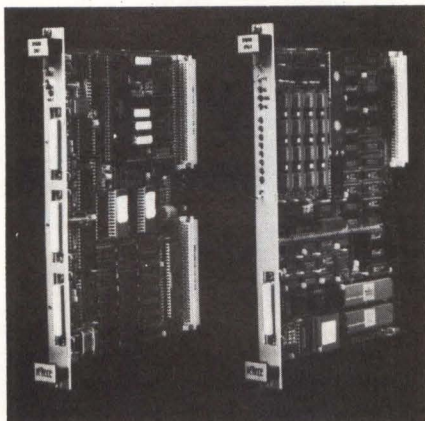
## Dataproducts Daisywheel Printers

CIRCLE NO. 122 ON INQUIRY CARD



# New Products

## SUBASSEMBLIES



### CPU boards suit industrial applications

Aimed at industrial applications, the CPU-1B and CPU-2 boards work with the 68000 microprocessor and the VMEbus. The CPU-1B board incorporates an 8- or 10-MHz 68000 microprocessor, 128K or 512K bytes of dynamic RAM, three RS232 I/O ports (110 to 38,400 baud) and one parallel I/O

port. It also features a 24-bit programmable timer, an on-board, real-time clock with battery and sockets for 128K bytes of EPROM or as much as 16K bytes of static RAM. The CPU-2 board incorporates an 8- or 10-MHz 68000 or 68010 microprocessor and from 128K bytes to 1M byte of dynamic RAM. It also contains support circuits for as many as four SA460-compatible 5¼-inch floppy disk drives. Both boards include on-board operating firmware that facilitates up- and down-loading of S-record format program transfers. CPU-1B: \$907 (100 units); CPU-2: \$1,432 (100 units). **Force Computers Inc.**, 2401 Mission College Blvd., Santa Clara, Calif. 95054, (408) 988-8686.

Circle No 335

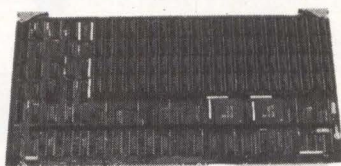
### Management system serves small factories

Intended for small manufacturers, the StarMate industrial productivity-management system monitors as many as 20 machines that perform repetitive



manufacturing of discrete parts. Microprocessor-based local monitors installed on or near the manufacturing machines automatically gather data on status, cycle time and downtime; operators input data on scrap and rejects as problems occur. An IBM PC, located off the factory floor, serves as the system's CPU. Users can view real-time data in color-coded graphics and tabular displays on the IBM PC and send the data to a printer or store it on disk. Approximately \$20,000. **PlantStar Inc.**, 725 Concord Ave., Cambridge, Mass. 02138, (617) 661-1950. Circle No 336

## UNFORGETTABLE MEMORIES MULTIBUS — QBUS

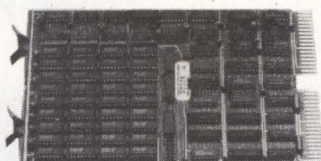


### MULTIBUS MEMORY 512KB TO 2MB EDC

- Error Detecting and Correcting (EDC)
- Faster Access Times

#### SINGLE QTY. PRICE

	Without/EDC	W/EDC
512KB	895.00	1495.00
2MB	4775.00	5775.00

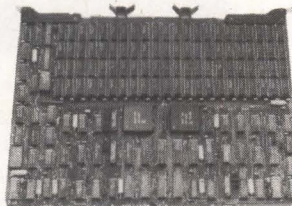


### Q-BUS MEMORY 256KB TO 4MB

- Battery Backup Mode
- Block Mode DMA, ECC or Parity
- Works with LSI-11, J-11, MicroVAX

#### SINGLE QTY. PRICE

1MB	1975.00
256KB	525.00



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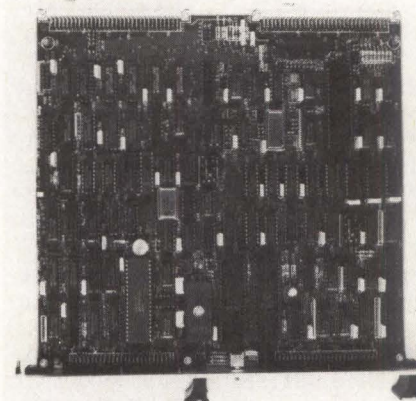


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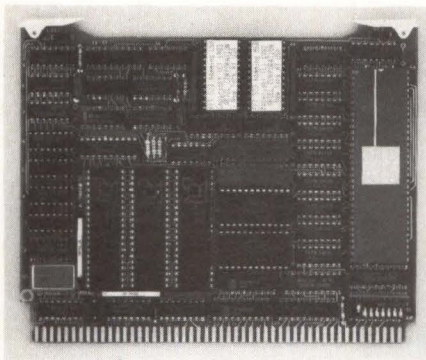
CIRCLE NO. 123 ON INQUIRY CARD



### Disk controller doubles as a microcomputer

The multipurpose Z80A-based DVME 712 intelligent disk controller functions as a general-purpose microcomputer. The card operates as a master or a slave on the VMEbus. It provides a DMA controller, 64K bytes of dynamic RAM with parity, one boot PROM socket, two serial I/O channels, a dual-density floppy disk controller and an SASI Winchester host adapter. One serial I/O channel can be configured synchronously with a maximum data rate of 800K bps and provides software selection of RS232C or RS422 drivers. \$2,000. **DY-4 Systems Inc.**, 1475 S. Bascom Ave., Suite 202, Campbell, Calif. 95008, (408) 377-9822. Circle No 337





### Board performs fast Fourier transforms

The model FFT 523 single-card FFT processor plugs into a single backplane slot of HP's Series 200 desktop computers. Execution of a single program line in BASIC or Pascal performs an FFT. Supplied disk-based, machine-language driver routines make the host/peripheral interface user-transparent. Standard algorithms include forward and inverse FFT, Hamming window and power spectral density. Operating on 16-bit

integer data, the device transforms arrays of as many as 1,024 complex points in a maximum of 9.2 msec. \$1,600. **Ariel Corp.**, 600 W. 116th St., Suite 84, New York, N.Y. 10027, (212) 662-7324.

Circle No 338

### QIC-02 tape controller resides on LSI-11 bus

Implemented on a dual-width LSI-11 bus card, the TS-11-compatible IS-QIC 2 1/4-inch cartridge-tape controller emulates the TS-11 command set, except for commands involving reading and writing a tape in reverse. The controller supports variable record sizes and 30- or 90-ips QIC-02-compatible tape drives. It also features 22-bit LSI-11 bus addressing and a 12K- or 48K-byte buffer that serves as a data cache for reads and writes. The data cache allows the controller to simulate the functions of the start/stop TS-11 tape unit while doing individual file backup. 12K-byte version: \$900; 48K-byte version: \$1,200. **Inte-**


**grated Solutions Inc.**, 2240 Lundy Ave., San Jose, Calif. 95131, (408) 943-1902.

Circle No 339

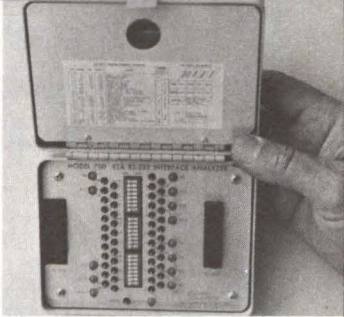
### Controller plots arcs at 800 nsec. per pixel

The dual-width VMEbus bit-mapped IV-1651 VMEgraf graphics display controller produces a 16-color display at 600-by-800-dot resolution and a four-color display at 1,024-by-1,024- or 1,280-by-768-dot resolution. Two IV-1651 cards can be synchronized to provide 16-color operation and faster plotting at the higher resolutions. The device features a hardware pixel processor that plots vectors and arcs at 800 nsec. per pixel, integer zoom and a DMA port for rapid screen updates. It can also operate in an eight-color mode using the fourth image plane memory to provide a blink attribute or a white overlay. \$1,995 with 128K bytes of display memory. **Ironics Inc.**, 117 Eastern Heights Drive, P.O. Box 356, Ithaca, N.Y. 14850, (607) 277-4060.

Circle No 340




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CIRCLE NO. 124 ON INQUIRY CARD

MINI-MICRO SYSTEMS/August 1984

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\*100 Unit Price

CIRCLE NO. 125 ON INQUIRY CARD



# New Products

## LITERATURE

### Report projects 1984-1985 micro sales

Compiled from a survey of top-level DP/MIS executives from more than 150 of the largest U. S. companies, the 1984 edition of *Microcomputer Usage Trends in Fortune Corporations* presents quantitative data and insights on microcomputer sales estimates for Fortune companies. The 250-page report projects 1984 and 1985 sales of specific desktop and portable computers and identifies the key factors that influence brand selection. \$750. **Newton-Evans Research Co. Inc.**, Suite 204, Bethany 40 Center, 10176 Baltimore National Pike, Ellicott City, Md. 21043, (301) 465-7316.

Circle No 341

### Catalog lists ANSI standards

The 1984 edition of the *Catalog of American National Standards* lists approximately 8,000 ANSI-approved stand-

ards. The standards establish dimensions, ratings, terminology, symbols, test methods and performance and safety requirements for materials, equipment and products. The 168-page catalog alphabetically lists titles of all standards under subject headings. Each entry includes title, designation, price and discount information. \$10. **American National Standards Institute Inc.**, 1430 Broadway, New York, N.Y. 10018, (212) 354-3315.

Circle No 342

### Guide covers CAD/CAM products

The 1,100-page *Directory of Computer Graphics and CAD/CAM* indexes more than 3,000 products from more than 1,000 vendors into more than 60 categories by name, function and vendor. Each listing describes a product, when it became available, the number of users, the price, configuration requirements and programming languages

used. Listings on each supplier include locations, size, areas of specialization, agents and contacts. \$185. **Computing Publications Inc.**, 401 First Federal Building, Pottstown, Pa. 19464, (215) 326-5188.

Circle No 343

### Report examines Winchester disk drives

Compiled by Jonah McLeod, *Winchester Disks in Microcomputers* examines the disk memory industry. The 180-page report analyzes recent technological developments and their applications, surveys the main suppliers and details major products. With more than 50 diagrams and illustrations, the report covers the problems of backup, read/write heads, disk media and system integration. \$95. **Elsevier Journal Information Center**, 52 Vanderbilt Ave., New York, N.Y. 10164, (212) 867-9040.

Circle No 344

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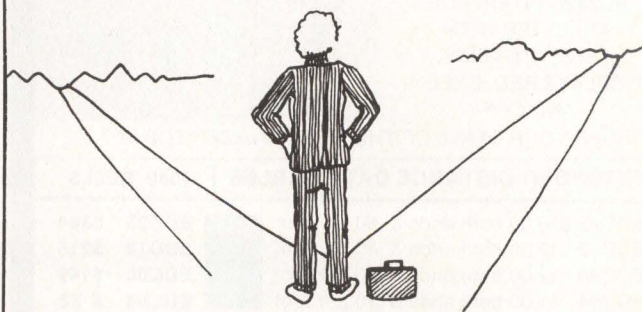
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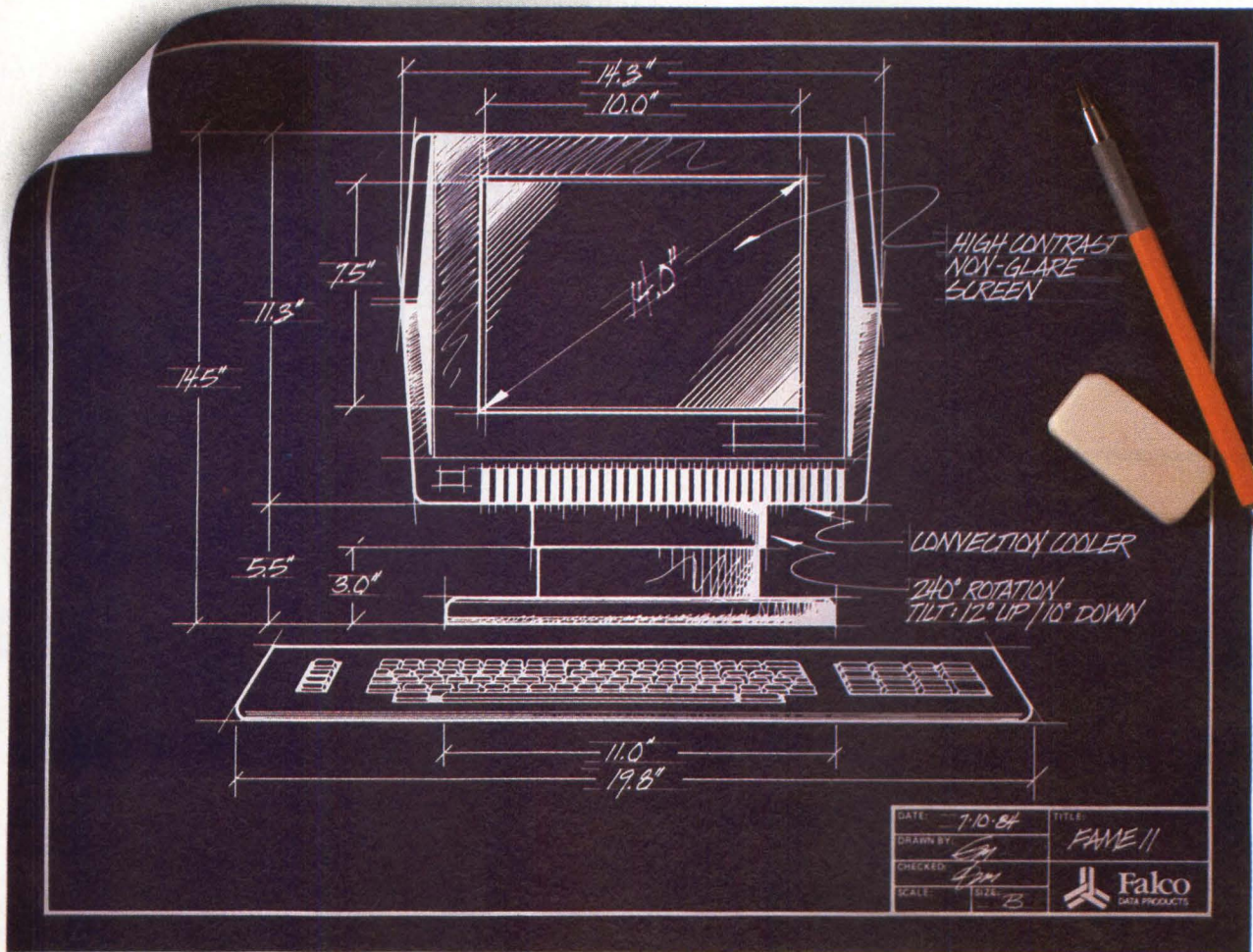
## Turn To Mini-Micro Systems

## Career Opportunities Section

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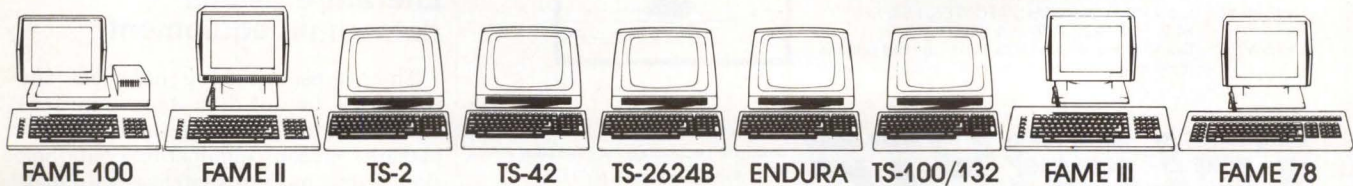
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(201) 472-2801



# New Products

## LITERATURE

### Publications list PDP-11 application software

The two-volume second edition of the PDP-11 Software Source Book covers more than 1,500 PDP-11 software products in 33 categories. Volume 1 describes application software for engi-

neering, accounting and finance, and Volume 2 details system software, such as language processors, operating systems, communications, tools and utilities. Each listing provides the program name; operating systems under which it runs; its price; and its vendor's name, address and telephone number. **Digital**

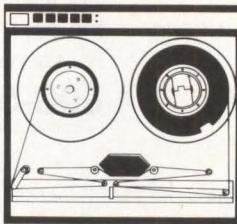
**Equipment Corp., Printing and Circulation Services**, 444 Whitney St., Northboro, Mass. 01532.

Circle No 345

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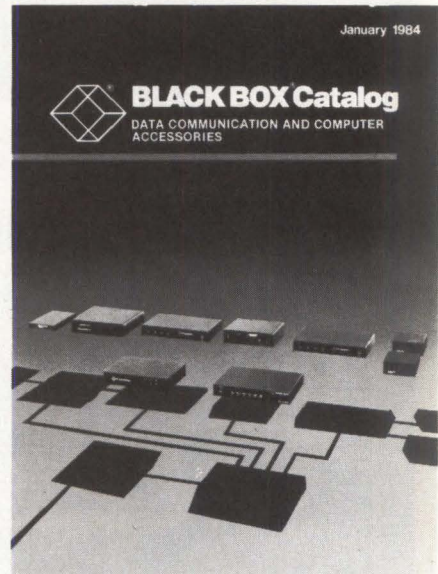
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# TELEBYTE

TDX Peripherals Division  
Telebyte Technology Inc., 148 New  
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### Catalog details 300 datacomm devices

This data-communications catalog lists more than 300 devices, including cables, data switches, junction panels, wall plates, modems, line drivers, interface test sets, data concentrators, data multiplexers, protocol converters, interface converters, code converters, speed converters, printer interfaces, printer spoolers and station protectors. The catalog describes each product with text, photographs, diagrams and price. **Black Box Corp.**, P.O. Box 12800, Pittsburgh, Pa. 15421, (412) 746-5500.

Circle No 346

### Literature details datacomm equipment

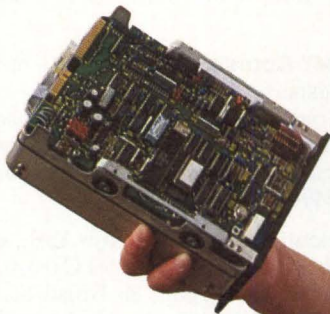
This 20-page catalog describes the company's line of data-communications equipment including statistical multiplexers, modem eliminators, data-link simulators, modem switches, auto dialers and data-protection devices. **Datatel Inc.**, Department DK, Pin Oak and Springdale Roads, Cherry Hill Industrial Center, Cherry Hill, N.J. 08003, (609) 424-4451.

Circle No 347

CIRCLE NO. 127 ON INQUIRY CARD



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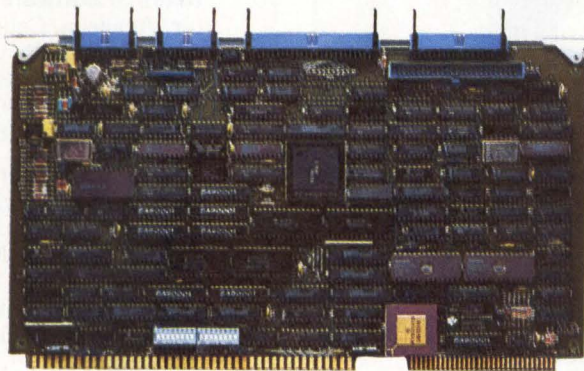
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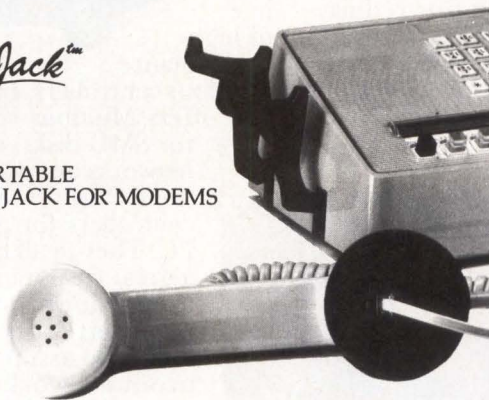
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\*the Black Jack is a trademark of The Microp peripheral Corporation. 2565 - 152nd Avenue NE, Redmond, WA 98052 (206) 881-7544

CIRCLE NO. 130 ON INQUIRY CARD

# Calendar

## AUGUST

**13-15 American Society of Mechanical Engineers (ASME) International "Computers in Engineering" Conference & Exhibit**, Hilton Hotel, Las Vegas, Nev., sponsored by ASME Contact: Mary S.H. Benedict, Exhibits Manager, or Eileen Dengler, Exhibits Administrator, ASME, United Engineering Center, 345 E. 47th St., 13M, New York, N.Y. 10017, (212) 705-7100.

**13-17 "Database '84" Course**, Wang Institute of Graduate Studies, Tyngsboro, Mass. sponsored by the Wang Institute of Graduate Studies. Contact: Roberta Wesley, Coordinator of Special Programs, Wang Institute of Graduate Studies, Tyng Road, Tyngsboro, Mass. 01879, (617) 649-9731.

**15-16 Telecommunications Seminar**, New York, sponsored by The Yankee Group. Contact: Lisa Caruso, Seminar Director, The Yankee Group, 89 Broad St., Boston, Mass. 02110, (617) 542-0100. Also to be held on Aug. 22-23 in San Francisco.

**22-24 Sixth Annual Conference on Interactive Videodisc in Education and Training**, J.W. Marriott, Washington, sponsored by the Society for Applied Learning Technology (SALT). Contact: Raymond G. Fox, SALT, 50 Culpeper St., Warrenton, Va. 22186, (703) 347-0055.

## SEPTEMBER

**5-7 National Software Show**, Anaheim Convention Center, Anaheim, Calif., sponsored by Raging Bear Productions Inc. Contact: Philip J. Russell, National Software Show, Raging Bear Productions, 21 Tamal Vista Drive, Suite 175, Corte Madera, Calif. 94925, (415) 924-1194 or (800) 732-2300.

**6-8 Halifax Computer and Office Automation Show**, Halifax Metro Centre, Halifax, Nova Scotia, organized by Industrial Trade Shows. Contact: Robert Grainger or Peter McLean, Show Managers, or James K. Mahon, Group Show Manager, Industrial Trade Shows, 20 Butterick Road, Toronto, Ontario M8W 3Z8, (416) 252-7791.

**9-12 First International Conference on Computer-Aided Technologies (COMPINT '85)**, Palais des Congres, Montreal, sponsored by the Institute of Electrical and Electronics Engineers (IEEE). Contact: Stephen G. Leahey, General Chairman, COMPINT '85, P.O. Box 577, Desjardins Postal Station, Montreal, Quebec H5B 1B7, (514) 870-3526.

**11-13 Midcon/84 High-Technology Electronics Exhibition and Convention**, Dallas, produced by Electronic Conventions Inc. Contact: Nancy Hogan or Kent Keller, Electronic Conventions Inc., 8110 Airport Blvd., Los Angeles, Calif. 90045, (213) 772-2965.



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# Calendar

**11-13 Mini/Micro Southwest '84 Computer Conference and Exhibition**, Dallas, produced by Electronic Conventions Inc. Contact: Nancy Hogan or Kent Keller, Electronic Conventions Inc., 8110 Airport Blvd., Los Angeles, Calif. 90045, (213) 772-2965.

**11-14 "Distributed Processing: Mini & Microcomputer Implementation" Course**, Washington, sponsored by Integrated Computer Systems. Contact: Ruth Dordick, Integrated Computer Systems, 6305 Arizona Place, P.O. Box 45405, Los Angeles, Calif. 90045, (213) 417-8888, (800) 352-8251 or (800) 421-8166. Also to be held on Sept. 25-28 in Boston, Oct. 2-5 in Palo Alto, Calif., and Oct. 30-Nov. 2 in Long Island, N.Y.

**11-14 "Data Communications" Course**, Washington, sponsored by Integrated Computer Systems. Contact: Ruth Dordick, Integrated Computer Systems, 6305 Arizona Place, P.O. Box 45405, Los Angeles, Calif. 90045, (213) 417-8888, (800) 352-8251 or (800) 421-8166. Also to be held on Sept. 25-28 in San Diego, Nov. 13-16 in Boston and Nov. 27-30 in Los Angeles.

**12-14 Fifth Annual Software/Expo**, Hyatt Regency, Chicago, organized by PEMCO News Bureau. Contact: Richard Lewis, Software/Expo, 2400 East Devon Ave., Suite 205, Des Plaines, Ill. 60018, (313) 299-3131 or (800) 323-5155.

**17-19 "Industrial Robots" Course**, Center for Robotics Research of the University of Cincinnati, Cincinnati, sponsored by the University of Cincinnati. Contact: Susan Lyons, Mechanical and Industrial Engineering Department Mail Location #72, University of Cincinnati, Cincinnati, Ohio 45221, (513) 475-4387 or (513) 475-2738.

**17-19 Data Storage '84**, Fairmount Hotel, Denver, sponsored by **Disk/Trend** Inc. and Freeman Associates. Contact: Carlidge & Associates Inc., 4030 Moorpark Ave., Suite 205, San Jose, Calif. 95117, (408) 554-6644.

**17-24 FOC/LAN '84**, Las Vegas, Nev., sponsored by Information Gatekeepers Inc. Contact: Michael O'Bryant, General Manager, Information Gatekeepers Inc., 138 Brighton Ave., Boston, Mass. 01234, (617) 787-1776.

**18-20 SEMICON/East '84**, Boston, sponsored by Semiconductor Equipment and Materials Institute Inc. Contact: Mary Beth Kern, Semiconductor Equipment and Materials Institute, 625 Ellis St., Suite 212, Mountain View, Calif. 94043, (415) 964-5111.

**18-20 Federal Computer Conference**, Washington Convention Center, Washington, sponsored by National Council for Education on Information Strategies. Contact: (617) 358-5301.

**18-21 "Implementing Local-Area Networks" Course**, San Diego, sponsored by Integrated Computer Systems, 6305 Arizona Place P.O. Box 45405, Los Angeles, Calif. 90045, (213) 417-8888, (800) 352-8251 or (800) 421-8166.



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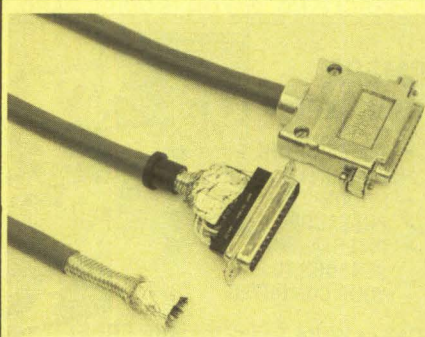
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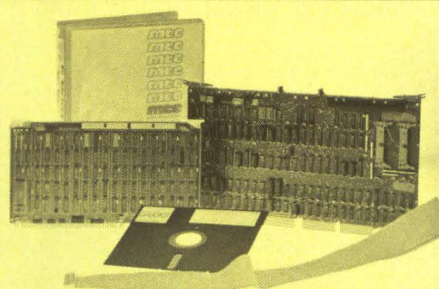
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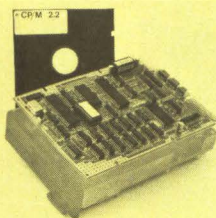
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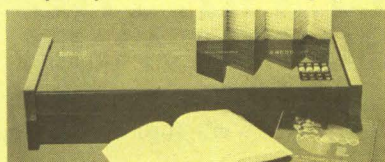
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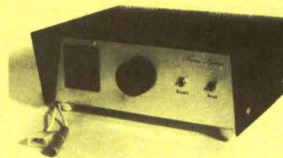
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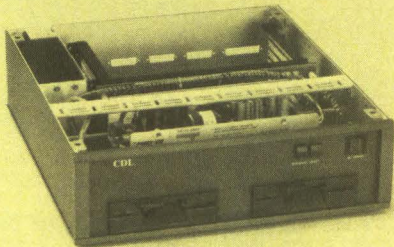
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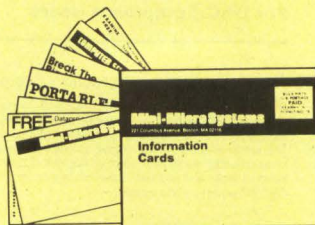
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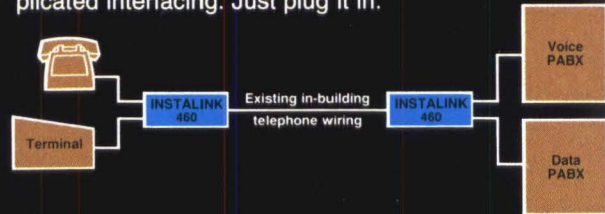
All you really need is a way to connect a terminal and the telephone to the same set of wires, and that's where MICOM's INSTALINK Voice/Data Multiplexor comes in.

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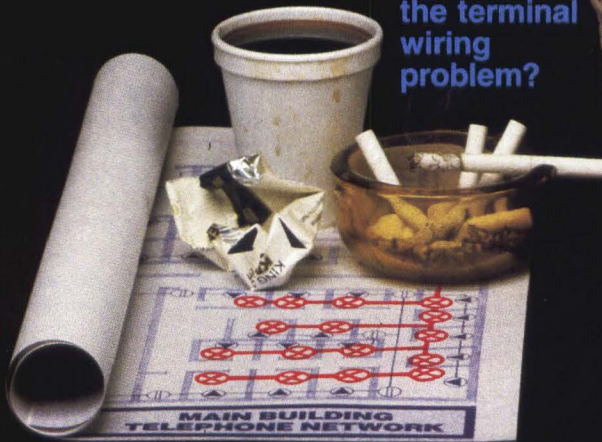
And it provides something else that many other in-house networks don't or can't: complete portability. A terminal can be moved to a new site and connected to any telephone line already in place. No rerouting of cables. No complicated interfacing. Just plug it in.



Best of all, INSTALINK provides all this without requiring any long-term commitment, without major investment, without disrupting normal business operations, and without fuss — "instantly."

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